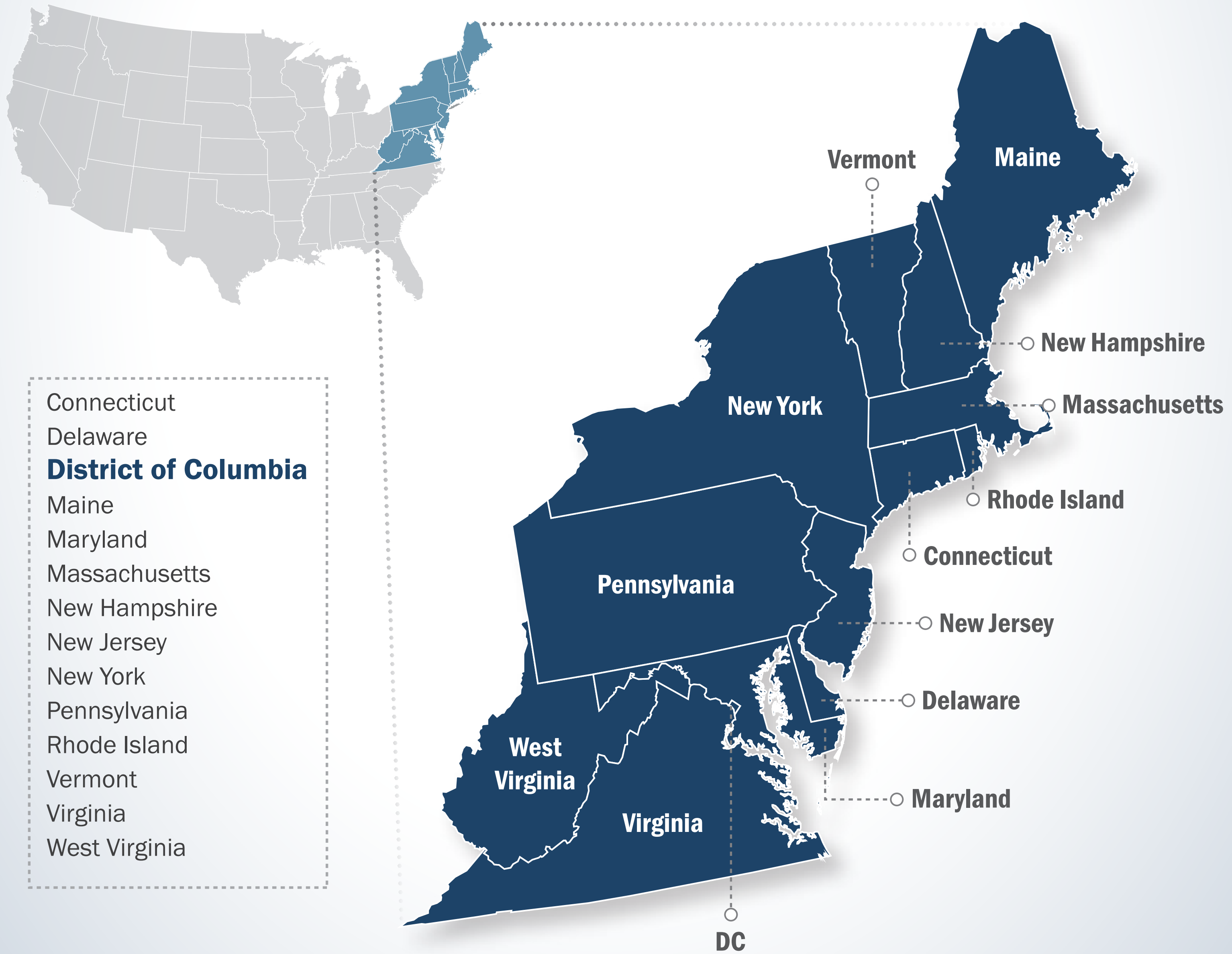
FirstNet®

Nationwide Public Safety Broadband Network

Draft Programmatic Environmental Impact Statement for the Eastern United States

VOLUME 3 - CHAPTER 5



Connecticut
Delaware
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West Virginia

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First Responder Network Authority

FirstNet®

Nationwide Public Safety Broadband Network
Draft Programmatic Environmental Impact Statement for the Eastern United States

VOLUME 3 - CHAPTER 5

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

April 2016

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5. DISTRICT OF COLUMBIA

Washington, D.C.

The District of Columbia is a federal District rather than a state, and serves as the seat of the United States' government. The District is bordered by Maryland to the north and northeast and Virginia to the southwest. This chapter provides details about the existing environment of the District, as it relates to the Proposed Action. General facts about Washington, D.C., are provided below.

- **Nickname:** NA
- **Land Area:** 61.05 square miles; **U.S. Rank**: NA (U.S. Census Bureau, 2014)
- **Capital:** NA
- **Counties:** NA
- **Estimated Population:** 658,893 people, 2014 estimate; **U.S. Rank:** NA (U.S. Census Bureau, 2014)
- **Most Populated Cites:** NA
- **Main Rivers:** Potomac River and Anacostia River
- **Bordering Waterbodies:** NA
- **Mountain Ranges:** NA
- **Highest Point:** Point Reno (409 feet) (USGS, 2015a)

5.1. Affected Environment

5.1.1. Infrastructure

5.1.1.1. Definition of the Resource

This section provides information on key District of Columbia (D.C. or the District) 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 5.1.1.3 provides an overview of the District's traffic and transportation infrastructure, including road and rail networks and waterway facilities. The District's public safety infrastructure could include any infrastructure utilized by a public safety entity[1] as defined in the Act, including infrastructure associated with police, fire, and emergency medical services (EMS). However, other organizations can qualify as public safety services as defined by the Act. Public safety services in the District are presented in more detail in Section 5.1.1.4. Section 5.1.1.5 describes the District's public safety communications infrastructure and commercial telecommunications infrastructure. An overview of District utilities, such as power, water, and sewer, is presented in Section 5.1.1.6.

5.1.1.2. Specific Regulatory Considerations

Several District laws and regulations pertain to public utility and transportation infrastructure and its public safety community. Table 5.1.1-1 identifies the relevant laws and regulations, the affected agencies, and their jurisdiction as derived from the District's applicable statutes and administrative rules referenced in column one. Appendix C, Environmental Laws and Regulations, identifies applicable federal laws and regulations.

Table 5.1.1-1: Relevant District of Columbia Infrastructure Laws and Regulations

District Law/Regulation	Regulatory Agency	Applicability
D.C. Code: Title 7, Human Health Care and Safety; D.C. Municipal Regulations: Title 10-A, Comprehensive Plan; Title 24, Public Space and Safety; Title 8, Environmental and Animal Control and Protection; Title 10, Parks,	Homeland Security and Emergency Management Agency (HSEMA); Fire and EMS Department	Provides police and fire protection in the District; prepares a comprehensive plan and program for civil defense in coordination with the federal government and nearby states and political subdivisions; outlines environmental requirements; details regulations regarding recreation areas, parks, and outlines payments for public areas.

[1] The term "public safety entity" means an entity that provides public safety services (7 U.S. Code [U.S.C.] § 140126)).

District Law/Regulation	Regulatory Agency	Applicability
Public Buildings, Grounds, and Space		
D.C. Code: Title 34, Public Utilities; D.C. Municipal Regulations: Title 10-A, Comprehensive Plan; Title 15, Public Utilities and Cable Television	District Department of the Environment (DDOE); District Department of Transportation (DDOT)	Oversees energy supply, demand, costs, projections, and forecasts; licenses electricity suppliers and oversees electric distribution, rates, and services; governs the construction of new electric generating facilities; governs the licensing of natural gas suppliers; oversees gas suppliers' residential practices and contracts including service quality, safety, and reliability.
D.C. Code: Title 9, Transportation Systems; Title 50, Motor and Non-Motor Vehicles and Traffic; Title 18, Vehicles and Traffic	DDOT; Washington Metropolitan Area Transit Authority	Authorizes the District's transportation authority to manage, control, and maintain transportation systems and traffic; and oversee public roads and bridges except those under the care of the federal government

Sources: (The Council of the District of Columbia, 2015) (Office of Documents and Administrative Issuances, 2015)

5.1.1.3. Transportation

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

The District Department of Transportation (DDOT) has jurisdiction over freeways and roads and select mass transit in the District. The mission of the DDOT is to "Develop and maintain a cohesive sustainable transportation system that delivers safe, affordable, and convenient ways to move people and goods – while protecting and enhancing the natural, environmental and cultural resources of the District" (DDOT, 2015a).

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

- 1,100 miles of urban streets,
- 65 miles of bike lanes,
- 117 miles of Metrorail track (WMATA, 2013),
- 453 miles of urban alleys (DDOT, 2014a), and
- Commercial and recreational vessel harbors and shoreline infrastructure (DDOT, 2014b) (CNIC, 2015) (DC Metropolitan Police Department, 2016).

Road Networks

As identified in Figure 5.1.1-1, the entire District is a major urban center and is part of the Washington, D.C., metropolitan statistical area (U.S. Census Bureau, 2013). The District has two major interstates that connect it to other major metropolitan areas. Local travel is conducted mainly via District routes and local streets. Table 5.1.1-2 lists the interstates and their start/end points in the District. 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, 2015a).

Table 5.1.1-2: District of Columbia Interstates

Interstate	Southern or Western Terminus in D.C.	Northern or Eastern Terminus in D.C.
I-66	Potomac River, Theodore Roosevelt Bridge	Whitehurst Freeway (U.S. 29) in the District
I-295	Oxon Creek overpass	Anacostia River, 11th Street Bridge
I-395	Potomac River, 14th Bridge	New York Avenue, Washington, D.C., NE
I-695	Capitol Street South, Washington, D.C., SW	Anacostia River, 11th Street Bridge

In addition to the Interstate System, the District has parkways owned and managed by the National Park Service (NPS). NPS parkways are roads that are recognized for one or more archaeological, cultural, historic, natural, recreational, or scenic qualities. Section 5.1.8, Visual Resources, describes the parkways found in the District from an aesthetic perspective.

NPS parkways are roads with nationwide interest that are designated and managed by NPS. The District has one parkway entirely within its borders and two parkways leading up to its boundary:

- Rock Creek and Potomac Parkway: 2.9 miles that runs between the National Mall and the Maryland state line at Chevy Chase;
- Baltimore-Washington Parkway: 32.5 miles that connects the District and Fort Meade, MD; and
- George Washington Memorial Parkway: 24.9 miles that runs along the Virginia side of the Potomac River, between Mount Vernon and Langley, VA.

Airports

The District is served by three international airports, none of which is within the District's boundaries:

- Ronald Reagan Washington National Airport (DCA) in Arlington, VA: Owned and operated by the Metropolitan Washington Airports Authority (MWAA). In 2014, the airport moved over 20.8 million passengers and over 3.9 million pounds of freight (MWAA, 2015a).
- Washington Dulles International Airport (IAD) in Dulles, VA: Owned and operated by the MWAA. In 2014, the airport moved over 21.5 million passengers and over 565.2 million pounds of freight (MWAA, 2015b).
- Baltimore-Washington International Thurgood Marshall Airport (BWI) in Baltimore, MD: Owned and operated by the Maryland Aviation Administration. In 2014, the airport moved over 22.31 million passengers (Maryland Aviation Administration, 2015a) and over 229 thousand pounds of freight in 2013 (Maryland Aviation Administration, 2015b).

There are no public use airports in the District. Section 5.1.7, Airspace, provides detail on airspace in the District.

Rail Networks

The District of Columbia is connected to a network of passenger rail (Amtrak), public transportation (commuter rail), and freight rail. All Amtrak trains and commuter rail pass though or terminate at Union Station near the U.S. Capitol Building. Union Station is Amtrak's second busiest train station in the nation, with over five million passengers in 2013 (Amtrak, 2015a). Figure 5.1.1-1 illustrates the major transportation networks, including rail lines, in the District.

Amtrak runs numerous lines through the District, including the Acela Express and Northeast Regional, which is a popular line, with routes running between the District and Boston in 6 hours 40 minutes and 7 hours 50 minutes, respectively. Union Station is the only train station in the District served by Amtrak. Table 5.1.1-3 provides a complete list of Amtrak lines that run through the District.

Table 5.1.1-3: Amtrak Train Routes Serving District of Columbia

Route	Starting Point	Ending Point	Length of Trip
Acela Express	Boston, MA	Washington, D.C.	6 hours 40 minutes
Cardinal/Hoosier State	New York, NY	Chicago, IL	26 hours 30 minutes
Capitol Limited	Washington, D.C.	Chicago, IL	18 hours
Carolinian/Piedmont	New York, NY	Charlotte, NC	13 hours 30 minutes
Crescent	New York, NY	New Orleans, LA	30 hours
Northeast Regional	Boston, MA	Virginia Beach, VA	12 hours 30 minutes
Silver Service/Palmetto	New York, NY	Tampa/Miami, FL	28+ hours
Vermonter	St. Albans, VT	Washington, D.C.	13 hours 45 minutes

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

The District of Columbia metropolitan area has two commuter rail services plus a subway system. The Virginia Railway Express (VRE) is a joint project of the Northern Virginia Transportation Commission and the Potomac and Rappahannock Transportation Commission. It provides service between Union Station and stations in Virginia along two lines: the Manassas Line and the Fredericksburg Line. VRE stops at 18 stations and currently carries an average of 20,000 passengers daily. (VRE, 2015)

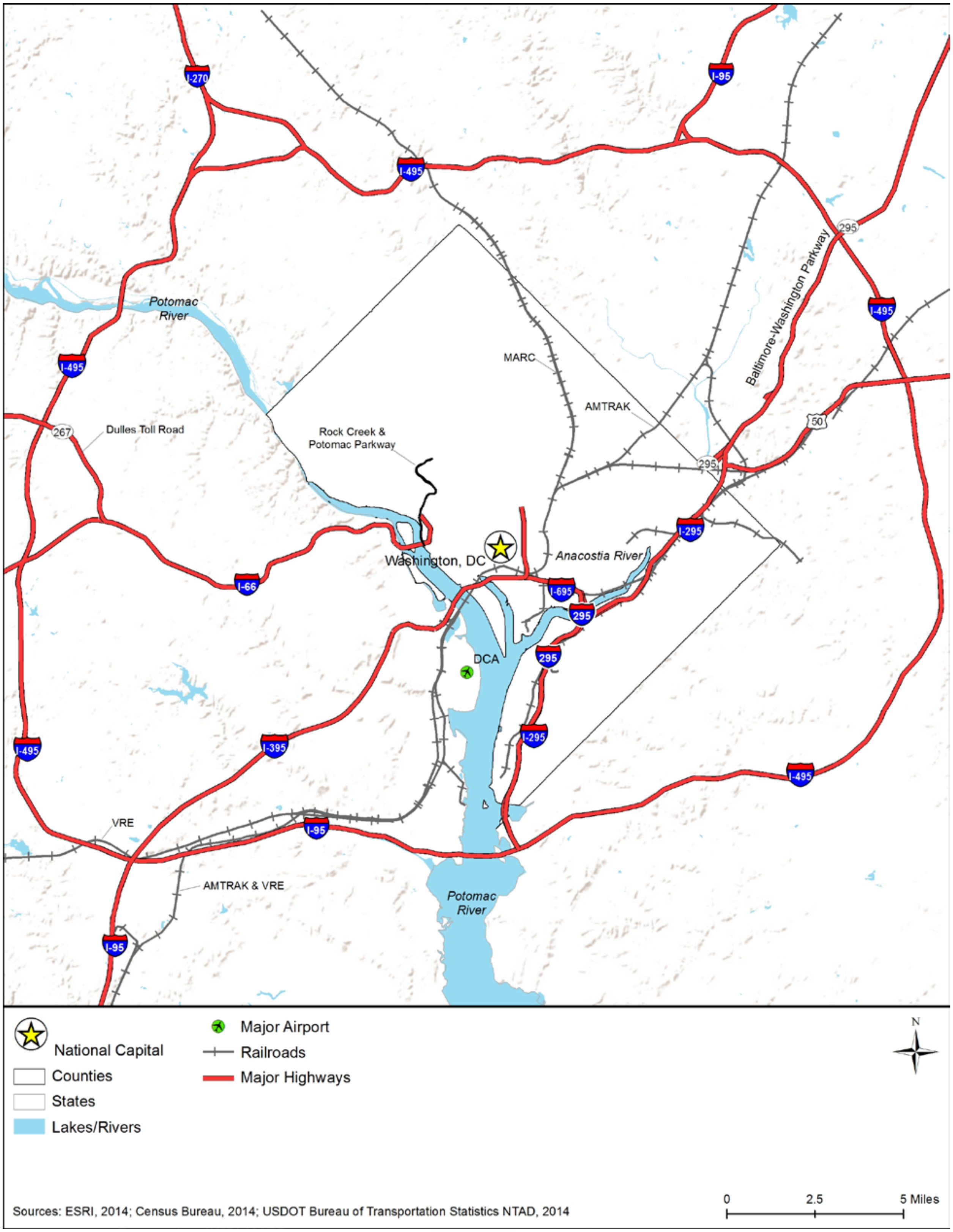


Figure 5.1.1-1: District of Columbia Transportation Networks

The Maryland Transit Administration, a division of the Maryland Department of Transportation, operates the Maryland Area Regional Commuter (MARC). It provides service between Union Station and stations in Maryland, including Baltimore, and West Virginia along three lines: the Penn, Camden, and Brunswick Lines. MARC stops at 43 stations (Maryland Transit Administration, 2015) and carried an average of 36,685 passengers daily in fiscal year 2013 (Maryland Transit Administration, 2013).

The Washington Metropolitan Area Transit Authority (WMATA) runs the District's public transportation system, called Metro. The system includes Metrorail and Metrobus. Metrorail is the District's subway system with 91 stations that are either above or below ground. Metrorail has 117 miles of track and is the nation's second largest heavy rail transit system. Metrorail served approximately 209 million passengers in 2013. (WMATA, 2013)

The District does not host major freight rail facilities or yards. The freight rail company CSX operates about 20 miles of railroad in the District; these lines are used to ship freight such as coal, iron, steel, machinery, railroad equipment, and logs through the District. (DDOT, 2015b).

Harbors and Ports

The District's waterway infrastructures primarily serves recreational boaters and tourists, with occasional visits by commercial vessels carrying bulk fuel or construction supplies, and visiting military vessels. Tugboats and barges periodically visit the fuel transfer pier on the east bank of the Anacostia River in the District, which is the terminus of a pipeline along the Suitland Parkway that serves Andrews Air Force Base in Maryland (DDOT, 2014b). The Washington Navy Yard, on the west bank of the lower Anacostia River, is a former shipbuilding facility and the oldest Navy shore installation in the United States. The Washington Navy Yard is now predominantly a military office park, which serves as the Headquarters of Naval District Washington. The Washington Navy Yard also houses the National Museum of the U.S. Navy and USS Barry (DD-933), a permanently moored retired Forrest Sherman-class destroyer (CNIC, 2015).

There are six public marinas in the District (Diamond Teague Piers, Fletchers Cove Boathouse, Gangplank Marina, James Creek Marina, Thompson Boat Center, and Washington Marina) along the Potomac and Anacostia Rivers, which serve a mix of recreational vessels, including powerboats, sailboats, houseboats, and rowing craft. There is also a marina for military personnel at Bolling Air Force Base (AFB) on the Anacostia River. Various law enforcement authorities also maintain harbor and shoreline infrastructure in the District, including the Metropolitan Police Department Harbor Patrol (DC Metropolitan Police Department, 2016).

The Southwest Waterfront area along the Washington Channel is a rapidly redeveloping area, and location of the Gangplank Marina (with a large houseboat community) and piers that serve commercial tourist vessels that offer sightseeing and evening entertainment cruises on the Potomac River. In April 2015, U.S. Transportation Secretary Anthony Foxx "designated three new Marine Highway Projects… [including]… the M-495 Potomac River Commuter Ferry Project to connect work and residential centers along the Potomac, Occoquan, and Anacostia

Rivers, providing a waterborne alternative for moving passengers and freight within the region and increase the resiliency of existing regional transit system (MARAD, 2015)."

5.1.1.4. Public Safety Services

The District of Columbia's public safety services generally consist of public safety infrastructure and first responder personnel throughout the District. The general abundance and distribution of public safety services may roughly follow key District demographic indicators. Table 5.1.1-4 presents the District's key demographics, including population; land area; population density; and number of counties, cities/towns, and municipal governments. More information about these demographics is presented in Section 5.1.9, Socioeconomics.

Table 5.1.1-4: Key District of Columbia Indicators

District of Columbia Indicators	
Estimated Population (2014)	658,893
Land Area (square miles) (2010)	61.05
Population Density (persons per sq. mile) (2014)	10,793
Municipal Governments (2013)	1

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

Table 5.1.1-5 presents the District's public safety infrastructure, including fire and police stations. Table 5.1.1-6 identifies first responder personnel including dispatch, fire and rescue, law enforcement, and emergency medical personnel in the District.

Table 5.1.1-5: Public Safety Infrastructure in District of Columbia by Type

Infrastructure Type	Number
Fire and Rescue Stations	42
Law Enforcement Agencies	4
Fire Departments	39

Sources: (National Fire Department Census, 2015) (Reaves, 2011)

Table 5.1.1-6: First Responder Personnel in District of Columbia by Type

First Responder Personnel	Number
Police, Fire and Ambulance Dispatchers	130
Fire and Rescue Personnel	1,489
Law Enforcement Personnel	14,659
Emergency Medical Technicians and Paramedics	1,220

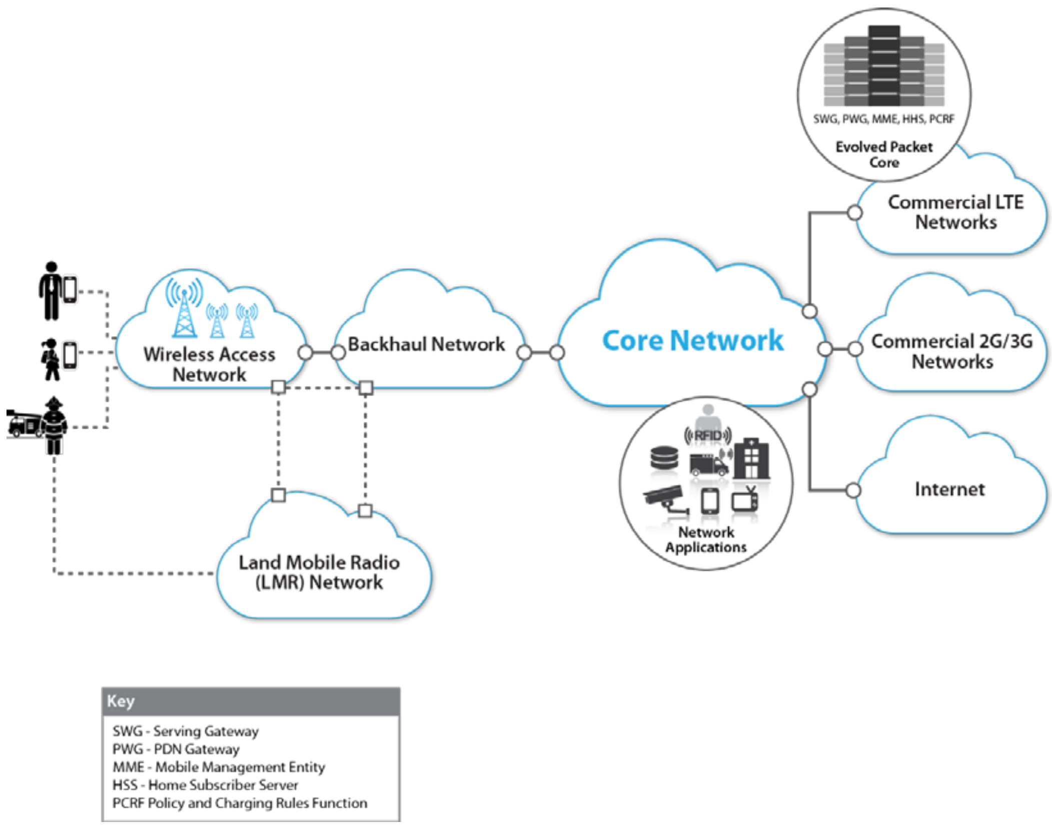
Sources: (National Fire Department Census, 2015) (BLS, 2015a) (Reaves, 2011)

5.1.1.5. Telecommunications Resources

Telecommunication resources in the District can be divided into two primary categories: specific public safety communications infrastructure and commercial telecommunications infrastructure (FCC, 2015a) (BLS, 2016). There is no central repository of information for either category;

therefore, the following information and data are combined from a variety of sources, as referenced.

In general, the deployment of telecommunications resources in the District is widespread and similar to the rest of the United States. Communications throughout the state are based on a variety of publicly and commercially owned technologies, including coaxial cable (traditional copper cable), fiber optics, hybrid fiber optics/coaxial cable, microwave, wireless, and satellite systems providing voice, data, and video services (BLS, 2016). Figure 5.1.1-2 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). It also shows backhaul (long-distance wired or wireless connections), core, and commercial networks including a long-term evolution (LTE) evolved packet core (modern broadband cellular networks); and network applications (software) delivering voice, data, and video communications (FCC, 2016a).



Prepared by: Booz Allen Hamilton

Figure 5.1.1-2: Wireless Network Configuration

Public Safety Communications

In order to protect and best serve the public interest, first responder and law enforcement communities must be able to communicate effectively. The evolution of the communications networks used by public safety stakeholders toward a broadband wireless technology, such as LTE (see Section 2.1.1), has the potential to provide users with better coverage, while offering additional capacity and potentially 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 (Rouil, Izquierdo, Gentile, Griffith, & Golmie, 2015). Historically, there have been many challenges and impediments to timely and effective sharing of information, including jurisdictional challenges, funding challenges, the pace of technology evolution, and communication interoperability. Communication interoperability has been a persistent challenge, along with issues concerning spectrum availability, embedded infrastructure, and differing standards among stakeholders (NTFI, 2005). This has caused a fragmented approach to communications implementation across the United States and at the District level, including in the District of Columbia. There are five key reasons why public safety agencies often cannot connect through existing communications (NTFI, 2005):

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

To enable the public safety community to incorporate disparate Land Mobile Radio networks into a nationwide public safety LTE broadband network, in 2015, the U.S. Department of Commerce Public Safety Communications Research (PSCR) prepared a locations-based services (LBS) research and development "roadmap" to examine the current state of location-based technologies. The program also forecasts the evolution of LBS capabilities and gaps, and identifies potential research and development opportunities that would improve the public safety community's use of LBS within operational settings. This is the first of several technology roadmaps that PSCR plans to develop over the next few years. (PSCR, 2015)

Public safety network communications in the District reflect a combination of older Very High Frequency (VHF)[2] and Ultra High Frequency (UHF)[3] analog radios operating across multiple frequency bands, as well as 700 megahertz (MHz) and 800 MHz analog and digital wireless radios and infrastructure (RadioReference.com, 2015a).

In addition, the District operates two 700 MHz broadband Public Safety networks. The first is the Wireless Accelerated Responder's Network, providing an interoperable 700 MHz broadband service in the District from 12 transceiver sites using an experimental license from the Federal Communications Commission (FCC). Operational since 2005, the network provides peak speeds in excess of 2.5 Megabits per second to local and federal agencies throughout the District. (Robert LeGrande, 2015). The second broadband 700 MHz network is the Regional Wireless Broadband Network (RWBN), a multijurisdictional interoperable network covering the National Capital Region (NCR), which in addition to the District includes adjacent Virginia and Maryland counties and key cities including Manassas, Alexandria, and Rockville. Figure 5.1.1-3 presents counties and cities included in the NCR (NCRHSP, 2015).

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

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

In 2004, Public Safety Communications management shifted from a joint operation of the Metropolitan Police Department and Fire Emergency Medical Services to a new District agency, the Office of Unified Communications. This agency provides District-wide public safety voice radio technology and other public safety communication systems. The Technology Operations Division operates 9-1-1 emergency call centers, dispatches fire, EMS, and police. This Division operates and maintains public safety voice radio technology and management of land and mobile radio systems supporting the emergency response network. The Office of Unified Communications plays a key role in the oversight and management of current operations and future network strategy and implementation. Specifically the Office:

- "Manages interoperable communication on 800MHz system with the NCR – capable systems to communicate on surrounding jurisdictions 800MHz systems for mutual aid and cross boundary communications
- Manages Radio Engineering planning, coordination, implementation, and operation of D.C.'s Public Safety Radio Network
- Is a key member of the Association of Public-Safety Communications Officials (APCO) Region 20 and the communications technical subcommittee for 800MHz and 700MHz
- Is a critical contributor to NCR RWBN – High speed broadband wireless data network" (Office of Unified Communications, 2016).

Public Safety Networks

Police, fire, and EMS networks in the District operate across VHF, UHF and 700 MHz/800MHz frequency networks. D.C. Common System Talkgroups (cross-agency) use 800 MHz analog voice and digital APCO-25 Common Air Interface[4] for daily operations, tactical communications, and mutual aid situations. For example, the Police Mutual Aid Radio System operates on this 800 MHz system. Additional users of these networks include the D.C. Department of Health, hospitals, and DDOT (Radioreference.com, 2015b).

In addition to the District's 800 MHz, analog and digital P-25 system referenced above, police, fire, and EMS personnel use a newer P-25 Phase II[5] system operating at 700 MHz/800 MHz. In addition to supporting D.C. System Common Talk Groups, such as Interoperable Communications with the Unified Communications Center and Mutual Aid users, the system supports fire, police, EMS, health/hospital, the Department of Communications, and a number of municipal users (RadioReference.com, 2015a).

Interoperability is critical to effective public safety communications and in its strategic plan the District's HSEMA point to two key examples of the District's focus on interoperability both beyond its borders with adjacent jurisdictions and within the District.

- "All District of Columbia agencies and responders have unencumbered access to communications and information technologies to facilitate interoperability. District of

[4] APCO-25 Common Air Interface is a Project 25 (P-25) digital communications standard 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.

[5] P-25 Phase II is an APCO digital communication standard using 2-slot Time Division Multiple Access and 12.5 KHz channels.

Columbia and NCR have one of the most advanced voice/radio interoperability capabilities among major metropolitan areas. District of Columbia's primary radio communications network is used by all responder agencies, and dispatchers are trained to facilitate cross-agency communications as appropriate."

- "The State Interoperability Committee leads District of Columbia's efforts continually to update and enhance interoperable communications. The committee also works to improve redundancy and resiliency of District of Columbia's emergency notification systems." (HSEMA, 2010)

Multijurisdictional Networks

The Justice Integrated Wireless Network (IWIN) in the District resulted as part of a broader 34 county law enforcement wireless network upgrade project. The 34 counties vary from Washington State, Oregon, District of Columbia, and Virginia. The IWIN project replaced standalone legacy equipment and provided improved interoperability for some federal agencies. In the District, federal agencies using IWIN include the Federal Bureau of Investigation; U.S. Marshals Service; the Drug Enforcement Agency; and the Bureau of Alcohol, Tobacco, and Firearms (RadioReference.com, 2015c).

The NCR includes the District plus five surrounding counties (NCRHSP, 2015). Figure 5.1.1-3 depicts the counties and cities included in the NCR.

Figure 5.1.1-3: National Capital Region Jurisdictions

Source: (NCRHSP, 2015)

As mentioned above, the District operates a 12-site broadband 700 MHz network called the RWBN, which supports cross-agency interoperable communications within the District's 27 agencies. In 2008, the NCR's Metropolitan Washington Council of Governments (MWCOG) issued a Request for Information, seeking, among other things, to expand the NCR RWBN to the 21 member jurisdictions to the NCR (MWCOG, 2008). Interoperability at 800 MHz and in selective other frequencies exist for NCR jurisdictions, albeit in a more limited fashion than that envisioned in the MWCOG's 2008 Request for Information.

Public Safety Answering Points (PSAP)

According to the 20's Master PSAP registry there are six PSAPs supporting the District of Columbia: five primary and one secondary/backup (FCC, 2015b).

Commercial Telecommunications Infrastructure

The District'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 the District'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

The District of Columbia'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 5.1.1-7 presents the number of providers of switched access[6] lines, Internet access,[7] and mobile wireless services including coverage.

Table 5.1.1-7: Telecommunications Access Providers and Coverage in District of Columbia as of December 31, 2013

Commercial Telecommunications Access Providers	Number of Service Providers	Coverage
Switched access lines	106	97.2% of households
Internet access	31	69.0% of households
Mobile wireless	6	100.0% of population

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

Table 5.1.1-8 shows the wireless providers in the District along with their geographic coverage. Figure 5.1.1-4, Figure 5.1.1-5, Figure 5.1.1-6, and Figure 5.1.1-7 show the combined coverage for the top two providers, AT&T and Verizon Wireless (each of which covers the entire District); T-Mobile and Cricket Wireless coverage; Sprint's coverage; and D.C. Access' coverage, respectively.

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

Table 5.1.1-8: Wireless Telecommunications Coverage by Providers in District of Columbia

Wireless Telecommunications Providers	Coverage
Verizon Wireless	99.98%
Cricket Wireless	99.97%
T-Mobile	99.97%
AT&T Mobility LLC	99.96%
Sprint	99.44%
D.C. Access, LLC	5.86%

Source: (NTIA, 2014)

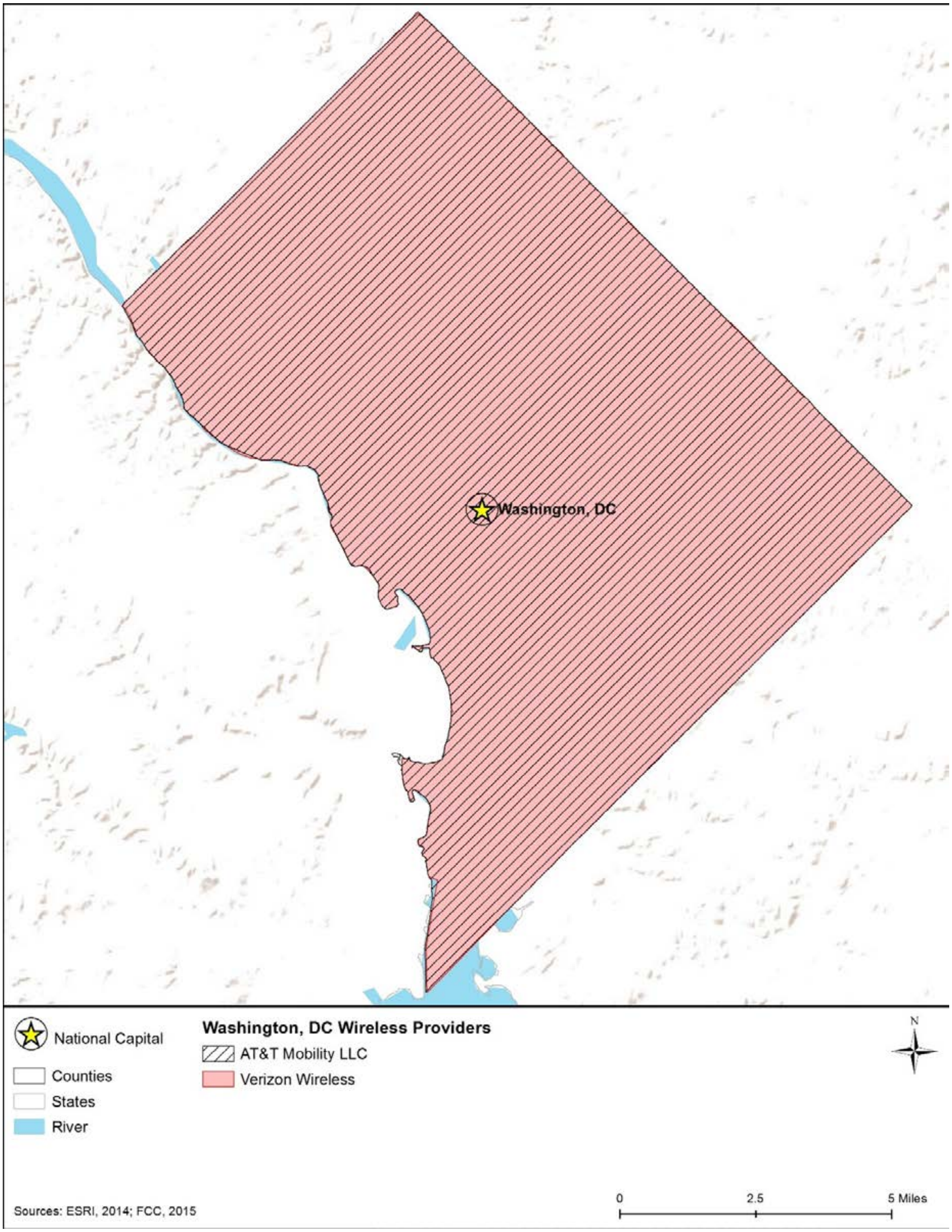


Figure 5.1.1-4: AT&T and Verizon Wireless Availability in District of Columbia

Source: (NTIA, 2014)

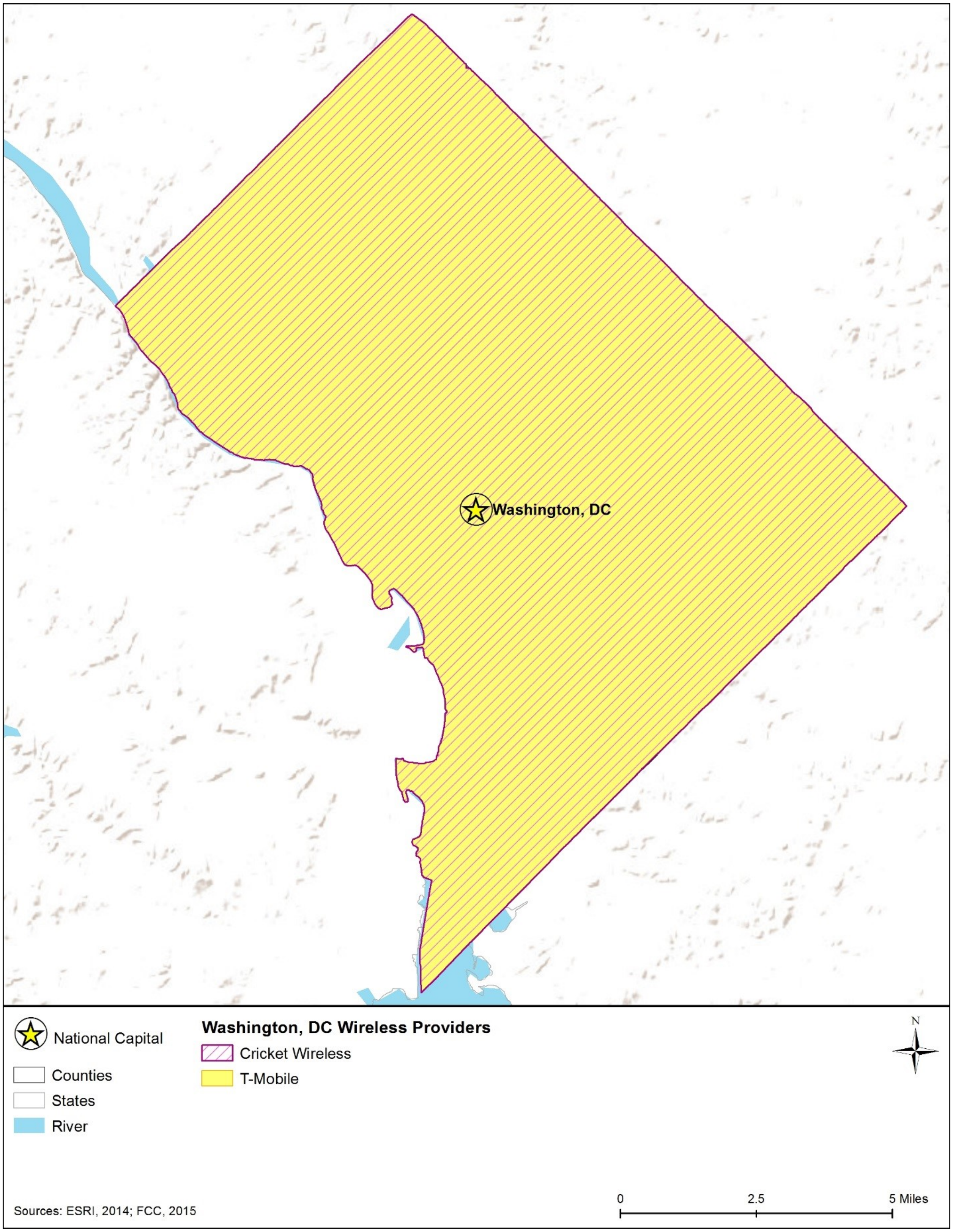


Figure 5.1.1-5: T-Mobile and Cricket Wireless Availability in District of Columbia

Source: (NTIA, 2014)

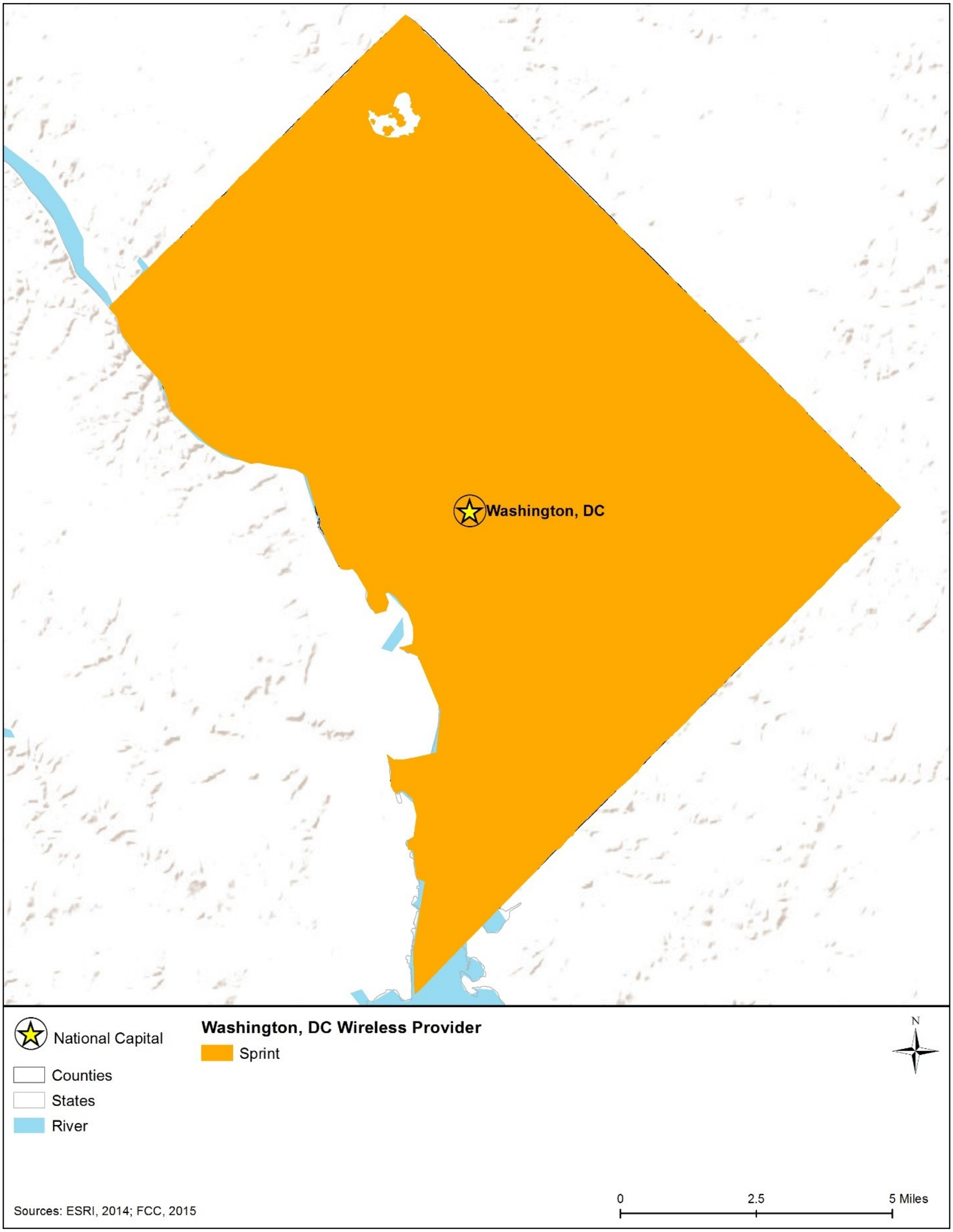


Figure 5.1.1-6: Sprint Wireless Availability in District of Columbia

Source: (NTIA, 2014)

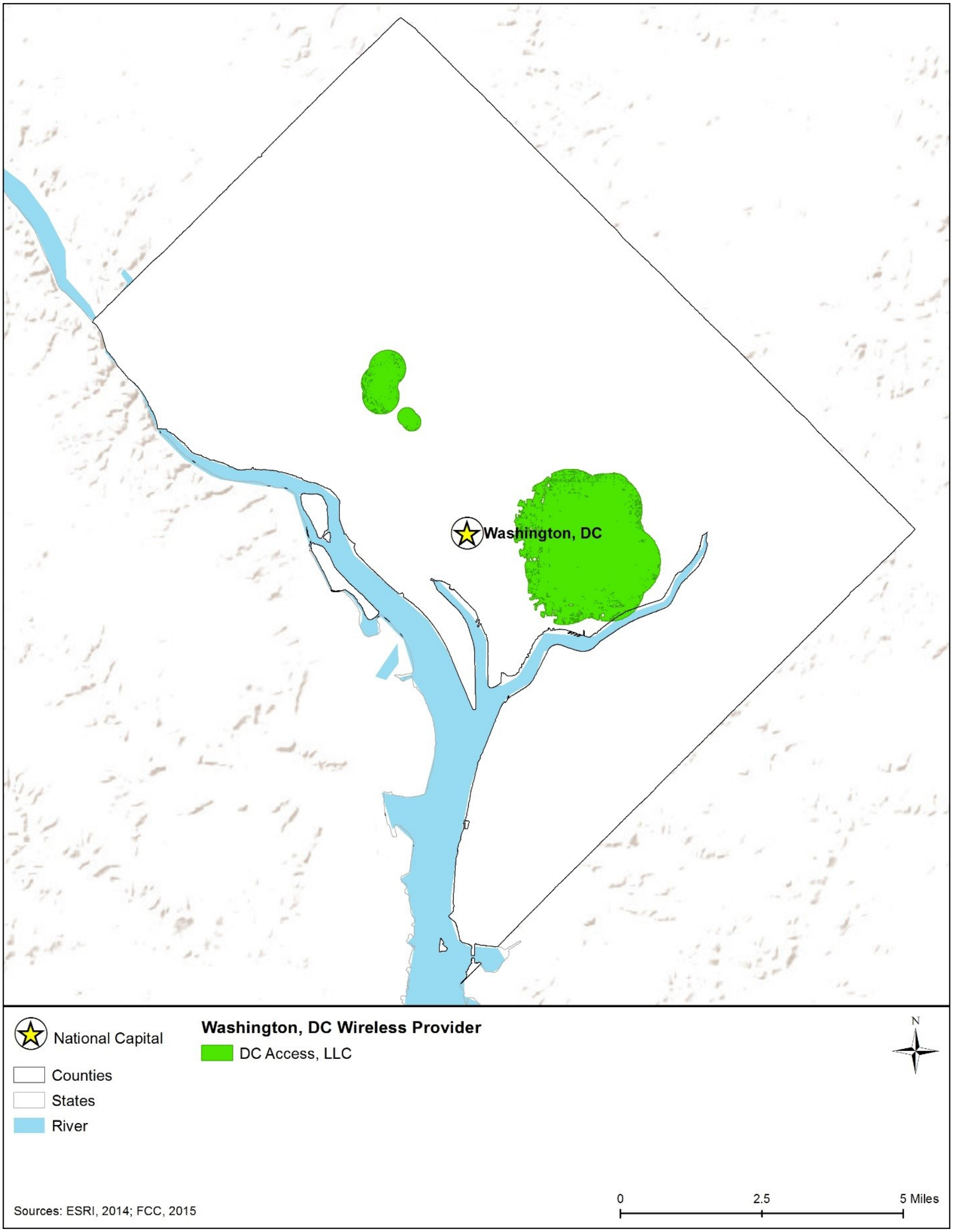


Figure 5.1.1-7: Access Wireless Availability in District of Columbia

Source: (NTIA, 2014)

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 (RF) 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 5.1.1-8 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 5.1.1-8: Types of Towers

Telecommunications tower infrastructure can be found throughout the District, although tower infrastructure is concentrated in the higher and more densely populated areas of the District. Owners of towers and some types of antennas are required to register those infrastructure assets with the FCC (FCC, 2016b).[8] Table 5.1.1-9 shows the number of towers (including broadcast towers) registered with the FCC in the District. Figure 5.1.1-9 shows the location of those 21 structures, as of June 2015.

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

Table 5.1.1-9: Number of Commercial Towers in District of Columbia by Type

Constructed[a] Towers[b]		**Constructed Monopole Towers**	
100ft and over	5	100ft and over	0
75ft – 100ft	2	75ft – 100ft	0
50ft – 75ft	0	50ft – 75ft	0
25ft – 50ft	2	25ft – 50ft	1
25ft and below	3	25ft and below	1
Subtotal	**12**	**Subtotal**	**2**
Constructed Guyed Towers		**Buildings with Constructed Towers**	
100ft and over	NA	100ft and over	0
75ft – 100ft	NA	75ft – 100ft	0
50ft – 75ft	NA	50ft – 75ft	1
25ft – 50ft	NA	25ft – 50ft	3
25ft and below	NA	25ft and below	0
Subtotal		**Subtotal**	**4**
Constructed Lattice Towers		**Multiple Constructed Structures[c]**	
100ft and over	1	100ft and over	NA
75ft – 100ft	1	75ft – 100ft	NA
50ft – 75ft	1	50ft – 75ft	NA
25ft – 50ft	0	25ft – 50ft	NA
25ft and below	0	25ft and below	NA
Subtotal	**3**	**Subtotal**	
Constructed Tanks[d]			
Tanks	0		
Subtotal	0		
Total All Tower Structures		**21**	

Source: (FCC, 2015c)

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

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

[c] Multiple constructed structures per antenna registration (FCC, 2013)

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

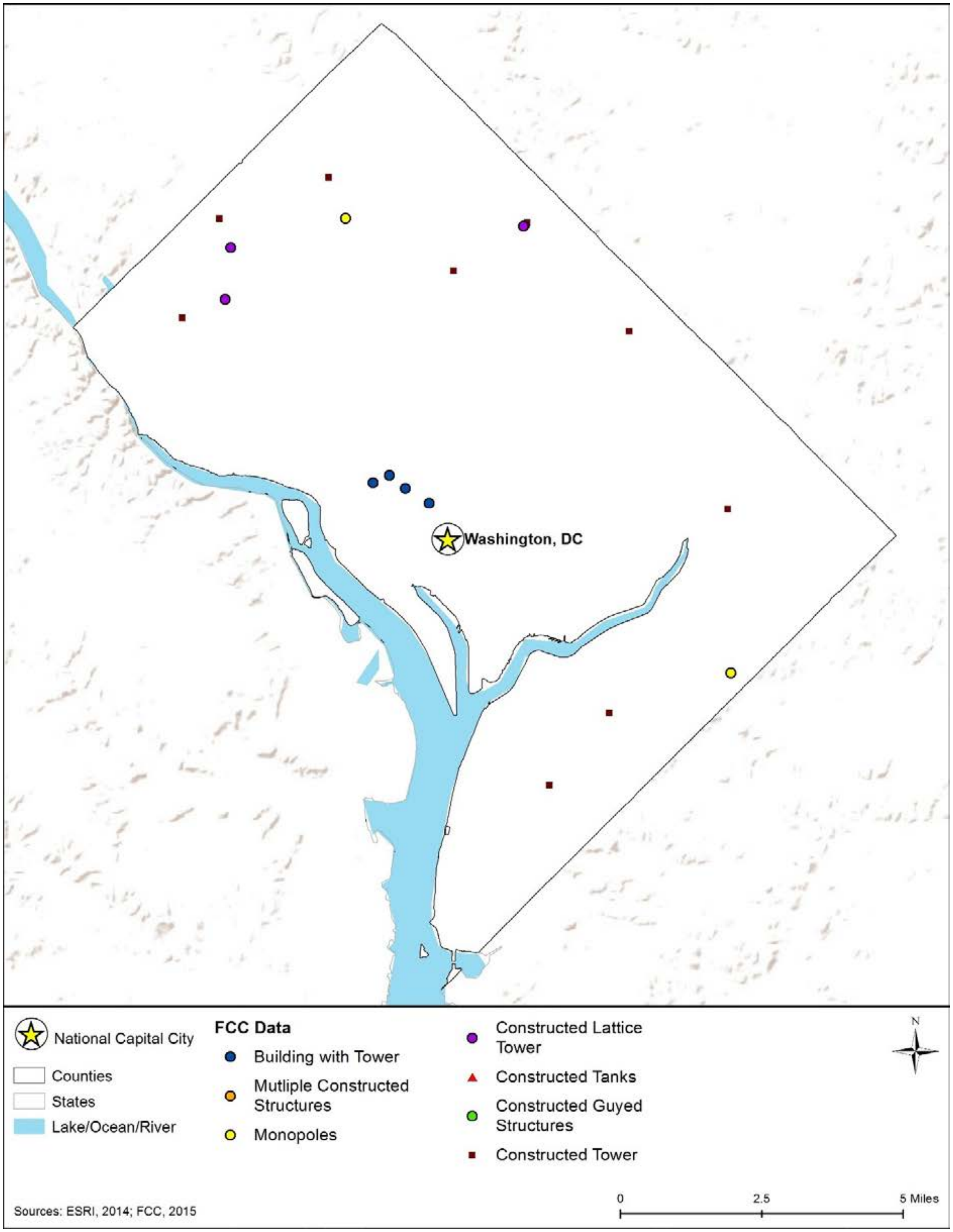
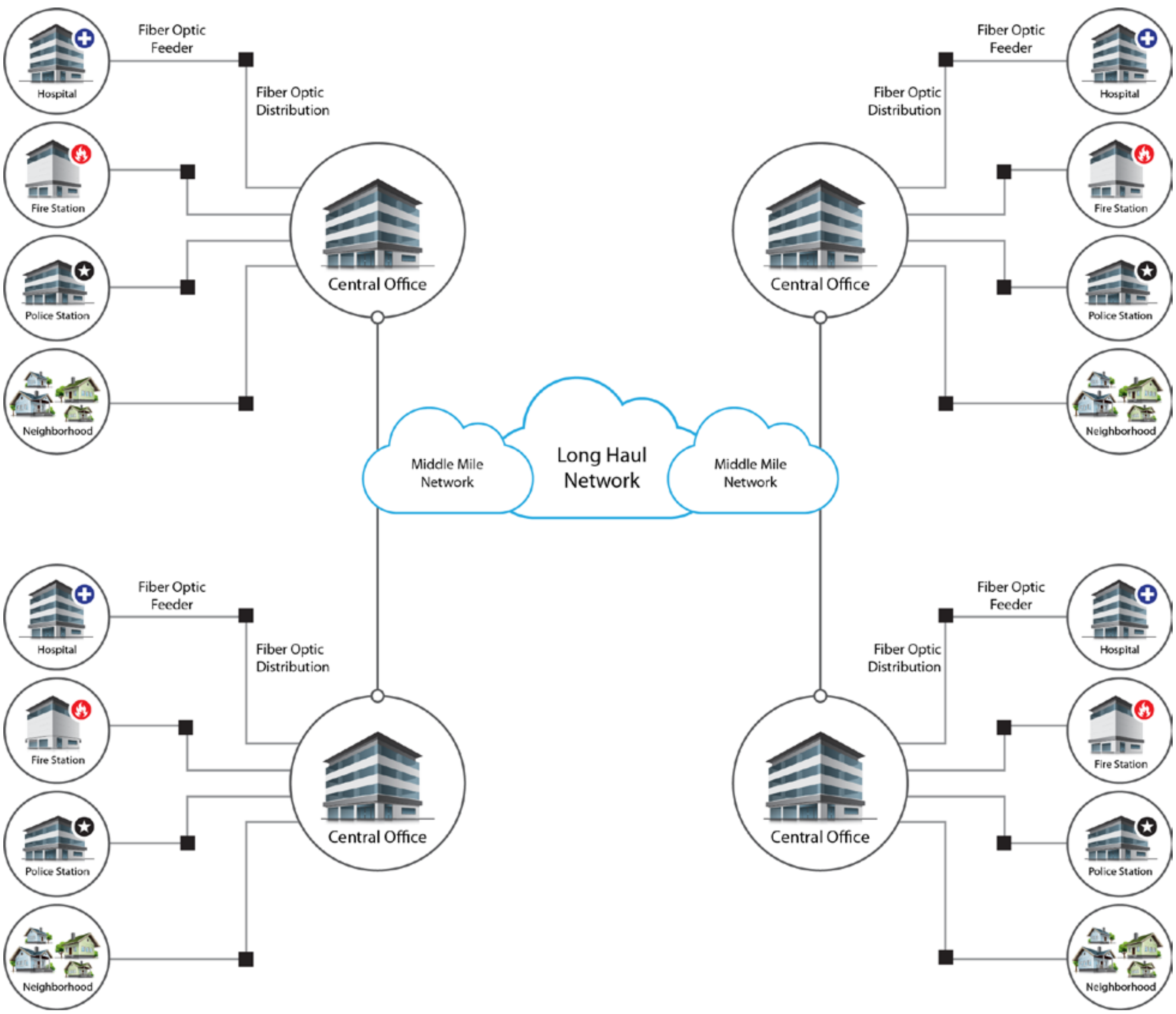


Figure 5.1.1-9: FCC Tower Structure Locations in the District of Columbia

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). They can also be placed under water; or installed aerially between poles, typically on utility rights-of-way (ROWs). 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 5.1.1-10. The network also may include a middle mile component (shorter distance cables linking the core network between central offices or network nodes across a region) and a long haul network component (longer distance cables linking central offices across regions). (FCC, 2000)



Prepared by: Booz Allen Hamilton

Figure 5.1.1-10: Typical Fiber Optic Network in District of Columbia

Last Mile Fiber Assets

In the District of Columbia, fiber access networks are concentrated in the highest population centers as shown in the figures below. Eleven fiber providers offer service in the District (see Table 5.1.1-10). Figure 5.1.1-11 shows coverage for all providers but Verizon, Comcast, Allied Telecom Group, Broadview Network, and Windstream, whose coverage areas are depicted in Figure 5.1.1-12, Figure 5.1.1-13, and Figure 5.1.1-14, respectively.

Table 5.1.1-10: Fiber Provider Coverage in District of Columbia

Fiber Provider	Coverage
Verizon Washington, D.C. Inc.	86.65%
Comcast	77.27%
Broadview Networks, Inc.	75.66%
MegaPath Corporation	68.05%
RCN and RCN Business Solutions	51.35%
Windstream	47.93%
Allied Telecom Group, LLC	47.55%
Level 3 Communications, LLC	6.60%
TW Telecom Inc.	2.24%
Cogent Communications, Inc.	0.66%
Zayo Group, LLC	0.58%

Source*:* (NTIA, 2014)

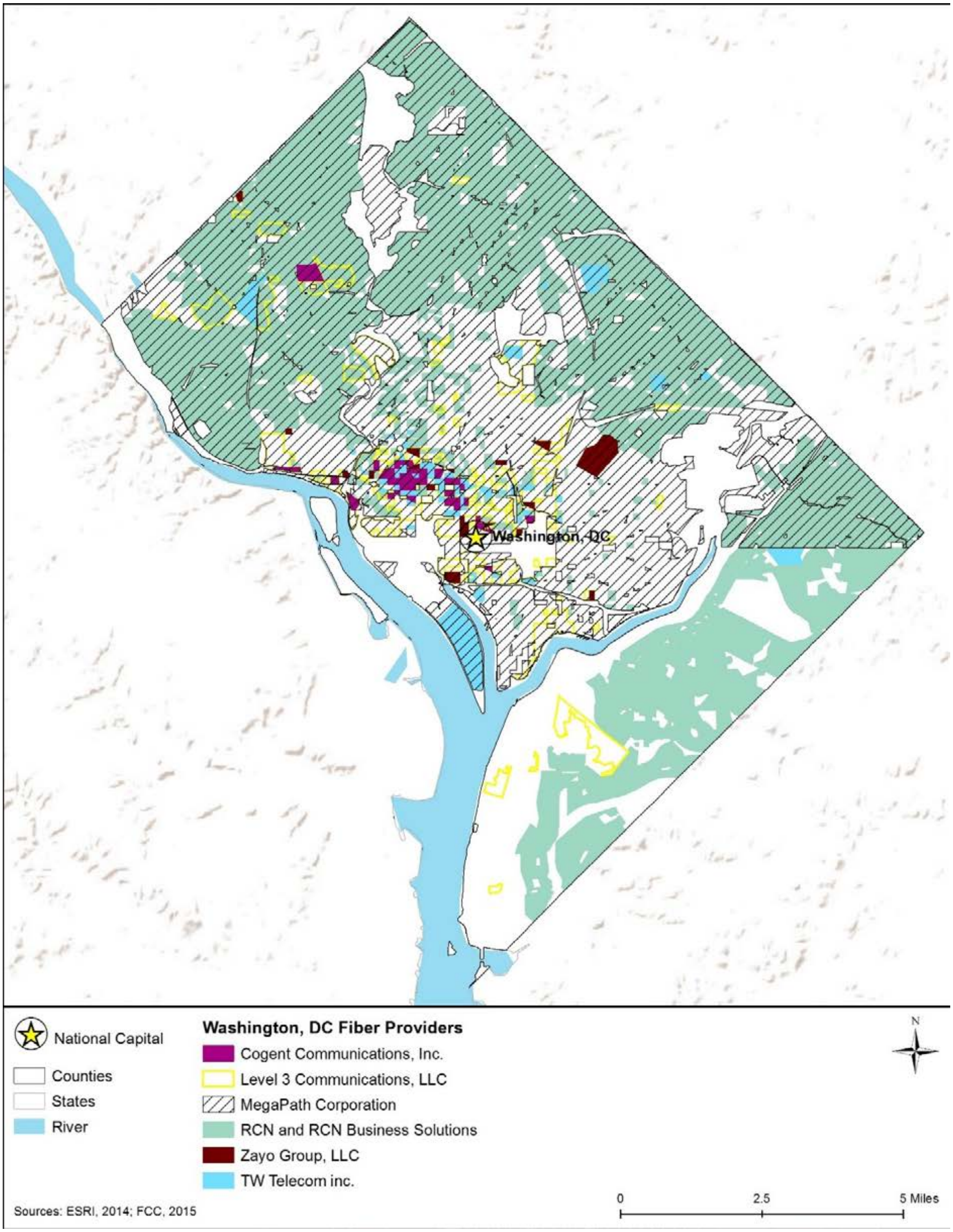


Figure 5.1.1-11: Fiber Availability in District of Columbia for All Providers but Verizon, Comcast, Allied Telecom Group, Broadview Network and Windstream

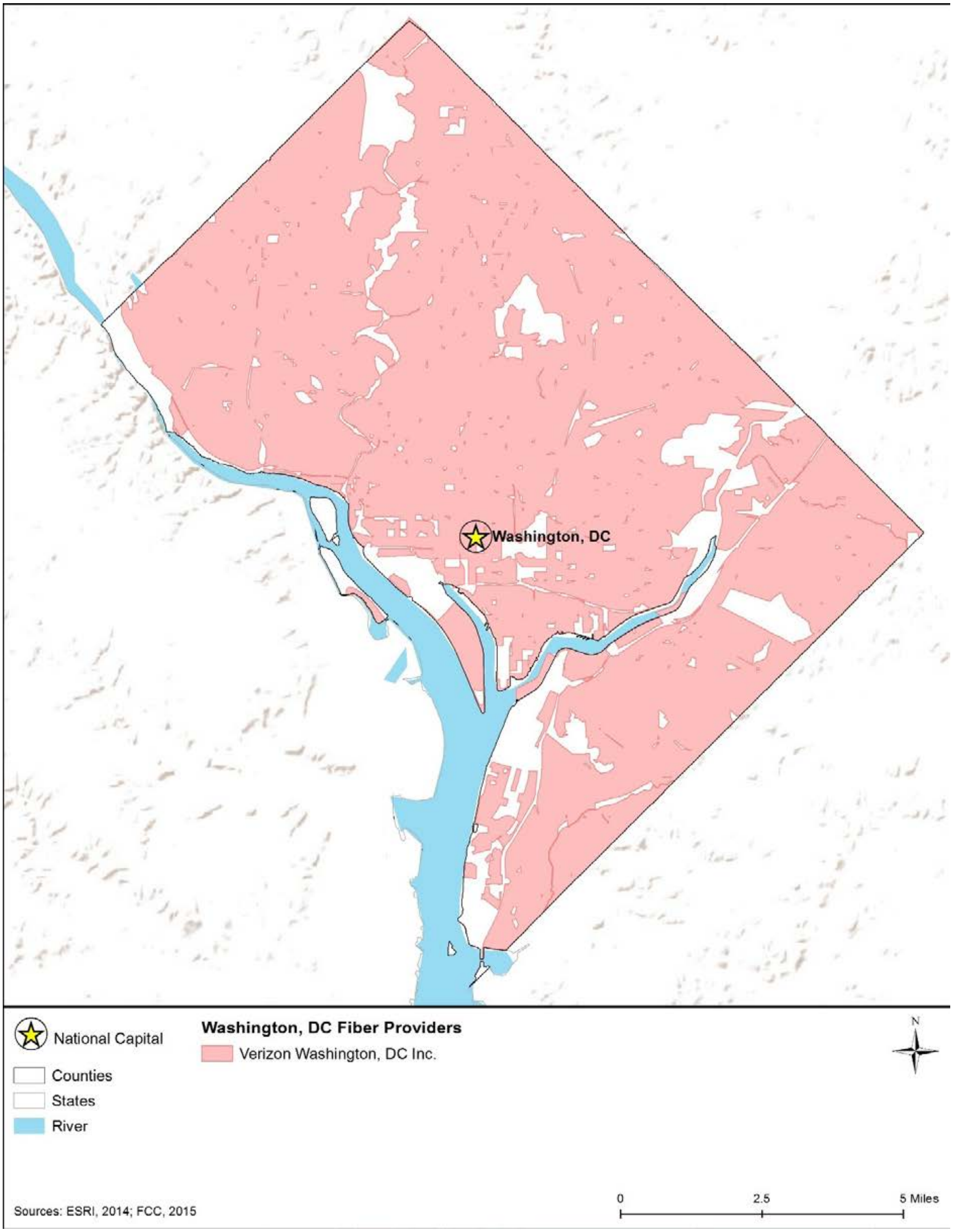


Figure 5.1.1-12: Verizon Fiber Availability in District of Columbia

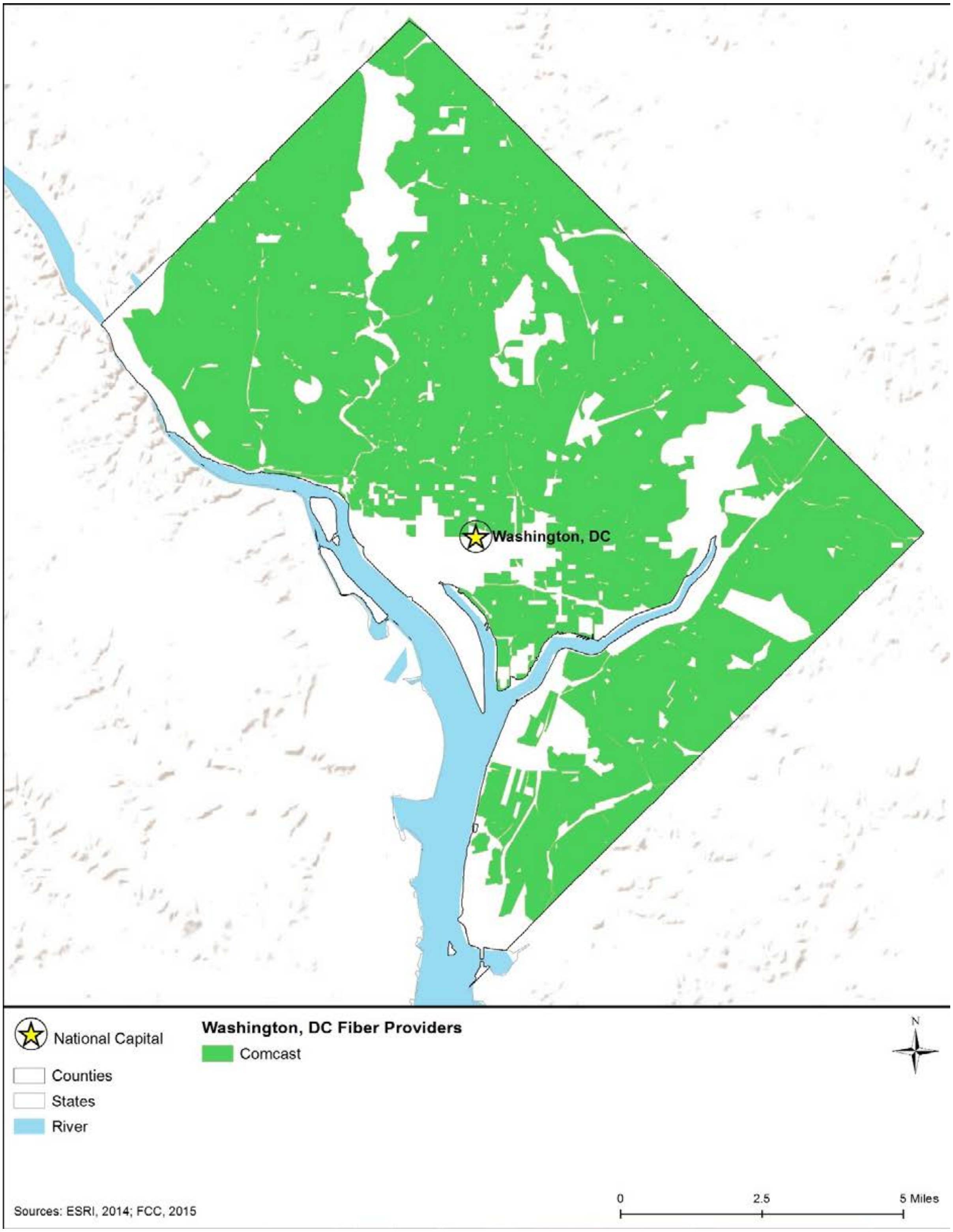


Figure 5.1.1-13: Comcast Fiber Availability in District of Columbia

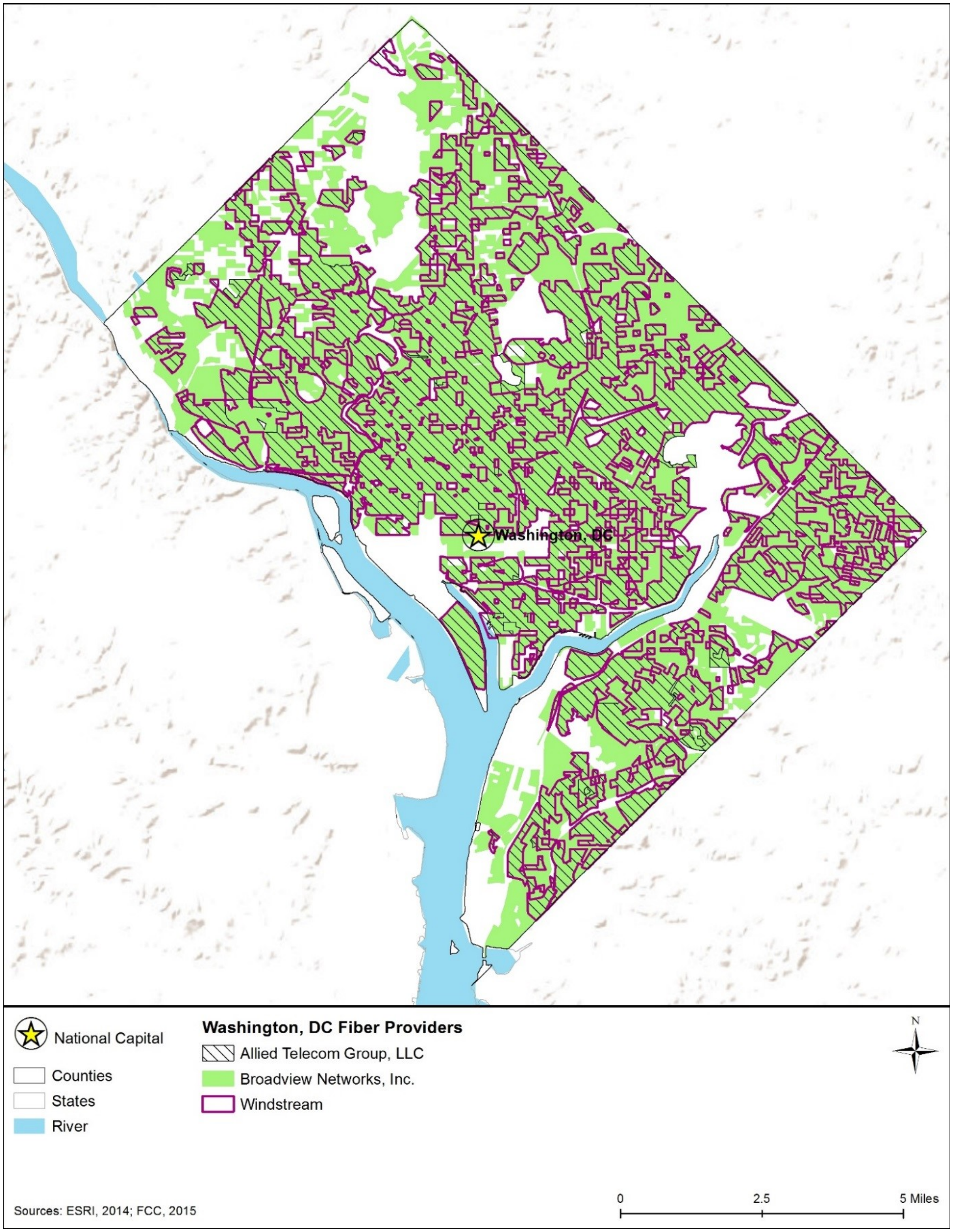


Figure 5.1.1-14: Allied Telecom Group, Broadview Network, and Windstream Fiber Availability in District of Columbia

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, 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).

5.1.1.6. 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 sewage. Section 5.1.4, Water Resources, describes the potable water sources in the District.

Electricity

The D.C. Public Service Commission (DCPSC) regulate the District's electricity, natural gas, and telephone companies (DCPSC, 2015a). While customers can choose the company that handles the generation and transmission of their electricity, the Potomac Electric Power Company (PEPCO) is the only electricity distributer in the District. Electricity transmission involves transport of the electricity from its site of generation to the District, while distribution involves the delivery of electricity to the customer (DCPSC, 2015b). Customers in the District have a choice of 158 utilities that have been approved as electricity generation or transmission suppliers. Of this number, 95 of them provide broker services, acting as an intermediary between suppliers and customers and helping to negotiate rates. Only six of these companies are in the District, the rest transport electricity from states as far away as Texas (DCPSC, 2015c). In 2013, D.C had a net gain of 121.1 Trillion British Thermal Units[9] from out of District sources (EIA, 2015a). As of December 2015, the District of Columbia had the 17th highest average residential electricity price in the country (EIA, 2015b). In 2014, 76 percent of the electricity sold went to commercial customers, largely due to the high number of government and commercial buildings in the District (EIA, 2015c).

Water

The District of Columbia Water and Sewer Authority (DC Water) is the distributer for all public water service in the District of Columbia; Arlington, VA; and parts of Fairfax County, VA. The Authority operates five reservoirs, four pumping stations, three elevated water storage tanks, and more than 1,300 miles of distribution pipes to serve more than 640,000 residents (Washington DC Government, 2015) (DC Water, 2015a). Raw river water is drawn from the Maryland side of the Potomac River, near Great Falls and Little Falls, and processed at the Washington Aqueduct treatment plants before distribution to customers (USACE, 2015) (DC Water, 2015b) (DC Water, 2015c). DC Water adheres to the water quality standards set forth by the Safe

[9] One British Thermal Unit is the amount of heat needed to raise the temperature of one pound of water by 1 °F. (EIA, 2015d)

Drinking Water Act of 1974, but strives to exceed these by setting its own standards (https://www.dcwater.com/drinking_water/about.cfm) (DC Water, 2015d). Monthly water test results are posted on the DC Water website (www.dcwater.com) (DC Water, 2015e). Additionally, a notice of availability of Annual Drinking Water Quality Reports is mailed to customers (DC Water, 2015b).

Wastewater

DC Water also handles wastewater collection and treatment in the District. Wastewater collection is accomplished using about 1,800 miles of sanitary, storm and combined sewers, 16 stormwater stations, 75,000 catch basins and manholes, 22 flow-metering stations, and 9 wastewater-pumping stations. Current construction materials are composed of polyvinyl chloride, concrete, and ductile iron. The older third of the collection area uses combined sewers, which contain both sanitary flow water and stormwater. The newer two-thirds of the system utilize separate sewers to manage sanitary water and stormwater. Combined sewer overflows (CSOs) are used when stormwater overreach the capacity of the combined sewers. There are 53 CSOs in the DC Water service area. The ACSO Abatement Program has been implemented to help counteract the negative impact of these combined sewers and includes, among other things, inflatable dams, sewer separations, and other flow regulating systems. (DC Water, 2015f)

Each day, over 330 million gallons of wastewater reach the Blue Plains Advanced Wastewater Treatment Plant, which is managed by DC Water. This includes collections from the District itself, as well as the surrounding suburbs in Virginia and Maryland. DC Water expects an increase of 54 million gallons/day by 2030. The Blue Plains Advanced Wastewater Treatment Plant is the largest of its kind in the world (DC Water, 2015g).

Solid Waste Management

The Department of Public Works (DPW) handles solid waste in the District. This includes collection of household or bulk trash, recycling collection, hazardous waste disposal, and solid waste education efforts. It collects trash and materials to be recycled from residential or commercial buildings with up to three living or working units. Buildings with four or more units have to contract with separate collection companies (DPW, 2015a). Yearly, 99,000 tons of trash and 34,000 tons of recyclable materials are collected from residences by the Department of Public Works. There are no active landfills in the District. Recyclables are sent to facilities in Maryland for processing. Most District trash and yard waste is sent to the Energy Resource Recovery Facility in Fairfax County, VA, where it is burned to generate electricity (DPW, 2015b). This facility is one of the largest of its kind in the United States (Fairfax County Virginia, 2015).

5.1.2. Soils

5.1.2.1. Definition of the Resource

The Soil Science Society of America defines soil as:

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

(ii) The unconsolidated mineral or organic matter on the surface of the Earth that has been subjected to and shows effects of genetic and environmental factors of: climate (including water and temperature effects), and macro- and microorganisms, conditioned by relief, acting on parent material over a period of time. A product-soil differs from the material from which it is derived in many physical, chemical, biological, and morphological properties and characteristics. (NRCS, 2015a)

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

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

5.1.2.2. 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 for Soils, such as the Farmland Protection Policy Act of 1981, are in Section 1.8. A list of applicable District laws and regulations is included in Table 5.1.2-1 below.

Table 5.1.2-1: Relevant District of Columbia Soil Laws and Regulations

District Law/Regulation	Regulatory Agency	Applicability
D.C. Code: Title 21 Water and Sanitation (2013 SW Rule)	DDOE	A Soil Erosion and Sediment Control Plan is required as part of the building permit process for any construction or redevelopment projects that clear, grade, or in any way disturb the ground surface.

Source: (DDOE, 2015a)

5.1.2.3. Environmental Setting

The District of Columbia is composed of one Land Resource Region (LRR),[10] as defined by the National Resources Conservation Service (NRCS) (NRCS, 2006):

- Northern Atlantic Slope Diversified Farming LRR

Within and among the District of Columbia's one LRR are two Major Land Resource Areas (MLRA),[11] which are characterized by patterns of soils, climate, water resources, land uses, and type of farming (NRCS, 2006). The locations and characteristics of the District of Columbia's MLRAs are presented in Figure 5.1.2-1 and Table 5.1.2-2, respectively.

Soil characteristics are an important consideration for FirstNet insomuch as soil properties could influence the suitability of sites for network deployment. Soil characteristics can differ over relatively short distances, reflecting differences in parent material, elevation, position on the landscape, biota[12] (e.g., bacteria, fungi, biological crusts, vegetation, animals, and human beings), and climatic variables such as precipitation and temperature. For example, expansive soils[13] with wet and dry seasons pose great risk to foundations, as they endure shrinking and swelling (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[14] (discussed further in the subsections below).

[10] Land Resource Region: "A geographical area made up of an aggregation of Major Land Resource Areas (MLRA) with similar characteristics." (NRCS, 2006)
[11] Major Land Resource Area: "A geographic area, usually several thousand acres in extent, that is characterized by a particular pattern of soils, climate, water resources, land uses, and type of farming." (NRCS, 2006)
[12] All living organisms of an area. (USGS, 2013a)
[13] 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)
[14] Rutting is indentations in soil from operating equipment in moist conditions or soils with lower bearing strength. (USFS, 2009b)

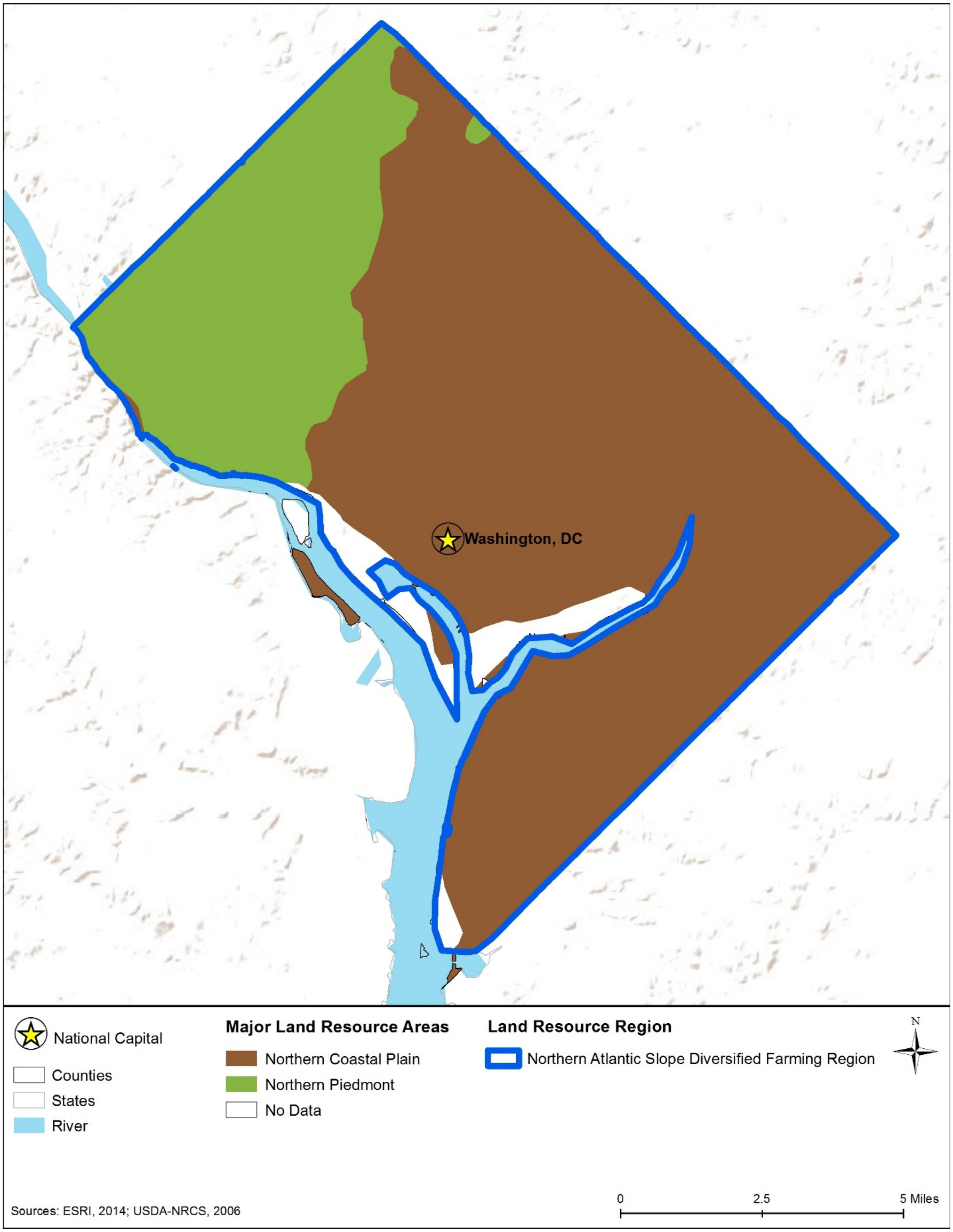


Figure 5.1.2-1: Locations of Major Land Resource Areas in the District of Columbia

Table 5.1.2-2: Characteristics of Major Land Resource Areas in the District of Columbia

MLRA Name	Region	Soil Characteristics
Northern Coastal Plain	Central and Eastern D.C.	Ultisols[15] are the dominant soil order in this MLRA, and soils in this area are very deep, excessively drained to very poorly drained, and loamy or sandy.
Northern Piedmont	Northwestern D.C.	Dominant soil orders are Alfisols,[16] Inceptisols,[17] and Ultisols. The soils in this area are moderately deep to very deep, moderately well drained to somewhat excessively drained, and loamy or loamy-skeletal.

Source: (NRCS, 2006)

5.1.2.4. 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[18]; there are 12 soil orders in the world and they are characterized by both observed and inferred[19] properties, such as texture, color, temperature, and moisture regime. Soil suborders are the next level down, and are differentiated within an order by soil moisture and temperature regimes, as well as dominant physical and chemical properties (NRCS, 2015b). The State Soil Geographic (STATSGO2)[20] soil database identifies three different soil suborders in the District (NRCS, 2015c). Figure 5.1.2-2 depicts the distribution of the soil suborders, and Table 5.1.2-3 provides a summary of the major physical-chemical characteristics of the various soil suborders found.

[15] Ultisols: "Soils found in humid environments that are formed from fairly intense weathering and leaching processes. This results in a clay-enriched subsoil dominated by minerals. They have nutrients concentrated in the upper few inches and make up 8 percent of the world’s ice-free land surface." (NRCS, 2015d)
[16] Alfisols: "Soils found in semiarid to moist areas that are formed from weathering processes that leach clay minerals and other constituents out of the surface layer and into the subsoil. They are productive for most crops, are primarily formed under forest or mixed vegetative cover, and make up nearly 10 percent of the world’s ice-free land surface." (NRCS, 2015d)
[17] Inceptisols: "Soils found in semiarid to humid environments that exhibit only moderate degrees of soil weathering and development. They have a wide range of characteristics, can occur in a wide variety of climates, and make up nearly 17 percent of the world’s ice-free land surface." (NRCS, 2015d)
[18] Taxonomy: A formal representation of relationships between items in a hierarchical structure. (USEPA, 2013a)
[19] “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, 2015d)
[20] STATS2GO 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 includes general soil association units and is maintained and distributed as a spatial and tabular dataset. (NRCS, 2015c)

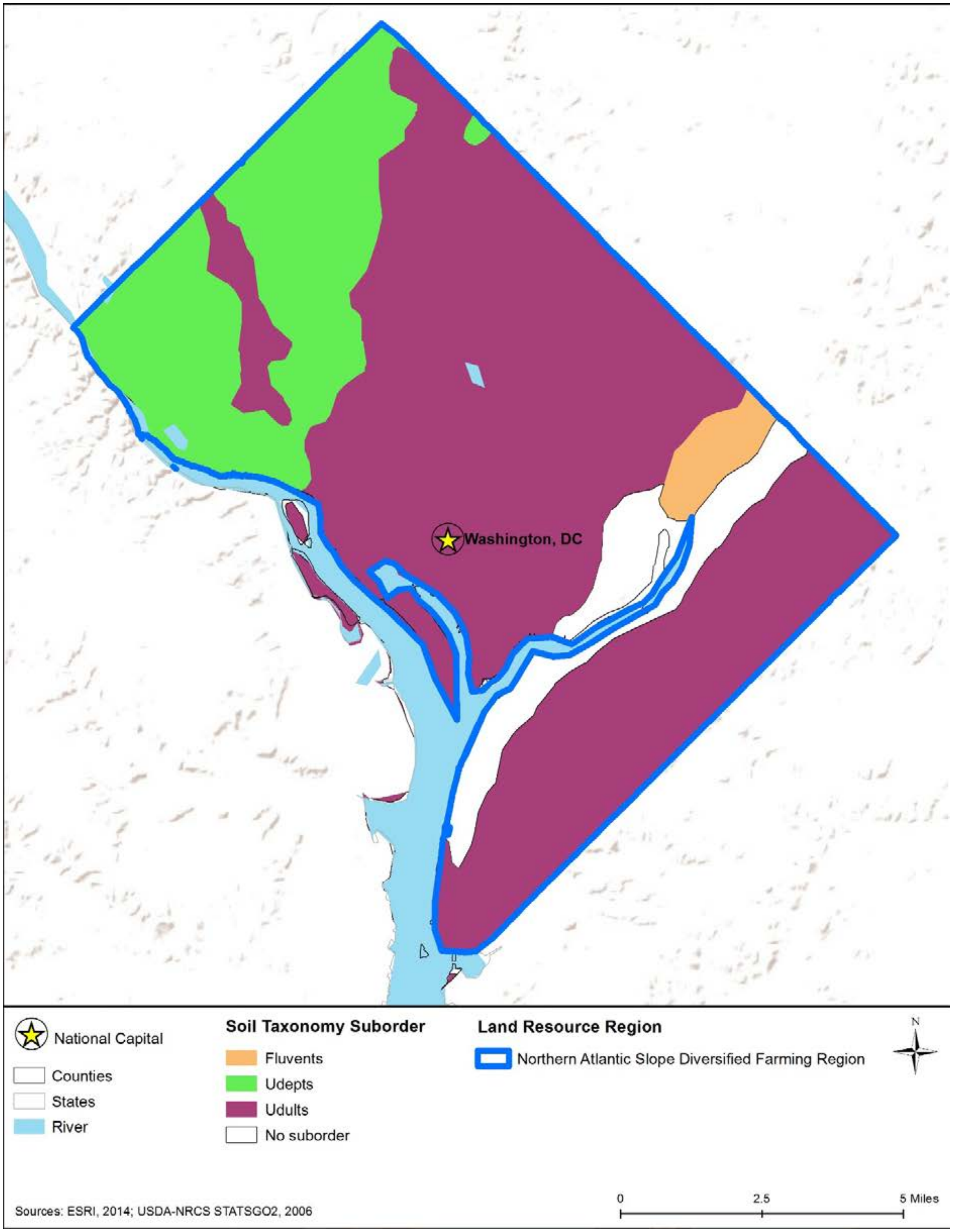


Figure 5.1.2-2: District of Columbia Soil Taxonomy[21] Suborders

[21] Soil taxonomies are defined in Table 5.1.2-3.

Table 5.1.2-3: Major Characteristics of Soil Suborders Found in the District of Columbia, as Depicted in Figure 5.1.2-2

Soil Order	Soil Suborder (Taxonomy)	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[22]	Hydrologic Group	Runoff Potential	Permeability[23]	Erosion Potential	Compaction and Rutting Potential
Entisols	Fluvents	Fluvents are generally freely drained and are frequently flooded, unless protected by dams or levees. It is normal to have material stratification. Most are used as forest, rangeland, pasture, wildlife habitat, and some are also used for cropland.	Loamy sand	0-2	Well drained	No	B	Medium	Moderate	Medium	Low
Inceptisols	Udepts	Udepts have an udic or perudic (saturated with water long enough to cause oxygen depletion) moisture regime, and are mainly freely drained. Most of these soils currently support or formerly supported forest vegetation, with mostly coniferous forest in the Northwest and mixed or hardwood forest in the East. Some also support shrub or grass vegetation, and in addition to being used as forest, some have been cleared and are used as cropland or pasture.	Channery[24] silt loam	15-25	Somewhat excessively drained	No	A	Low	High	Low	Low
Ultisols	Udults	Udults are more or less freely drained, relatively humus poor, and have an udic moisture regime. Most of these soils currently support or formerly supported mixed forest vegetation, and many have been cleared and used as cropland (mostly with the use of soil amendments).	Clay, loam,[25] sandy loam, silt loam, very gravelly loamy sand	0-15	Moderately well drained to well drained	No	B, C	Medium	Moderate, Low	Medium	Low

Sources: (NRCS, 2015c) (NRCS, 1999)

[22] Hydric Soil: A soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part. (NRCS, 2015e)
[23] Based on Infiltration Characteristics.
[24] Channery: An accumulation of thin, flat, course fragments of sandstone, limestone of schist up to 6 inches. (University of Delaware, 2016)
[25] Loam: Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles. (University of Delaware, 2016)

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Runoff Potential

The NRCS uses four Hydrologic Soil Groups (A, B, C, and D) that are based on a soil's runoff potential.[26] Group A generally has the smaller runoff potential, whereas Group D generally has the greatest (Purdue University, 2015). Table 5.1.2-3 (above) provides a summary of the runoff potential for each soil suborder in the District of Columbia.

Group A. Sand, loamy sand or sandy loam soils. This group of soils has "low runoff potential and high infiltration rates[27] 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). Udepts fall into this category in the District of Columbia.

Group B. Silt loam or loam soils. This group of soils has a "moderate infiltration rate when thoroughly wetted and consists chiefly or moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures" (Purdue University, 2015). This group has medium runoff potential. Fluvents and Udults fall into this category in the District of Columbia.

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. Udults fall into this category in the District of Columbia.

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). This group has the highest runoff potential. No soils fall into this category in the District of Columbia.

Soil Erosion

"Soil erosion involves the breakdown, detachment, transport, and redistribution of soil particles by forces of water, wind, or gravity" (NRCS, 2015f). Water-induced erosion can transport soil into streams, rivers, and lakes, degrading water quality and aquatic habitat. When topsoil is eroded, organic material is depleted, creating loss of nutrients available for plant growth. Soil particles displaced by wind can cause human health problems and reduced visibility, creating a public safety hazard (NRCS, 1996a). Table 5.1.2-3 provides a summary of the erosion potential

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[26] 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.

[27] 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)

for each soil suborder in the District. Soils with the highest erosion potential include those in the Fluvents and Udults suborders, which are found throughout the District.

5.1.2.5. Soil Compaction and Rutting

Soil compaction and rutting occurs when soil layers are compressed by machinery or animals, which decreases both open spaces in the soil, as well as water infiltration rates (NRCS, 1996b). Moist soils with high soil water content are most susceptible to compaction and rutting, as they lack the strength to resist deformation caused by pressure. When rutting occurs, channels form and result 5in 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 (NRCS, 1996b), (NRCS, 2003).

Loam, sandy loam, and sandy clay loam soils are most susceptible to compaction and rutting; silt, silty clay, silt loam, silty clay loam, and clay soils are more resistant to compaction and rutting (NRCS, 1996b). Table 5.1.2-3 provides a summary of the compaction and rutting potential for each soil suborder in the District of Columbia. There are no soils in the District with high potential for compaction and rutting.

5.1.3. Geology

5.1.3.1. 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 5.1.4), Human Health and Safety (Section 5.1.15), and Climate Change (Section 5.1.14).

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

- Section 5.1.3.3, Major Physiographic Regions and Provinces[28] [29]
- Section 5.1.3.4, Surface Geology
- Section 5.1.3.5, Bedrock Geology[30]
- Section 5.1.3.6, Paleontological Resources[31]
- Section 5.1.3.7, Fossil Fuel and Mineral Resources

[28] Physiographic regions: Areas of the United States that share commonalities based on topography, geography, and geology. (Fenneman, 1916)
[29] Physiographic provinces: Subsets within physiographic regions. (Fenneman, 1916)
[30] Bedrock: Solid rock beneath the soil and superficial rock. (USGS, 2015b)
[31] Paleontology: "Study of life in past geologic time based on fossil plants and animals." (USGS, 2015c)

- Section 5.1.3.8, Potential Geologic Hazards[32]

5.1.3.2. Specific Regulatory Considerations

The Proposed Action must meet the requirements of the NEPA and other applicable laws and regulations. Applicable federal laws and regulations that apply to Geology, such as the National Historic Preservation Act and the Clean Water Act (CWA), are detailed in Appendix C. A list of applicable District laws and regulations is included in Table 5.1.3-1 below.

Table 5.1.3-1: Relevant District of Columbia Geology Laws and Regulations

District Law/Regulation	Regulatory Agency	Applicability
D.C. Building Code (2013)	Department of Consumer and Regulatory Affairs	Provisions for earthquake-resistant design

Source: (International Building Code, 2014)

5.1.3.3. Environmental Setting: Physiographic Regions and Provinces

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

The District of Columbia has two major physiographic regions: Atlantic Plain and Appalachian Highlands. The locations of these regions and their provinces are shown in Figure 5.1.3-1, and their general characteristics summarized in the following subsections.

[32] 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)

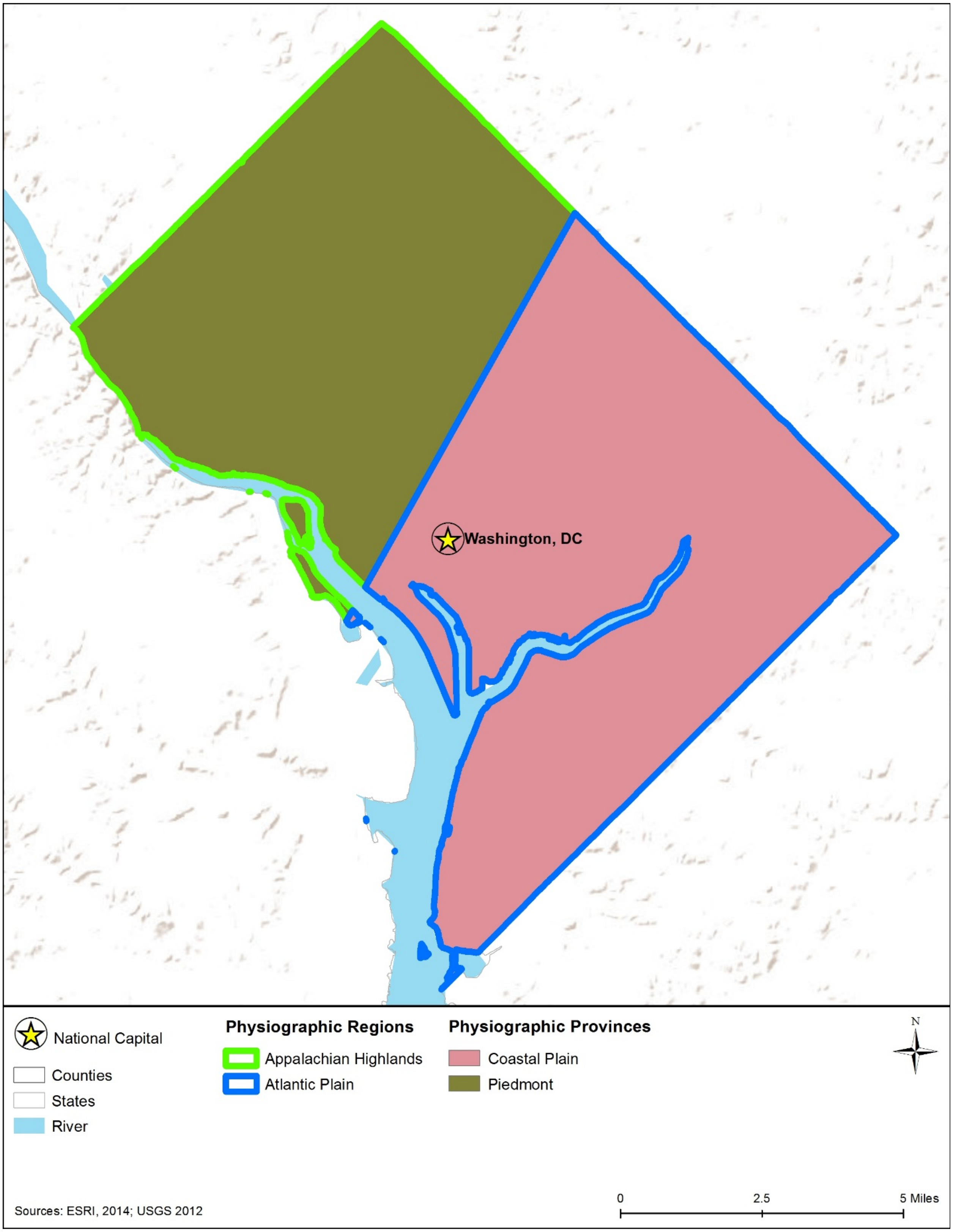


Figure 5.1.3-1: Physiographic Regions and Provinces of the District of Columbia

Atlantic Plain Region

The Atlantic Plain Region includes the Continental Shelf and the Gulf and Atlantic Coast plains stretching from New York to Texas. The Atlantic Plain Region formed through the repetitive rise and fall of the oceans over the last 150 million years. Sedimentary strata become thinner moving westward through the region, and thicken to several thousand feet thick along the coastline. Erosion from the nearby Appalachian Mountains, which began to form 480 to 440 million years ago (MYA), dislodged sediments, which were subsequently deposited by rivers to form the Atlantic Plain. Gentle topography and a transition zone between the land and sea often having marshes, lagoons, swamps, sand bars, and reefs characterize the area. Deposits of coastal marine life over millions of years form the basis for rich fossil fuel reserves in the region. (NPS, 2015a)

Within the District of Columbia, the Atlantic Plain (referred to locally as the Coastal Plain) is in the eastern portion of the city. The Coastal Plain's sands, gravels, and clays range in age from 145 MYA to 66 MYA to much more recent. These sediments measure only a few inches thick at the Fall Line[33] to 1,800 feet in the extreme southeastern portion of the District. The western edge of the Coastal Plain abuts the Piedmont Province (discussed in the Appalachian Highlands Region Section) in an area known as the Fall Zone[34] (Virginia Department of Conservation and Recreation, 2013). The Fall Zone passes roughly from Fort Belvoir (VA) on the south, through Roosevelt Island and the District of Columbia, and north to Silver Spring (MD) (Johnston, 1964).

Appalachian Highlands Region

The Appalachian Highlands Region extends from Canada to Alabama. This region is composed of layers of folded sedimentary rock[35] created when the North American plates collided with Eurasian and African plates more than 500 MYA. Once similar in height to the present-day Rocky Mountains,[36] the Appalachian Highlands have eroded considerably, and most peaks are now under 5,000 feet above sea level. The current Appalachian Highlands Region is characterized by prime and unique farmlands and are rich in mineral resources. (USGS, 2003a)

The Appalachian Highlands Region within the District of Columbia is composed of the Piedmont physiographic province (USGS, 2003a).

<u>Piedmont Province</u> – The Piedmont Province encompasses the entire northwest half of the District of Columbia. The Piedmont rocks near District of Columbia are metamorphic rocks that

[33] Fall Line: “Imaginary line marking the boundary between the ancient, resistant crystalline rocks of the Piedmont province of the Appalachian Mountains, and the younger, softer sediments of the Atlantic Coastal Plain province in the Eastern United States. Along rivers, this line commonly is reflected by waterfalls.” (USGS, 2013a)
[34] Fall Zone: "A narrow zone that marks the boundary between the older, resistant, metamorphic rocks of the Piedmont Province and younger, softer, mostly unconsolidated sediments of the Coastal Plain.” (Virginia Department of Conservation and Recreation, 2013)
[35] 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, 2014a)
[36] The Rocky Mountains exceed 14,000 feet above sea level. (NPS, 2004)

generally resist weathering, and may contain localized quartz veins and igneous[37] pegmatite[38] intrusions. Most of the crystalline rocks on the uplands formed about 550 to 600 MYA, and have since weathered to saprolite (a porous, spongy, red-brown clay-rich material, as much as 200 feet thick) or a reddish clay. (USGS, 1999a)

5.1.3.4. Surface Geology

Surficial geology is characterized by materials such as till,[39] 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,[40] subsidence,[41] and erosion. (Thompson, 2015)

Most of the surficial materials in the District of Columbia are residual soils except for locations where these materials have been eroded and bedrock is exposed. The District has never been affected by glaciation. (Johnston, 1964)

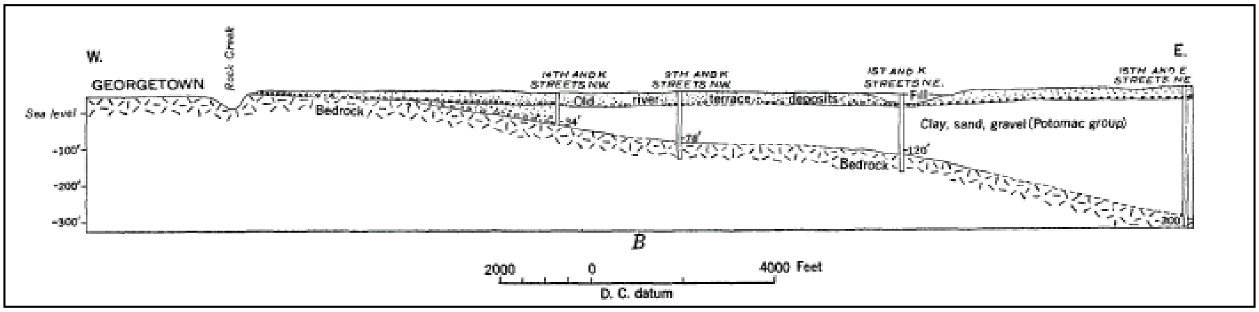
5.1.3.5. Bedrock Geology

Bedrock geology analysis, and "the study of distribution, position, shape, and internal structure of rocks" (USGS, 2015d) reveals important information about a region's surface and subsurface characteristics, including dip (slope of the formation),[42] rock composition, and regional tectonism. [43] These structural aspects of bedrock geology are often indicative of regional stability, as it relates to geologic hazards such as landslides, subsidence, earthquakes, and erosion (New Hampshire Department of Environmental Services, 2014).

Bedrock dominated by granite,[44] gneiss,[45] schist,[46] and other crystalline rocks underlies the District of Columbia. These igneous and metamorphic[47] rocks are exposed or just below the surface in the western part of the city, including Rock Creek Park, and descend eastward under the Coastal Plain's overlying sedimentary layers. In the southeastern half of the city, igneous and

[37] Igneous Rock: "Rocks that solidified from molten or partly molten material, such as magma." (USGS, 2005a)
[38] Pegmatite: "A very coarse-grained igneous rock, commonly with a granitic composition. Usually forms from molten rock rich in water or other volatiles that facilitate the growth of large crystals." (NPS, 2000)
[39] 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)
[40] Slope failure, also referred to as mass wasting, is the downslope movement of rock debris and soil in response to gravitational stresses.
[41] Subsidence: "Gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials." (USGS, 2000)
[42] Dip: "A measure of the angle between the flat horizon and the slope of a sedimentary layer, fault plane, metamorphic foliation, or other geologic structure." (NPS, 2000)
[43] Tectonicisms: "Structure forces affecting the deformation, uplift, and movement of the earth's crust." (USGS, 2015e)
[44] Granite: "A coarse-grained intrusive igneous rock with at least 65 percent silica." (NPS, 2000)
[45] Gneiss: "A coarse-grained, foliated metamorphic rock that commonly has alternating bands of light and dark-colored minerals." (NPS, 2000)
[46] Schist: "Metamorphic rock usually derived from fine-grained sedimentary rock such as shale." (NPS, 2000)
[47] Metamorphic Rock: "A rock that has undergone chemical or structural changes produced by increase in heat or pressure, or by replacement of elements by hot, chemically active fluids." (NPS, 2000)

metamorphic bedrock slope at a rate of 100 to 150 feet per mile, at the eastern edge of the District, the igneous and metamorphic bedrock is about 700 feet below sea level (Darton, 1950). Figure 5.1.3-2 depicts a cross section of the relationship between igneous/metamorphic bedrock and sedimentary layers moving from west to east (i.e., left to right across the figure) across the District.



Source: (Darton, 1950)

Figure 5.1.3-2: Cross Section of Underlying Geology for the District of Columbia, from Georgetown to 15th and E St. NE

Two geologic formations are prominent throughout the Piedmont bedrock in the Western portion of the District of Columbia: the Wissahickon Formation and Sykesville Formation. The Wissahickon is thought to be Cambrian (542 to 488 MYA) to Ordovician (488 to 444 MYA) in age though a definitive age has not been established. The Wissahickon is composed of the metamorphic rock schist, which contains the minerals quartz (30 to 60 percent), sericite (15 to 45 percent), and variable amounts of biotite and chlorite. Rocks of the Sykesville Formation are estimated to contain 35 to 60 percent quartz along with 15 to 35 percent of the mineral feldspar and 8 to 20 percent of the mineral biotite. (Johnston, 1964)

5.1.3.6. Paleontological Resources

Although fossil locations within the District of Columbia boundaries are scarce, there are fossils in the greater National Capital Region.

During the Mesozoic Era (251 to 66 MYA), the District's regional climate ranged from a shallow, warm sea, to tropical lowlands. Dinosaurs inhabited the area, with at least twelve species documented from the late Triassic period (229 MYA) to the late Cretaceous period (100 MYA). In the Mesozoic Era, intermittent volcanic activity along with heavy sedimentation from the highlands to the west of the area provided the ideal conditions for both formation and preservation of fossils. Animal and plant remains were rapidly buried, and those not destroyed by erosion or scavenging were preserved. (NPS, 2008a)

Within the Piedmont physiographic province (which includes the western portion of the District) (see Figure 5.1.3-2), iron-rich Triassic age sedimentary units are the only fossiliferous areas in the region, while flats in the Coastal Plain physiographic province (includes the eastern portion of the District) contain a more rich paleontological record, stretching from the Cretaceous period all the way to modern times. Gravels, sandstones, siltstones, and shales in the Coastal Plain contain both marine and fluvial deposits. (NPS, 2007)

Reptilian tracks can be found within the Piedmont province, along with many freshwater lacustrine[48] fossils (e.g., clam shrimp, tadpole shrimp, ostracodes,[49] crustaceans, mollusks, and occasionally stromatolites,[50] fish teeth, and fish scales). One noteworthy fossil is that of the tadpole shrimp (notostracan), because discovery of these fossils resulted in the first record of Triassic-aged notostracans in North America. (NPS, 2007)

Isurus Shark Tooth Fossil (Fossil Found in National Capital Region)

Source: (NPS, 2007)

Further east, within the Coastal Plain, fossils of significance include many marine mammals, dozens of shark and ray species, hundreds of snail and bivalve species, and abundant plant material. Additionally, many of the first dinosaur fossils in the United States were recorded from Cretaceous sediments in the National Capital Region, as were some of the oldest angiosperm (flowering plants) fossils. During the 1800s, paleontologists from Europe frequented Coastal Plain exposures along the Potomac River. These scientists described many mollusk species new to science, and their comparisons of fossils in the area to those in Europe were some of the first attempts to correlate fossils from different geographic locations. (NPS, 2007)

5.1.3.7. Fossil Fuel and Mineral Resources

There are no active oil production or non-fuel mineral production in the District of Columbia. Petroleum products are usually trucked in from nearby facilities in Maryland or Virginia. No interstate natural gas pipelines enter the District. (EIA, 2015a) (USGS, 2014b)

5.1.3.8. Geologic Hazards

The three major geologic hazards of concern in the District of Columbia are earthquakes, landslides, and subsidence. A discussion of each geologic hazard is included below.

Earthquakes

Seismic threats are minimal throughout the District of Columbia, though earthquakes occurring outside of the District have affected that area previously (USGS, 2015f). 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;

[48] Lacustrine: pertaining to, produced by, or formed in a lake. (USGS, 2013a)

[49] Ostracoda is a group of small (from 0.1 to 32 mm) crustaceans, composed of approximately 8000 living species. Some ostracods are pelagic (live in the water column) but most species crawl on or burrowing into the sediments at the bottom of the ocean or lakes. (University of California, Berkeley , 2016)

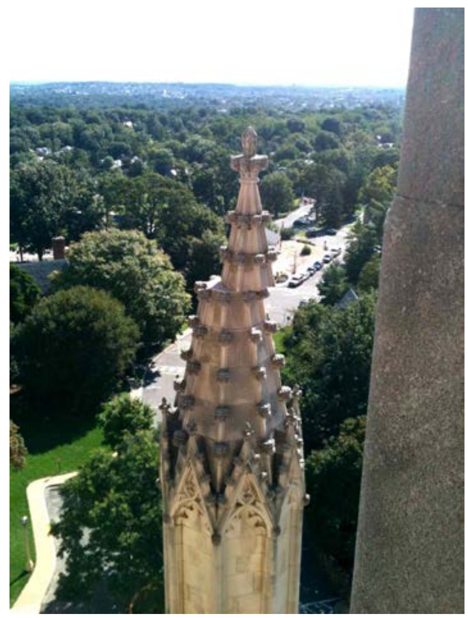
[50] "Stomatolites are large mounds of bacteria and algae that both accrete sediment because they are sticky, and secrete calcium carbonate sediment due to the biochemical microenvironment within their cells and within their communities. The cyclical process of laying down a layer of sediment, and then the bacteria and algae moving toward the new surface toward the light creates laminations." (Oberlin University, 2002)

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 or from tsunamis. (USGS, 2012a)

The shaking due to earthquakes can be noteworthy 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.[51] 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). The District of Columbia is in the middle of a tectonic plate, far from convergence boundaries (USGS, 2011).

Figure 5.1.3-4 depicts the seismic risk throughout the District of Columbia. The map indicates levels of horizontal shaking (measured in Peak Ground Acceleration) 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). If an earthquake were to exceed 10%g, most pre-1965 buildings would likely suffer damage.[52] (USGS, 2010)

No historical earthquake has been centered within the District of Columbia. However, earthquakes from other seismic regions, including the St. Lawrence River Valley, Missouri, Ohio, Virginia, and South Carolina have been felt in the District of Columbia. The 1886 Charleston, SC, earthquake was also felt as far north as the District of Columbia. More recently, a magnitude-5.7, 2011 earthquake centered in Oilville, VA (roughly 85 miles southwest of the District), caused damage to several District landmarks, including the National Cathedral,[53] Washington Monument,[54] and Smithsonian Castle.[55] (USGS, 2015f)



Source: (USGS, 2014c)

Figure 5.1.3-3: Damage to Washington National Cathedral Caused by the 2011 Earthquake

[51] 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 thirty-fold difference in magnitude. (USGS, 2014d)
[52] Post-1985 buildings (in California) have experienced only minor damage with shaking of 60 percent g. (USGS, 2010)
[53] Cathedral Church of Saint Peter and Saint Paul in the City and Diocese of Washington.
[54] An obelisk on the National Mall built to commemorate George Washington.
[55] Home to the Smithsonian Institution’s administrative offices and information center.

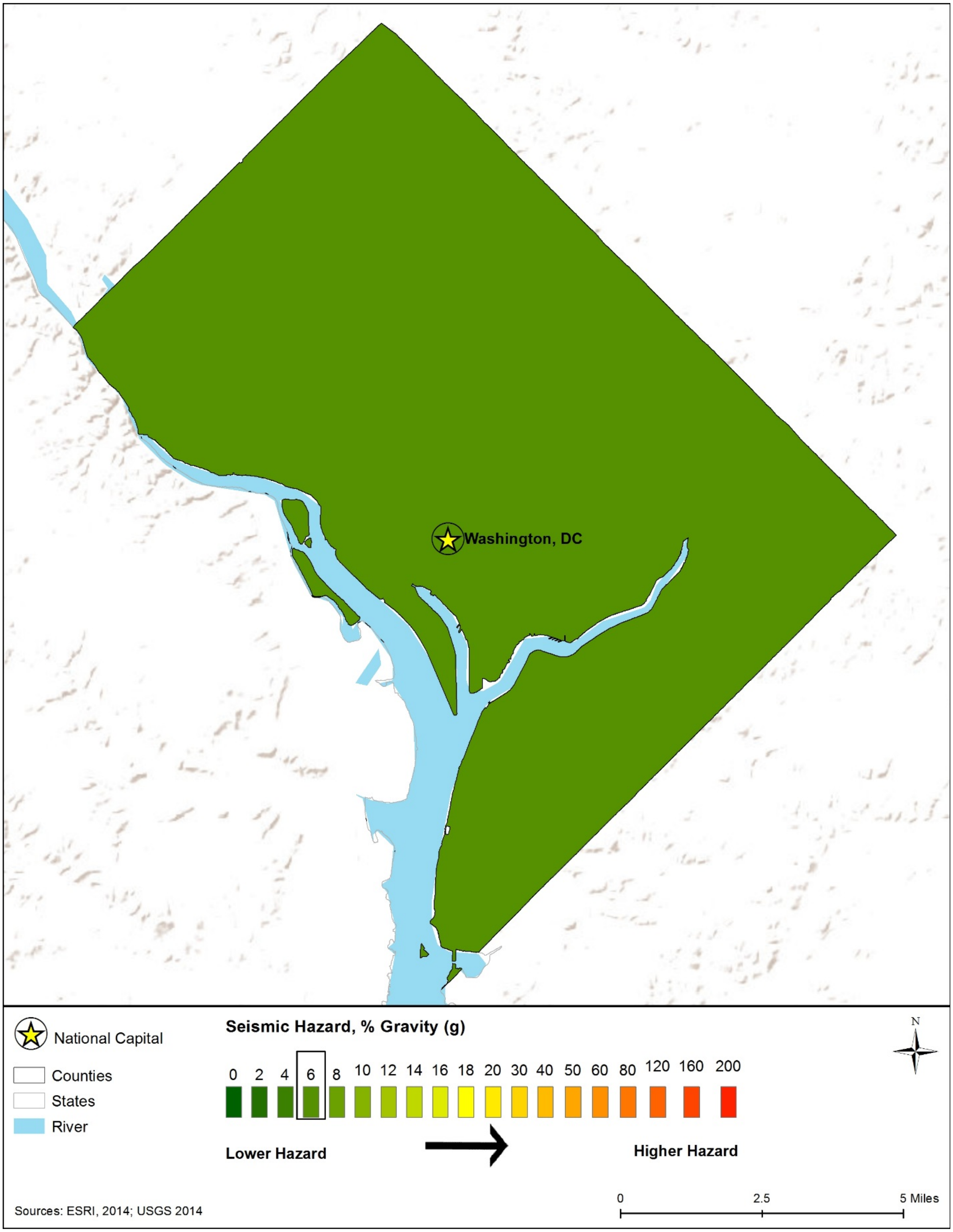


Figure 5.1.3-4: District of Columbia 2014 Seismic Hazard Map

Landslides

According to the USGS, the District of Columbia has a high potential for landslides (USGS, 2014e), especially in areas with increased slope. These areas include (but are not limited to) Fort Dupont Park, Newcomb Street, and along O St. SE near Shepherd Parkway and Anacostia Park (NPS, 2008b).

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

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, 2003b)

Land Subsidence

Land subsidence is a "gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials." 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 layers of silt or clay, which do not transport groundwater, confine an aquifer, the lowered water pressure in the sand and gravel causes slow drainage of water from the clay and silt beds. The reduced water pressure compromises support for the clay and silt beds, causing them to collapse on one another. The effects of this compression are seen in the permanent lowering of the land surface elevation. (USGS, 2000)

Land subsidence can result in altered stream elevations and slopes; detrimental effects to infrastructure and buildings; and collapse of wells due to compaction of aquifer sediments. Subsided areas can become more susceptible to inundation, both during storm events and non-events. Lowered terrain is more susceptible to inundation during high tides. Changes in ground-surface elevation not only affect the integrity and operation of existing infrastructure, but also complicate vegetation and best management of land use. (USGS, 2013c)

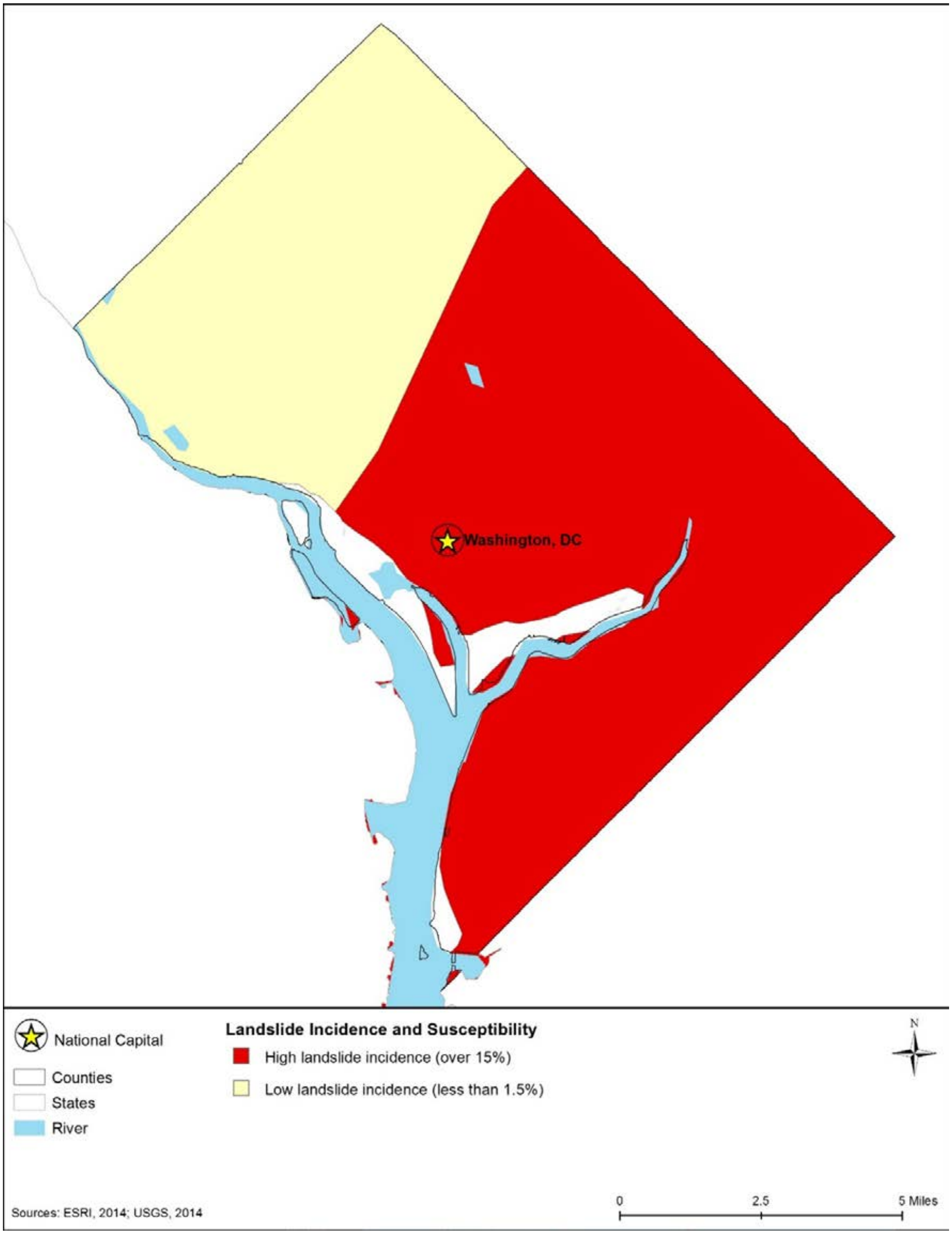


Figure 5.1.3-5: District of Columbia Landslide Incidence and Susceptibility Hazard Map[56]

[56] Susceptibility hazards not indicated in Figure 5.1.3-4 where same or lower than incidence. Susceptibility to landslides is defined as the probable degree of response of areal rocks and soils to natural or artificial cutting or loading of slopes, or to anomalously high precipitation. High, moderate, and low susceptibility are delimited by the same percentages used in classifying the incidence of landslides. Some generalization was necessary at this scale, and several small areas of high incidence and susceptibility were slightly exaggerated. (USGS, 2014e)

In the District of Columbia, land subsidence appears to be occurring at a rate of about 1.43 mm/yr (USEPA, 2014a). One factor contributing to land subsidence in the District of Columbia is the retreat of glaciers following the end of the last glaciation about 14,000 years ago. Since that time, much of Canada and inland portions of New England have been slowly rising because of the (geologically recent) removal of the Wisconsin Ice sheet. While the depression of those areas by the ice sheet also caused the Mid-Atlantic to move upward, the removal of the ice is causing the Mid-Atlantic to compress on itself. Land subsidence in the District of Columbia also is occurring because of compression of deeper sediment layers due to groundwater extraction (Ayyub, Braileanu, & Qureshi, 2011).

5.1.4. Water Resources

5.1.4.1. Definition of the Resource

Water resources are defined as all surface waterbodies and groundwater systems including streams, rivers, lakes, floodplains, aquifers, and other aquatic habitats (wetlands are discussed separately in Section 5.1.5). 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 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 District laws. An adequate supply of water is essential for human and ecological health and economic wellbeing. (USGS, 2014f)

5.1.4.2. Specific Regulatory Considerations

Federal laws relevant to protecting the quality and use of water resources are summarized in Appendix C. Table 5.1.4-1 identifies the relevant laws and regulations for water resources in the District of Columbia.

Table 5.1.4-1: Relevant District of Columbia Water Resources Laws and Regulations

District Law/Regulation	Regulatory Agency	Applicability
2013 Rule on Stormwater Management and Soil Erosion and Sediment Control	DDOE	Applicable to all sources of pollution affecting the Potomac River and its tributaries within the District, including pollution carried by stormwater runoff and domestic and industrial waste. A Soil Erosion and Sediment Control Plan is required as part of the building permit process for any construction or redevelopment projects that clear, grade, or in any way cause runoff or domestic and industrial waste. (DDOE, 2015a)
Title 20, Chapter 31, Flood Hazard Rules	D.C. HSEMA	New construction or development in the Special Flood Hazard Areas must apply for a permit. (DDOE, 2015b)

District Law/Regulation	Regulatory Agency	Applicability
Water Pollution Control Act of 1984 (D.C. Law 5-188)	Department of Energy and Environment (DOEE)	Regulates against water pollution and preserve and restore aquatic life in District waters for aesthetic enjoyment, for recreation, and for industry (DOEE, 2011)
Title 21: Water and Sanitation	DOEE	District of Columbia water quality laws and regulations, including water quality standards, groundwater classification, and riparian[57] rights, applicable to all sources of pollution affecting the Potomac River and its tributaries within the District. (DDOE, 2015a) (DOEE, 2016)

5.1.4.3. Environmental Setting: Surface Water

Surface water resources are lakes, ponds, rivers, and streams. The District of Columbia is at the junction of the Anacostia and Potomac Rivers. The District's approximate 68.34 square miles (7.29 square miles of surface waters and 61.05 square miles of land) include approximately 40 miles of rivers, 8 lakes and reservoirs,[58] and a variety of ponds (approximately 240 acres). These surface waters provide flood control, transportation corridors, aquatic habitat, and support power generation, recreation, and tourism across the District. (DDOE, 2014a)

Watersheds

Watersheds, or drainage areas, consist of surface water and all underlying groundwater, and encompass an area of land that drains all the streams and rainfall to a common outlet (e.g., reservoir, bay). All District of Columbia waters (lakes, rivers, and streams) are within one drainage basin (or watershed), the Potomac River. The Potomac River's main tributaries, Rock Creek and Anacostia River and their tributaries, flow into the Potomac (Figure 5.1.4-1). (DDOE, 2014a)

The drainage patterns and water quality within the District's watersheds have been affected by urbanization. Approximately 76 percent of the District is developed land, approximately 13 percent is undeveloped land, and the remaining percentage is open water (USGS, 2012c). For example, as of 1990, approximately 70 percent of the Anacostia subwatershed that is within the District was covered by an impervious surface[59] (DDOE, 2012a). The Rock Creek subwatershed is 76.5 square miles, 15.9 square miles of which are in the District; approximately 95 percent of the subwatershed within the District is covered by an impervious surface (DDOE, 2010a). The Oxon Run subwatershed is approximately 7,906 acres, or 12.4 square miles in the District; approximately 37 percent is covered in impervious surface (DDOE, 2010b). The large percentage of impervious surface within the District contributes to impaired water quality from stormwater runoff. The DOEE's website (http://doee.dc.gov/watershed) provided more

[57] Riparian: "Referring to the areas adjacent to rivers and streams with a differing density, diversity, and productivity of plant and animal species relative to nearby uplands." (USEPA, 2015a)
[58] DDOE classifies the Chesapeake and Ohio (C&O) Canal as a lake. (DDOE, 2014a)
[59] Impervious: A hardened surface or area that does not allow water to pass through. For example, roads, rooftops, driveways, sidewalks, pools, patios, and parking lots are all impervious surfaces. (USEPA, 2015a)

information and additional maps about the District of Columbia's watershed locations, sizes, and water quality.

Freshwater

Freshwater streams and rivers are dynamic interconnected systems of moving water that join, ultimately flowing into lakes, bays, or estuaries[60] (USEPA, 2013b). The primary waterways in the District are the Potomac River, Anacostia River, and Rock Creek, as shown in Figure 5.1.4-1. The Potomac and Anacostia Rivers support fish and wildlife habitats. Other notable waterways include Oxon Run, Hickey Run, Fort Dupont, Pope's Branch, and Watts Branch. The C&O Canal flows west along the Potomac River from Rock Creek. For more information on this historic canal and park, see Section 5.1.11. The District has seven artificial lakes, some that store untreated water (Dalecarlia Reservoir and MacMillan Reservoir), and one that stores treated water (Georgetown Reservoir) (DDOE, 2014a). Within the District, the Potomac and Anacostia Rivers, the Washington Ship Channel, and the Channel Lagoon are freshwater tidally influenced waters. All major surface water systems in the District are considered freshwater; there are no estuarine waters (USEPA, 2013b).

- The **Potomac River** is approximately 14,670 square miles and extends from West Virginia and Pennsylvania through Maryland and Virginia before draining into the Chesapeake Bay. The Potomac varies in depth from 80 feet at Chain Bridge (0.4 miles south of the Maryland-District border) to less than a foot in some areas. The Potomac is the main and largest river within District, stretching 10 miles along the western border. The Potomac River receives water flows from the Anacostia River and other smaller tributaries, such as Rock Creek and Oxon Run in Maryland and Four Mile Run in Virginia. The total flow of the main-stem Potomac River averages about 6,975 million gallons per day (10,790 cubic feet per second [cfs]). In contrast to the Anacostia River, the large volume of the Potomac River and the high flow rates result in higher dilution and flushing rates for pollutants that enter the waterway. (DC Department of Health, 2004a)
- The **Anacostia River** is tidal in the District of Columbia (though not in Maryland). The river consists of the tidal river and its floodplain, as well as small streams that flow directly to the tidal river; most of these streams are enclosed in storm sewer systems. The tidal reach of the Anacostia River is 8.4 miles (DDOE, 2012a). The Anacostia River varies in depth from 30 feet to less than a foot. Where it enters the District, the Anacostia River is 150 feet wide; at its mouth at the Potomac River, the river is 1,000 feet wide. For its entire length in District, the Anacostia's riverbanks have no natural shorelines. The average flow in the Anacostia River is approximately 139 cfs. The Anacostia River includes intertidal shore systems such as intertidal mudflats, as well as beds of submerged aquatic vegetation. (DDOE, 2014a)

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

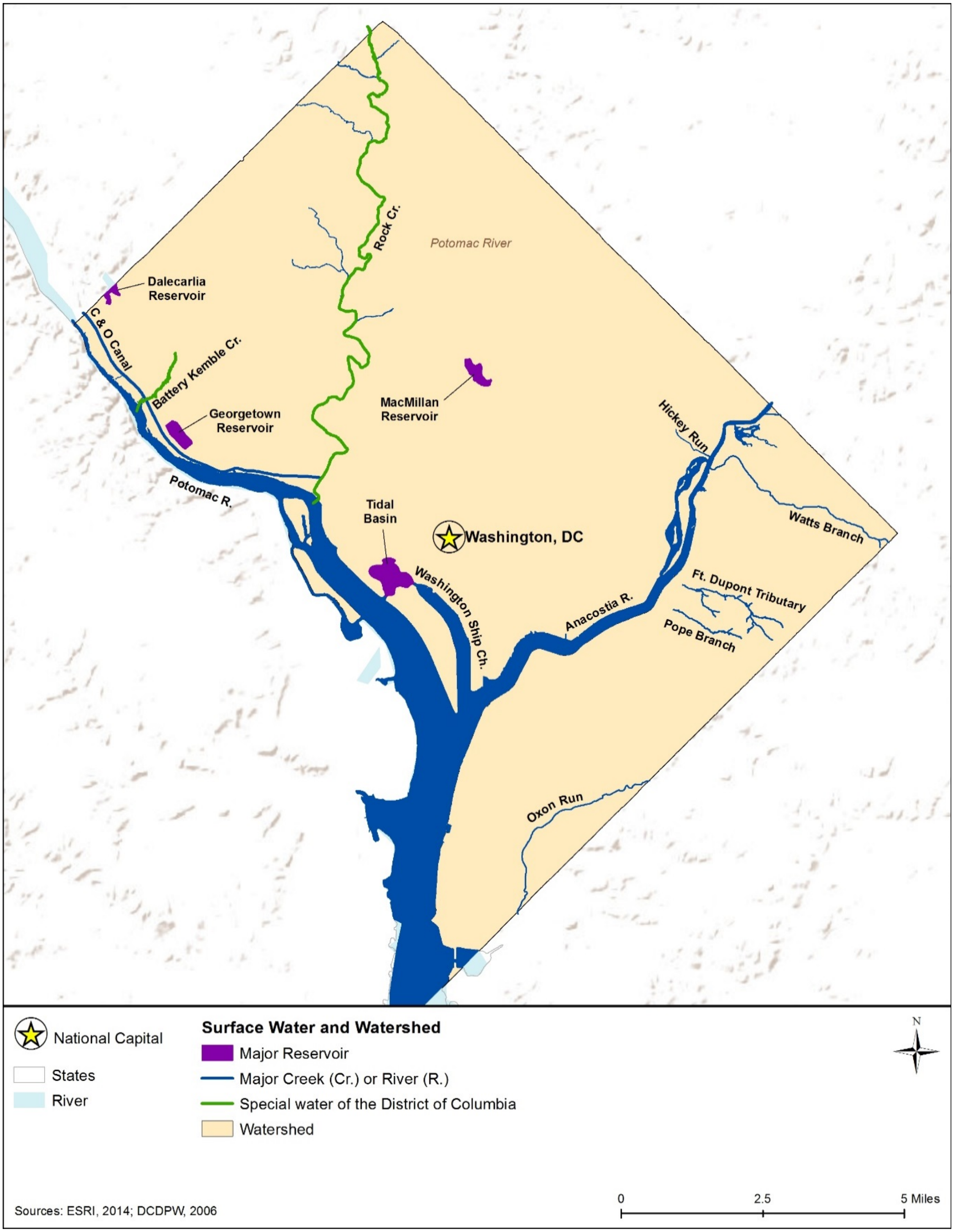


Figure 5.1.4-1: Major District of Columbia Watersheds and Surface Waterbodies

- **Rock Creek** is a perennial, warm-water tributary of the Potomac River, varying in width from 20 feet at its widest to five feet where it enters the District. Approximately one-third (9.52 miles) of Rock Creek's total 33 miles flows through the District. The Rock Creek's average flow rate is approximately 63.7 cfs. Publicly owned parkland primarily surrounds Rock Creek, except in its uppermost portions. (DDOE, 2010a)
- **Oxon Run** is a tributary of the Potomac River that begins its eight-mile course in Prince Georges County, MD, northeast of Pennsylvania Avenue "with headwaters emanating from a storm drainpipe that drains a shopping center parking lot" (DDOE, 2010b). From here, Oxon Run roughly parallels Pennsylvania Avenue up to the District line. Oxon Run is approximately 3 miles long in the District and is almost entirely encased in concrete. Most of its feeder streams have been converted to stormwater pipes. (DDOE, 2010b)
- The **Washington Ship Channel** and **Tidal Basin** are manmade waterbodies in the southwest section of the District along the Potomac River. The Tidal Basin was built in the late 19th century by the U.S Army Corps of Engineers (USACE) as a part of a land use management plan for the Potomac River and the District. The freshwater Tidal Basin's main function is to flush the salt water from the Washington Ship Channel with freshwater from the Potomac River. Two sets of floodgates direct freshwater flow from the Potomac River to the Tidal Basin then to the Washington Ship Channel. The Washington Ship Channel is about 0.3 square miles with depth varying between 3 to 26 feet. The Tidal Basin has an average depth of 6.5 feet and a surface area of about 0.15 square miles. (DC Department of Health, 2004b)

Drinking Water

None of the waterbodies within the District has been designated for drinking water uses. Drinking water, collected from the Potomac River at Great Falls, MD, is treated by the Washington Aqueduct, which is owned and operated by the U.S. Army Corps of Engineers (USACE) (DC Water, 2015g). The Potomac River is the District's only source of drinking water. There are no drinking water intakes within the District (DC Department of Health, 2004a).

DC Water purchases the treated water from the USACE and distributes it to District and Virginia customers. In fiscal year 2013, DC Water pumped an average of 100 million gallons of water per day. Additionally, DC Water stores approximately 95 million gallons of treated water at its eight facilities and the Washington Aqueduct stores an additional 49 million gallons. (DC Water, 2015a)

5.1.4.4. Sensitive or Protected Waterbodies

As shown in Figure 5.1.4-1, Rock Creek and Battery Kemble Creek and their tributaries are designated as "Special Waters of the District of Columbia" (SWDC) according to the District of Columbia's Water Quality Standards. SWDC are "any segment or segments of the surface waters of the District that are of water quality better than needed for the current use or have scenic or aesthetic importance" (21 DCMR 1102.5, 2010).

5.1.4.5. *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 CWA, states and the District of Columbia are required to assess water quality and report a listing of impaired waters,[61] the causes of impairment, and probable sources (USEPA, 2015b). Table 5.1.4-2 summarizes the District's assessed major waterbodies by category, percent impaired, designated use,[62] cause, and probable sources, as of 2014.

As shown in Table 5.1.4-2, all of the District's surface waterbodies (rivers, streams, lakes, reservoirs, ponds, estuaries, and bays) are impaired. The main causes of impairment are polychlorinated biphenyls (PCBs), most likely from illegal dumping or waste disposal, fecal coliform (bacteria)[63] from nonpoint[64] and point source[65] pollution from stormwater, and sewer overflows. (USEPA, 2015c)

Table 5.1.4-2: Section 303(d) Impaired Waters of District of Columbia, 2014

Water Type[a]	Amount of Waters Assessed (Percent)	Amount Impaired (Percent)	Designated Uses of Impaired Waters	Top Causes of Impairment	Top Probable Sources for Impairment
Rivers and Streams	98.5%	100%	Navigation, protection and propagation of fish, shellfish and wildlife, and protection of human health related to consumption of fish and shellfish, and recreation	PCBs, fecal coliform, and metals (copper, zinc)	Illegal dumping or waste disposal, urban related stormwater, nonpoint source and point source discharges, and sewer overflows
Lakes, Reservoirs, and Ponds	100%	100%		PCBs, fecal coliform, and pesticides	No probable sources reported
Estuaries and Bays[b]	99%	100%		PCBs, fecal coliform, sediment, and pH (acidic sources)	No probable sources reported

[a] Some waters may be considered for more than one water type.
[b] The Washington Ship Channel and the Channel Lagoon are considered Estuaries and Bays by USEPA and DOEE.

Source: (USEPA, 2015c)

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

[62] Designated Use: An appropriate intended use by human beings and/or aquatic life for a waterbody. Designated uses may include recreation, shellfishing, or drinking water supply. (USEPA, 2015a)

[63] Fecal bacteria: "Tiny single-celled organisms (primarily fecal coliforms and fecal streptococci) found in the wastes of warm-blooded animals. Their presence in water is used to assess the sanitary quality of water for body-contact recreation or for consumption. Their presence indicates contamination by the wastes of warm-blooded animals and the possible presence of pathogenic (disease producing) organisms." (USGS, 2013a)

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

[65] A source of pollution that can be attributed to a specific physical location – an identifiable, end-of-pipe "point." (USEPA, 2015a)

The District's water quality evaluation found that none of its water resources fully support their designated uses. According to the DDOE's 2014 water quality report, the major causes of impairment to the District's waterbodies are "organic enrichment (fecal coliform) and the resulting low dissolved oxygen" (DDOE, 2014a). A main source of impairment to the District's waterbodies is urban runoff from impervious surfaces. In undeveloped areas, large amounts of rainfall is absorbed into the ground. In urban settings like the District, there is a higher percentage of impervious surfaces (pavement, roofs, parking lots) resulting in a lower rate of infiltration and nonpoint pollution. Impervious materials, such as pavement, rapidly channel runoff to a storm sewer conveyance. Storm sewers normally discharge directly into surface waters, such as the Potomac and Anacostia Rivers. Runoff entering these waters is normally untreated and carries a large amount of contaminants, such as sediments, oils, fertilizers, and metals. (DDOE, 2014a)

While the larger rivers support aquatic life, many of the smaller streams do not. Causes of impairment to streams and rivers include pathogens, low amounts of oxygen, flow alteration from development, streambed or streamside habitat alterations, toxic inorganic chemicals, toxic organic chemicals, heavy metals, pesticides, acidity, and sedimentation. The Potomac River is improving from CSO improvements, yet the Anacostia River continues to have poor water quality (DDOE, 2012b). The District's CSOs have about 80 overflow events per year that deposit raw sewage into the Anacostia River (DDOE, 2012a).

5.1.4.6. Floodplains

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

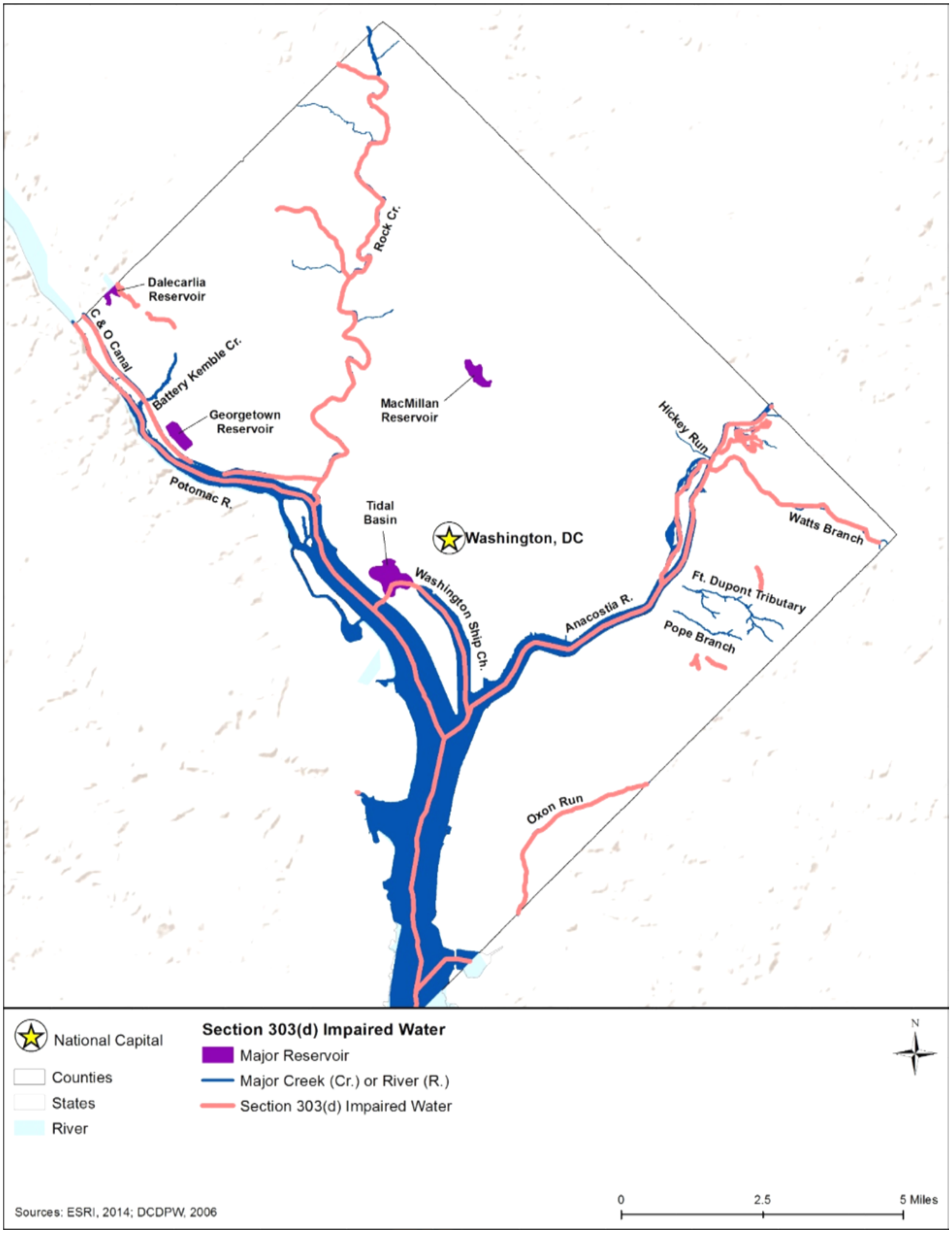

Figure 5.1.4-2: Section 303(d) Impaired Waters of District of Columbia, 2014

Riverine floodplains are found within the District of Columbia area along rivers and streams where overbank flooding may occur, inundating adjacent land areas. In areas with relatively little topographic relief, 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 United States. (NOAA, 2015a). The main causes of flooding in the District are severe thunderstorms, hurricanes, and intense rainfall on existing snowpack, all of which can cause flash floods (FEMA, 2008) (NWS, 2016).

The District of Columbia is highly susceptible to flood events due to the city's geographic location at the confluence of the Potomac and Anacostia Rivers, in combination with relatively flat elevations and historic underground waterways. Portions of the city, such as the National Mall, were originally under water prior to development. To prevent floodwaters from entering the downtown areas around the National Mall, the USACE constructed a levee along the north side of the Mall (National Capital Planning Commission, 2008). Between 1889 and 2008, the District had 18 historical noteworthy flood events, with the most recent occurring in 2006 (FEMA, 2008) (DOEE, 2015a).

Flooding along the Potomac River poses a large threat to the region due to the size and extent of the Potomac Watershed (14,670 square miles) (Gerhart, 2012), which can carry large volumes of water downstream during storm events. Within the highly developed Anacostia Watershed, a moderate rainfall event can cause notable localized flooding because of impervious surfaces, stream channelization, and wetland loss. Flooding associated with the Potomac and Anacostia Rivers generally occurs due to a combination of storm surge along the river from Chesapeake Bay (due to the tidal influence around the District) and existing flowing water in the channels. (FEMA, 2008)

June 2006 Federal Triangle Flash Flood

On June 26, 2006, 6 inches of rain fell in a 6-hour period. The event caused extensive flooding in the Federal Triangle Area; several federal buildings were damaged and businesses were interrupted from the flooding of two DC Metro train stations that were inaccessible for several hours. (DOEE, 2015a) The McGowan Theater (Figure 5.1.4-3) was closed until October (NWS, 2016).

Source: (Jeff Reed, National Archives, 2016)

Local communities often have floodplain management or zoning ordinances that restrict development within the floodplain. The District participates in the National Flood Insurance Program (NFIP), which was established to reduce the economic and social cost of flood damage by subsidizing insurance payments. The NFIP encourages communities "to adopt and enforce floodplain management regulations and to implement broader floodplain management programs" and allows property owners in participating communities to purchase insurance protection against losses from flooding (FEMA, 2015). As an incentive, communities can voluntarily participate in the NFIP Community Rating System (CRS), which is a program that rewards communities by reducing flood insurance premiums in exchange for doing more than the minimum NFIP requirements for floodplain management. As of June 2014, the District was not participating in the CRS (FEMA, 2014c).[66]

5.1.4.7. Groundwater

Groundwater systems are sources of water that result from precipitation infiltrating the ground surface, and includes underground water that occupies pore spaces between sand, clay, or rock particles. An aquifer is a permeable geological formation that stores or transmits water to wells and springs. Groundwater is contained in either confined (bound by clays or nonporous bedrock) or unconfined (no layer to restrict the vertical movement of groundwater) aquifers (USGS, 1999b). 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.

The District's, principal aquifers consist of crystalline-rock[67] and unconsolidated coastal-plain aquifers.[68] The District depends entirely on water supplies from Maryland, as discussed in Section 5.1.4.3, Drinking Water, and does not use groundwater except for occasional industrial use (less than 1 percent of total water used) (DC Water Resources Research Center, 1992). Information regarding the quality and quantity of groundwater in the District is not readily available (DC Water Resources Research Center, 1992). Districtwide, the most serious threats to groundwater quality include hazardous waste discharge from federal and private cleanup and remediation sites, discharge from de-icing applications, pesticide, underground storage tanks, discharge from graveyards in the District and the surrounding area, historic landfills, illegal dumpsites, leaking pipeline and sewer lines, and spills from the transportation of materials. (DDOE, 2012b)

Table 5.1.4-3 provides details on aquifer characteristics in the District; Figure 5.1.4-4 shows the District of Columbia's principal aquifers. There are no sole source aquifers in the District. (USEPA, 2007).

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[66] Additional program information is available from FEMA's NFIP CRS website (www.fema.gov/national-flood-insurance-program-community-rating-system).

[67] Crystalline-rock aquifers are composed of igneous and metamorphic rock, and spaces between the crystals are extremely small. This type of aquifer generally yields little water, and is only permeable when the rock is fractured. (USGS, 2015g)

[68] Unconsolidated sedimentary deposits: "Loosely bound sediments such as sand, gravel, and silt, which tend to accumulate in low areas or valleys." (USGS, 2015h)

Table 5.1.4-3: Description of the District of Columbia Principal Aquifers

Aquifer Type and Name	Location in District	Groundwater Quality
Northern Atlantic Coastal Plain Aquifer System Unconsolidated sediments (primarily clay, sand, and gravel) overlie igneous and metamorphic rocks. The major geologic units in D.C. are alluvium and artificial fill, river terrace deposits, upland gravel and sand, and the Potomac Group.	Southern two-thirds	"Nearly three-fourths of the land in the District of Columbia forms a recharge area for the lower Potomac aquifer system, which supplies water to many counties in Maryland and Virginia" (DC Water Resources Research Center, 1992). Generally, the Potomac Group aquifers supply the largest quantity of groundwater for public supplies and overall, the natural water quality is satisfactory for most uses. The average concentration of dissolved solids is usually less than the drinking water standard. However, iron content may be high in areas of the aquifers. Deeper within the aquifer, the water tends to become harder and more alkaline, and contain less iron, more chloride, and more dissolved solids until the water becomes too salty for human consumption use.
Piedmont and Blue Ridge crystalline-rock aquifer Composed of crystalline metamorphic and igneous (volcanic) rocks of many types	Northeastern third of D.C.	Natural water quality within the Piedmont and Blue Ridge aquifers is generally satisfactory, but locally, dissolved iron concentrations may be high (greater than 0.3 parts per million).

Source: (Moody, Carr, Chase, & Paulson, 1986), (DC Water Resources Research Center, 1992)

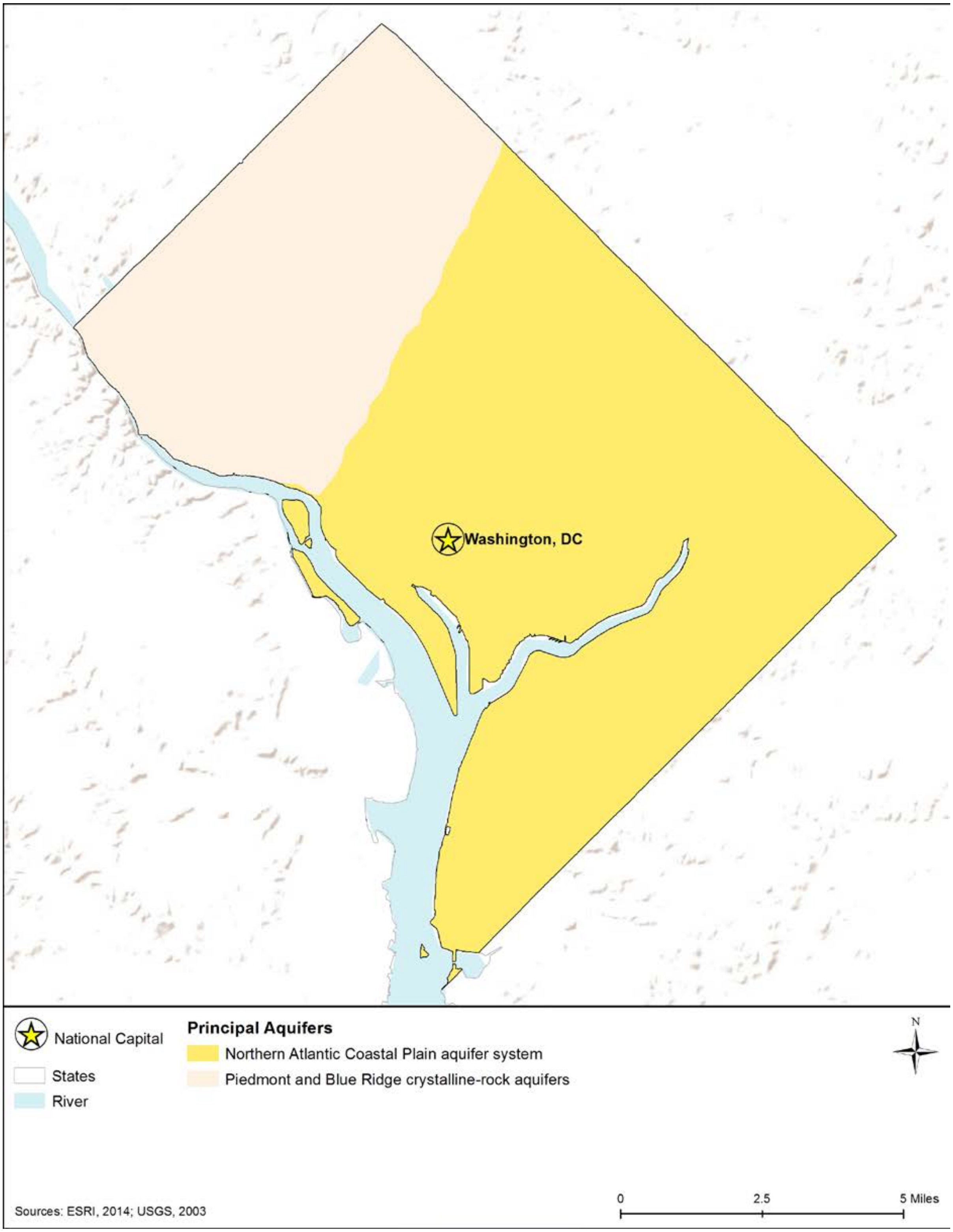

Figure 5.1.4-4: Principal Aquifers of the District of Columbia

5.1.5. Wetlands

5.1.5.1. Definition of the Resource

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

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

5.1.5.2. Specific Regulatory Considerations

Appendix C explains the pertinent federal laws to protecting wetlands in detail. Table 5.1.5-1 summarizes the major District of Columbia laws and permitting requirements relevant to the District's wetlands.

In March 2015, an Interim Policy on Wetlands[69] in the District was issued to provide clarity to the regulated community of how the District interprets its obligations to protect wetlands under the District’s Water Pollution Control Act (D.C. Official Code §§ 8-103.01, et seq.) (DDOE, 2015d).

Table 5.1.5-1: Relevant District of Columbia Wetland Laws and Regulations

District Law/Regulation	Regulatory Authority	Applicability
Water Pollution Control Act	DDOE	DDOE issues a letter of authorization for activities in a wetland that are not under USACE jurisdiction, pursuant to D.C. Official Code §§ 8-103.06 and 8-103.13 (DDOE, 2015a)
		In accordance with Section 401 of the CWA, DDOE issues a District certification for activities requiring a USACE Section 404 permit (DDOE, 2015a)

5.1.5.3. Environmental Setting: Wetland Types and Functions

The U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) mapping adopted a national Wetlands Classification Standard that classifies wetlands according to shared environmental factors, such as vegetation, soils, and hydrology, as defined by (Cowardin, Carter, Golet, & LaRoe, 1979). The Wetlands Classification System includes five major wetland

[69] www.doee.dc.gov/publication/interim-policy-wetlands

Systems: Marine, Estuarine, Riverine, Lacustrine, and Palustrine. The District includes three of these Systems, as detailed in Table 5.1.5-2. The first four of these include both wetlands and deepwater habitats but the Palustrine includes only wetland habitats. (USFWS, 2015a)

- The Marine System consists of open ocean, continental shelf, including beaches, rocky shores, lagoons, and shallow coral reefs. Normal marine salinity (saltiness) to hypersaline (more than 35 percent salty) water chemistry; minimal influence from rivers or estuaries. Where wave energy is low, mangroves, or mudflats may be present.
- The Estuarine System consists of deepwater tidal habitats and adjacent tidal habitats that usually semi-enclosed by land but have open, partly obstructed, or sporadic access to the open ocean and the ocean water is at least occasionally diluted by freshwater runoff from the land.
- Riverine System includes all wetlands and deepwater habitats contained within a channel with two exceptions (1) wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens, and (2) habitats with water containing ocean-derived salts of 0.5 ppt or greater.
- Lacustrine System includes inland water bodies that are situated in topographic depressions, lack emergent trees and shrubs, have less than 30 percent vegetation cover, and occupy at least 20 acres. Includes lakes, larger ponds, sloughs, lochs, bayous, etc.
- Palustrine includes all nontidal wetlands dominated by trees, shrubs, persistent emergent plants, or emergent mosses or lichens, and all wetlands that occur in tidal areas where the salinity is below 5 percent. The system is characterized based on the type and duration of flooding, water chemistry, vegetation, or substrate characteristics (soil types) (Cowardin, Carter, Golet, & LaRoe, 1979) (FGDC, 2013).

In the District of Columbia, the main type of wetlands is palustrine (freshwater) wetlands found primarily along the Anacostia and Potomac Rivers, as well as Theodore Roosevelt Island, as shown in Figure 5.1.5-1. Table 5.1.5-2 uses 2014 NWI data to characterize and map District wetlands on a on a broad-scale. The data is not intended for site-specific analyses and is not a substitute for field-level wetland surveys, delineations, or jurisdictional determinations, which may be conducted, as appropriate, at the site-specific level once those locations are known. The map codes and colorings in Table 5.1.5-2 correspond to the wetland types in Figure 5.1.5-1.

Table 5.1.5-2: District of Columbia Wetland Types, Descriptions, Location, and Amount, 2014

Wetland Type	Map Code and Color	Description[a]	Occurrence	Amount (Acres)[b]
Palustrine forested wetland	PFO	PFO wetlands contain woody vegetation that are at least 20 feet tall. Floodplain forests and hardwood swamps are examples of PFO wetlands.	Along the Anacostia and Potomac	191

Wetland Type	Map Code and Color	Description[a]	Occurrence	Amount (Acres)[b]
Palustrine scrub-shrub wetland	PSS	Woody vegetation less than 20 feet tall dominates PSS wetlands. Thickets and shrub swamps are examples of PSS wetlands.	Rivers and Theodore Roosevelt Island	
Palustrine emergent wetlands	PEM	PEM wetlands have erect, rooted, green-stemmed, annual, water-loving plants, excluding mosses and lichens present for most of the growing season in most years. PEM wetlands include freshwater marshes, wet meadows, fens,[70] prairie potholes, and sloughs[71].		12
Palustrine unconsolidated bottom	PUB	PUB and PAB wetlands are commonly known as freshwater ponds, and includes all wetlands with at least 25% cover of particles smaller than stones and a vegetative cover less than 30%.		26
Palustrine aquatic bed	PAB	PAB wetlands include wetlands vegetated by plants growing mainly on or below the water surface line.		
Riverine wetlands	R	Riverine systems include rivers, creeks, and streams. They are contained in natural or artificial channels periodically or continuously containing flowing water.	Along open waters of the Anacostia River	52
Lacustrine wetland	L2	Lacustrine systems are lakes or shallow reservoir basins generally consisting of ponded waters in depressions or dammed river channels, with sparse or lacking persistent emergent vegetation, including any areas with abundant submerged or floating-leaved aquatic vegetation. These wetlands are less than 8.2 feet deep.	Wetlands along Kenilworth Park and Aquatic Gardens and Kingman Lake	26

[a] The wetlands descriptions are based on information from the Federal Geographic Data Committee 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. (USFWS, 2015b)
Source: (Cowardin, Carter, Golet, & LaRoe, 1979) (USFWS, 2015a), (FGDC, 2013)

Palustrine Wetlands

Palustrine wetlands, including vernal pools, springs and seeps, and tidal freshwater wetlands, are the most prevalent wetlands within the District of Columbia, comprising approximately 75 percent of all wetlands (USFWS, 2014a).

Although seasonal in nature, vernal pools are important to wildlife populations in the District, and support plants, insects, crustaceans and amphibians (including the spotted salamander *[Ambystoma maculatum]* and wood frog *[Lithobates sylvaticus]*) found only in these wetlands. Vernal pools in the District are typically found within federally protected land in woodland areas and along the Potomac River in rocky floodplain areas. (DDOE, 2015c)

[70] Fens are nutrient-rich, grass- and sedge-dominated emergent wetlands that are recharged from groundwater and have continuous running water. (Edinger, et al., 2014)
[71] Slough: "Swamp or shallow lake system, usually a backwater to a larger body of water." (NOAA, 2014a)

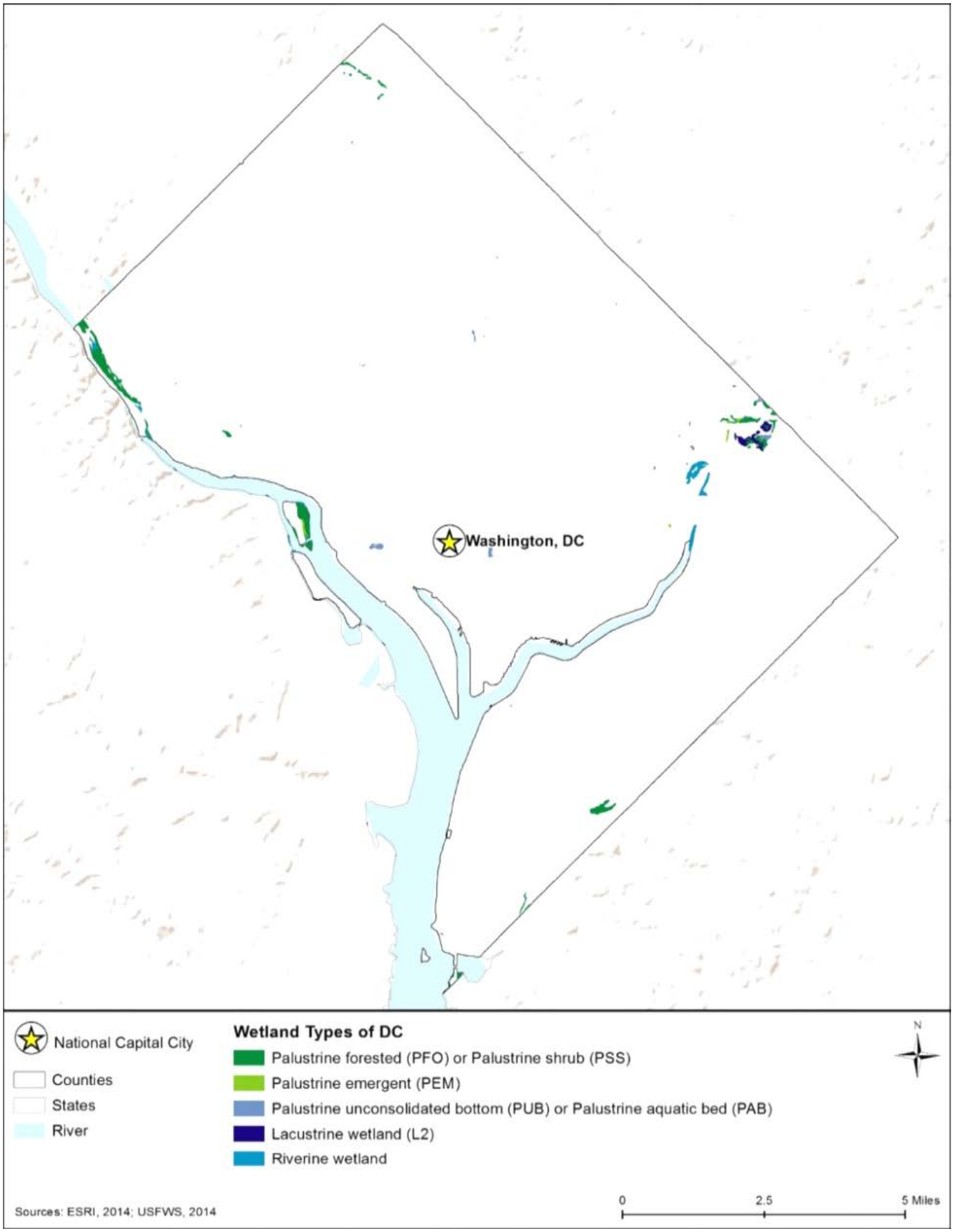

Figure 5.1.5-1: Wetlands by Type in the District of Columbia, 2014

Springs and seeps are found in areas where the water table is higher than the ground surface; springs come out of a concentrated source, whereas seeps have a sheet flow that flows downslope. Springs can be found in the Rock Creek valley, while seeps are typically east of the Anacostia River, at the base of gravel terrace hills. (DDOE, 2015c)

The USACE and DDOE have implemented tidal freshwater wetland reconstructions along the Anacostia River on lands managed by the NPS. Kenilworth Marsh was reconstructed in 1993, and Kingman Marsh was reconstructed in 2000. The last project was the River Fringe Wetlands, reconstructed along the main stem of the Anacostia River in 2003. Species observed at this site are consistent with those commonly identified in freshwater tidal marshes, and include dominant vegetation from forb/herb[72] groups (approximately 55 percent of total species observed), including non-woody broad-leaved plants such as green arrow arum *(Peltandra virginica)*, broadleaf arrowhead (*Sagittaria latifolia*), and purple loosestrife (*Lythrum salicaria).* Also commonly observed are grasses, including rice cutgrass *(Leersia oryzoides)*, annual wildrice *(Zizania aquatica)*, and the common reed *(Phragmites australis)*, along with sedges and rushes such as the common rush (*Juncus effuses*). Remaining species observed include those from tree (6 percent), vine (3.5 percent), or shrub (1 percent) categories. (DDOE, 2009)

Large amounts of wetlands within the District of Columbia have been lost due to draining, filling, and other urban alterations. The remaining wetlands are threatened by contaminated stormwater runoff from impervious sources, municipal and industrial wastewater discharge, sedimentation, and public and private land redevelopment and construction activities. (DDOE, 1997)

Riverine Wetlands

Riverine wetlands are associated with flowing water systems (such as rivers, creeks, perennial streams, intermittent streams, and similar waterbodies) and connecting wetlands. In the District, these wetlands are primarily along open waters of the Anacostia River. Riverine wetlands comprise 17 percent of total wetlands in the District. (USFWS, 2014a)

Lacustrine Wetlands

Lacustrine wetlands include both open lake water and the shallow edges of lakes. Lacustrine wetlands occur primarily along Kenilworth Park and Aquatic Gardens and Kingman Lake, and consist of approximately 8 percent of all the wetlands found in the District. (USFWS, 2014a)

Wetlands of Special Concern or Value in the District of Columbia

There are no wetlands of special concern within the District of Columbia. Other wetlands may be protected under easements or agreements through voluntary government programs and resource conservation groups found across the District, including easements managed by natural resource conservation groups such as the Potomac Conservancy. According to the National Conservation Easement Database, a national electronic repository of government and privately

[72] Forb/herb: "Vascular plant without significant woody tissue above or at the ground. Forbs and herbs may be annual, biennial, or perennial but always lack significant thickening by secondary woody growth and have perennating buds borne at or below the ground surface." (NRCS, 2015g)

held conservation easements (http://conservationeasement.us/), the Potomac Conservancy holds six acres in conservation easements, and the NPS holds two acres within the District. (National Conservation Easement Database, 2015)

For more information on The District's conservation programs and easements, see Section 5.1.8 Visual Resources, and Section 5.1.7 Land Use, Recreation, and Airspace.

5.1.6. Biological Resources

5.1.6.1. *Definition of the Resource*

This chapter describes the biological resources of the District of Columbia. Biological resources include terrestrial[73] vegetation, wildlife, fisheries and aquatic habitats[74], threatened[75] and endangered[76] species, and communities and species of conservation concern. Wildlife habitat and associated biological ecosystems are also important components of biological resources. The District is small in area (approximately 61.05 square miles of land and 7.29 square miles of water) and characterized by relatively little topographic variation (U.S. Census Bureau, 2014). Only 12 percent of the District is undeveloped, including more than 7,000 acres of NPS lands and 900 additional acres of District-owned parkland (DDOE, 2015c). Consequently, the biological resources within the District are limited, with the majority comprising aquatic habitats including the Potomac River. Each of these topics is discussed in more detail below.

The information for this chapter was gathered from the 2006 District of Columbia's Wildlife Action Plan (DC WAP) (DDOE, 2006). An update to the WAP is currently being finalized, and some information in this section comes from the draft 2015 DC WAP (DDOE, 2015c).

5.1.6.2. *Specific Regulatory Considerations*

The pertinent federal laws relevant to the protection and management of biological resources in the District are summarized in Appendix C. Table 5.1.6-1 summarizes the District laws relevant to biological resources and the FirstNet project.

Table 5.1.6-1: Relevant District of Columbia Biological Resources Laws and Regulations

District Law/Regulation	Regulatory Agency	Applicability
D.C. Law 3-30: Wildlife Protection Act of 2010	DOEE, Fisheries and Wildlife Division	Regulates wildlife control activities
D.C. Law 5-188: The Water Pollution Control Act of 1984	DOEE	Ensures that the District's fisheries and wildlife resources are properly managed and protected

[73] Terrestrial: "Pertaining to the land." (USEPA, 2015d)
[74] 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, 2015d)
[75] Threatened species are "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." (16 U.S.C. §1532(20)) (USEPA, 2015d)
[76] Endangered species are "any species which is in danger of extinction throughout all or a significant portion of its range." (16 U.S.C. §1532(6)) (USEPA, 2015d)

District Law/Regulation	Regulatory Agency	Applicability
D.C. Law 14-614: District of Columbia Urban Forest Preservation Act	DDOT	Establishes an urban forest preservation program

5.1.6.3. Terrestrial Vegetation

The distribution of flora[77] within the District of Columbia is a function of the characteristic geology,[78] soils, climate, and water of a given geographic area and correlates to distinct areas identified as ecoregions[79]. Ecoregions are broadly defined areas that share similar characteristics, such as climate, geology, soils, and other environmental conditions, and represent ecosystems contained within a region. The boundaries of an ecoregion are not fixed; they depict a general area with similar ecosystem types, functions, and qualities. (National Wildlife Federation, 2015) (USDA, 2015a) (World Wildlife Fund, 2015)

Ecoregion boundaries often coincide with physiographic[80] regions of an area. The ecoregions mapped by the USEPA are the most commonly referenced, although individual states and organizations have also defined ecoregions that may differ slightly from those designated by the USEPA. The USEPA Level I ecoregion is the coarsest level, dividing the United States into 15 ecological regions. Level II further divides the country into 50 regions. The continental U.S. contains 104 Level III ecoregions and the contiguous lower 48 states has 84 ecoregions. This section presents a discussion of biological resources for the District for USEPA's Level III ecoregion. (Bryce, et al., 2010)

As shown in Figure 5.1.6-1, the USEPA divides the District into two Level III ecoregions. These two ecoregions support a variety of different plant communities; all predicated on their general location within the District, with one occurring in the Northern Piedmont and the other in the Southeastern Plains. The Northern Piedmont ecoregion is limited to the northwestern region of the District, while the Southeastern Plain covers the southeast. Vegetation communities range from mixed hardwood communities and pines in the Northern Piedmont, to mixed hardwood communities in the Southeastern Plains region of the District.

Table 5.1.6-2 provides a summary of the general abiotic[81] characteristics, vegetative communities, and the typical vegetation found within each of the ecoregions.

[77] The plants of a particular region, habitat, or geological period.

[78] USGS defines geology as an interdisciplinary science with a focus on the following aspects of earth sciences: geologic hazards and disasters, climate variability and change, energy and mineral resources, ecosystem and human health, and groundwater availability.

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

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

[81] Physical rather than biological; not derived from living organisms.

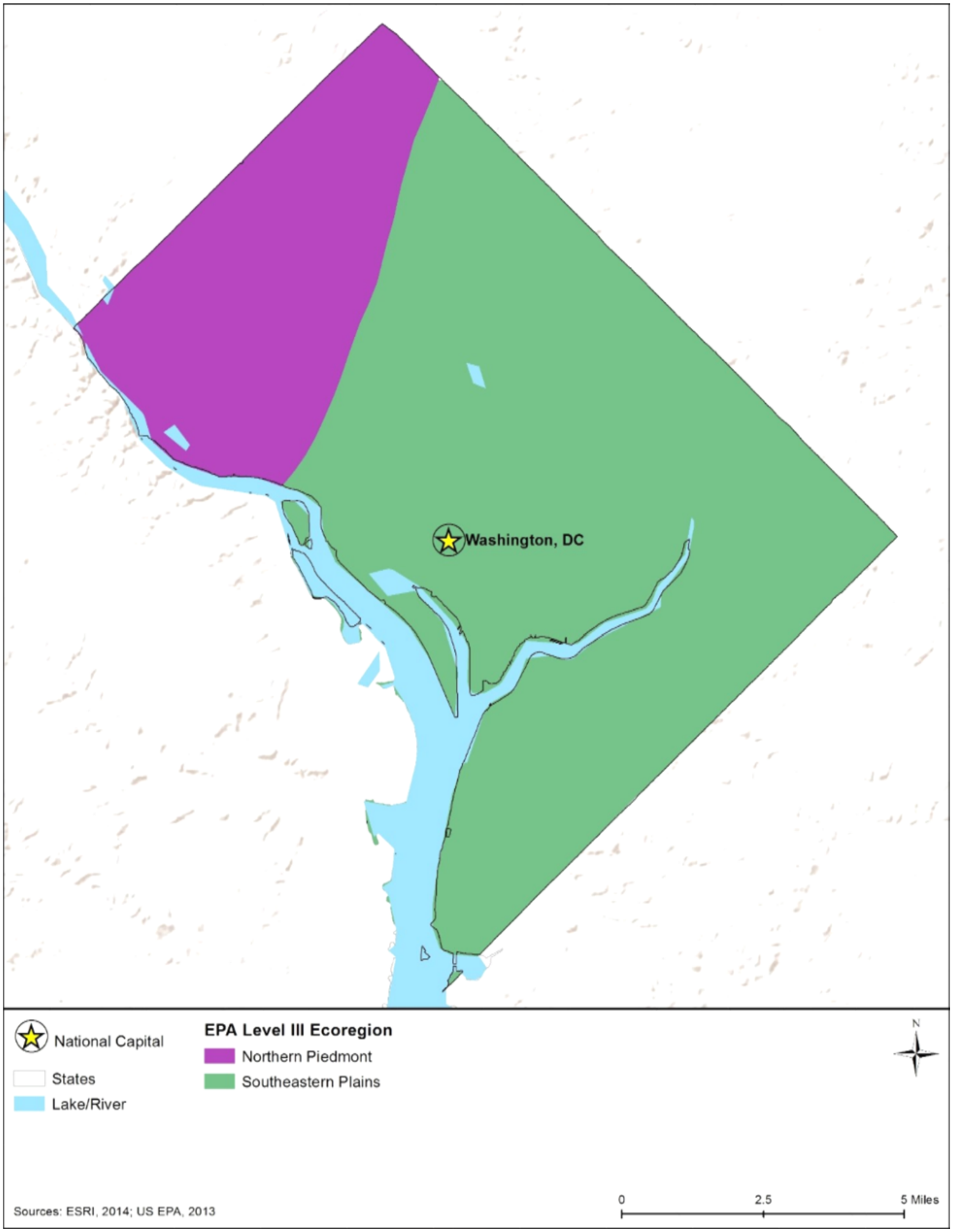

Figure 5.1.6-1: USEPA Level III Ecoregions of District of Columbia

Table 5.1.6-2: USEPA Level III Ecoregions of District of Columbia

Ecoregion Number	Ecoregion Description	Abiotic Characterization	General Vegetative Communities	Typical Vegetation
64	Northern Piedmont	Transitional region composed of low hills, irregular plains, and open valleys in contrast to the low mountains to the north and west and the flatter coastal plains to the east	Mixed Hardwoods and Pines	**Hardwoods –** Oaks (*Quercus spp.*); Black gum (*Nyssa sylvatica*); Beech (*Fagus spp.*); Tulip poplar (*Liriodendron tulipifera*) **Conifer Trees** – Virginia pine (*Pinus virginiana*)
65	Southeastern Plains	Interior coastal plain with rolling to smooth plains	Mixed Hardwoods	**Hardwoods –** Red maple (*Acer rubrum*); Green ash (*Fraxinus pennsylvanica*); Sweetgum (*Liquidambar spp.*); American elm (*Ulmus americana*)

Sources: (Bryce, et al., 2010) (Elias, 1989) (USEPA, 2013c) (Petrides, 1986)

Communities of Concern

The DDOE Fisheries and Wildlife Division (FWD) manages the Natural Heritage Program for the District. The Natural Heritage Program inventories, catalogues and facilitates protection of rare and outstanding elements of the natural diversity in the United States. The DDOE FWD provides much of the data regarding the sensitive vegetation communities occurring within the District (DDOE, 2006).

Nevertheless, the 2006 DC WAP has designated 13 vegetative communities as priority habitat types for conservation in the District. The working group for the 2006 DC WAP determined these priority habitat types using data from the DDOE FWD. The District's ranking system for designating vegetative communities of concern prioritizes habitat types based on (1) the number of species of greatest conservation need; (2) acreage; and (3) habitats that have many potential conservation opportunities may be given weight during the implementation process. These habitat types are considered priority habitats because they contain greater numbers of species in greatest conservation need, and are large in acreage. As new surveys and studies continue to provide additional data, these ranks are revised as necessary to reflect the current state of the community (DDOE, 2006) (DDOE, 2015c). Table 5.1.6-3 summarizes the nine terrestrial priority habitat types found in the District of Columbia (DDOE, 2006).

Table 5.1.6-3: Priority Habitats for Conservation in District of Columbia [82]

Community Type	USEPA Ecoregion(s)	Geographic Region(s)	Description	Distribution
Hardwood Forests	Northern Piedmont and Southeastern Plains	Entire District	Five major types of hardwood forests: chestnut oak forests, mixed oak-beech forests, tulip poplar forests, loblolly pine-mixed oak forests, and Virginia pine-oak forests.	Primarily in the northwestern portion of the District and southeast of the Anacostia River
Emergent Non-Tidal Wetlands	Southeastern Plains	Southeastern D.C.	Newly formed wetlands that are not subject to tidal fluctuation.	Upper reaches of the Anacostia River
Grasslands/ Managed Meadows	Southeastern Plains	Entire District	Primarily composed of grasslands and vegetation that does not mature into successional growth or shrubland. Managed meadows are similar to grasslands, but are managed, typically through mowing, by agencies or organizations.	Southeastern portion of the District along the Anacostia River corridor
Forested Wetlands/ Riparian Woodlands/ Floodplains	Northern Piedmont and Southeastern Plains	Entire District	Forested wetlands support vegetation with roots that are adapted to saturation during the growing season. Riparian woodlands are woodlands surrounding rivers and streams. Floodplains are low areas surrounding streambanks, rivers, and other wet areas that are subject to flooding.	Along the Potomac River and Anacostia River corridors
Tidal Mudflats	Northern Piedmont and Southeastern Plains	Entire District	Wetlands that occur between vegetated marsh and the water's edge and alternate being exposed and submerged by the tide.	Along the Potomac River and Anacostia River corridors
Springs and Seeps	Northern Piedmont and Southeastern Plains	Entire District	Either occur where groundwater flows to the surface as a concentrated flow (spring) or diffuse flow (seep).	In the northwest and southeast portions of the District along the hardwood forest fringe
Vernal Pools	Northern Piedmont and Southeastern Plains	Entire District	Seasonal bodies of water that flood annually for a few months in spring and are dry by the end of summer.	Primarily at the far northwestern portion of the District on the hardwood forest fringe
Early Successional/ Shrub-scrub/ Edge	Southeastern Plains	Southeastern D.C.	Woody vegetated habitat that has not matured into a larger forest because of natural or human disturbances.	Primarily in the northwest along the Potomac River and in the Southeast along the Potomac and Anacostia River corridors
Emergent Tidal Wetlands	Southeastern Plains	Southeastern D.C.	Lands that are temporarily, seasonally, or semi-permanently inundated by tidal waters.	Upper reaches of the Anacostia River

Source: (DDOE, 2006)

[82] Wetland communities are described in Section 5.1.5.

Nuisance and Invasive Plants

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

Noxious weeds are typically non-native species that have been introduced into an ecosystem inadvertently; however, on occasion native species can be considered a noxious weed. Noxious weeds greatly affect agricultural areas, forest management, natural, and other open areas (U.S. Legal, 2015). The District does not maintain a noxious weeds list or regulate noxious weeds; however, 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 United States (88 terrestrial, 19 aquatic, and 5 parasitic) (USDA, 2015b), of which six are known to occur in the District:

- **Aquatic –** waterthyme *(Hydrilla verticillata)* and kariba-weed *(Salvinia molesta)*
- **Terrestrial Forbs, Grasses, and Grass-like Plants –** British yellowhead *(Inula britannica),* mile-a-minute *(Mikania micrantha),* cuscuta *(Cuscuta spp.),* and broomrape *(Orobranche spp.)*

5.1.6.4. *Terrestrial Wildlife*

This section discusses the terrestrial wildlife species in the District, divided among mammals, birds, reptiles and amphibians, and invertebrates. Terrestrial wildlife are those species of animals, and their habitats, that live predominantly on land. Terrestrial wildlife include common big game species, small game animals and furbearers,[83] nongame animals, and game birds and waterfowl whose habitats that may be found in the District. A discussion of non-native and/or invasive wildlife species is also included. There are 32 mammal species, 230 species of resident and migratory birds, 40 reptile and amphibian species, and 65 species of invertebrates considered by the DDOE FWD that represent the fauna of the District (DDOE, 2015c).

Mammals

Common and widespread mammal species in the District of Columbia include the Virginia opossum (*Didelphis virginiana*) and Eastern chipmunk (*Tamias striatus*). DDOE FWD has identified 32 species in the District, 21 species of which it has identified as Species of Greatest Conservation Need (SGCN).

- Northern Long-Eared Bat (*Myotis septentrionalis*)
- Eastern Small-Footed Bat (*Myotis leibii)*
- Little Brown Bat (*Myotis lucifugus*)
- Tri-colored Bat (*Perimyotis subflavus*)

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

- Northern River Otter (*Lontra canadensis*)
- Striped Skunk (*Mephitis mephitis*)
- Hoary Bat (*Lasiurus cinereus*)
- Evening Bat (*Nycticeius humeralis*)
- American Mink (*Neovison vison*)
- Eastern Red Bat (*Lasiurus borealis*)
- Muskrat (*Ondatra zibethicus*)
- Big Brown Bat (*Eptesicus fuscus*)
- Silver Haired Bat (*Lasionycteris noctivagans*)
- Beaver (*Castor canadensis*)
- Eastern Chipmunk (*Tamias striatus*)
- Southern Flying Squirrel (*Glaucomys volans*)
- Gray Fox (*Urocyon cinereoargentus*)
- Virginia Opossum (*Didelphis virginiana*)
- Northern Short-tailed Shrew (*Blarina brevicauda*)
- Meadow Vole (*Microtus pennsylvanicus*)
- Eastern Cottontail (*Sylvilagus floridanus*)

The SGCN list consists of at-risk species that are rare or declining, and grants can provide funding for efforts to reduce their potential for listing as endangered[84] (DDOE, 2015c). The northern long-eared bat (*Myotis septentrionalis*) is the only federally listed mammal species in the District of Columbia (additional information in Section 5.1.6.6).

The white-tailed deer *(Odocoileus virginianus)* is the only mammal currently managed in the District. The NPS has approved a plan to reduce the population of deer at Rock Creek Park in order to protect the forests and associated habitat functions[85] (NPS, 2014a).

Birds

The number of native bird species documented in the District varies according to the timing of the data collection effort, changes in bird taxonomy[86], and the reporting organization's method for categorizing occurrence and determining native versus non-native status. The presence of aquatic habitats in the District supports a large variety of bird species. As of 2015, 230 species of resident and migratory birds had been documented in the District, 58 of which (approximately 24 percent) were identified as SCGN (DDOE, 2015c). No federally threatened or endangered birds are known to occur as residents within the District.

The District of Columbia in the Atlantic Flyway, which spans more than 3,000 miles from the Arctic tundra to the Caribbean. It is the most densely human-populated of the four waterfowl

[84] The current SGCN list is available at http://doee.dc.gov/service/2015-district-columbia-wildlife-action-plan or http://doc.dc.gov/sites/default/files/dc/sites/ddoe/service_content/attachments/03%202015%20WildlifeActionPlan%20%20Ch2%20SGCN.pdf.
[85] The NPS Rock Creek Park Deer Management Plan and December 2011 EIS is available through this webpage: https://parkplanning.nps.gov/projectHome.cfm?projectID=14330. The May 1, 2012 Record of Decision (ROD) is posted here: http://www.nps.gov/rocr/learn/management/upload/ROCR-Deer-Management-Plan-ROD-May-1-2012.pdf.
[86] Taxonomy: "A formal representation of relationships between items in a hierarchical structure." (USEPA, 2015d)

migration flyways in North America (Atlantic, Mississippi, Central, and Pacific), and many waterfowl species are thus threatened by urban sprawl and development (Ducks Unlimited, 2015). Nevertheless, large numbers of waterfowl and non-waterfowl birds utilize this flyway and other migration corridors and pathways during their annual migrations northward in the spring and southward in the fall. Despite the dense human population and development within the District of Columbia, the aquatic habitats and forested corridors are an important ecological resource for migrating birds (National Audubon Society, Inc., 2015a). "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).

Bald eagles (*Haliaeetus leucocephalus*) are protected under the Bald and Golden Eagle Protection Act. Bald eagles are generally found near large rivers and lakes throughout the District during summer breeding (eBird, 2015). Bald eagles are often observed in the District as they nest along the Anacostia River (DDOE, 2015c). Golden eagles are rarely seen and a transient species in the District (Birds of DC, 2015).

Important Bird Areas assist in achieving local conservation priorities to provide important habitat for native bird populations during breeding[87], migratory stops, feeding, and over-wintering areas (National Audubon Society, Inc., 2015b). There are no identified Important Bird Areas in the District of Columbia; however, in 2011, the District became a USFWS Urban Bird Treaty City (DDOE, 2015c). The Urban Conservation Treaty for Migratory Birds program was created to help municipal governments conserve birds that live and nest in, overwinter, or migrate through their cities. By restoring and conserving green-space, Urban Bird Treaty cities enhance urban areas for migratory birds. The Urban Bird Treaty program has an emphasis on education and outreach programs and includes resources educating citizens about birds and their conservation in an urban environment. Key features of the program also includes suggestions for reducing hazards to birds during migration; restoring, enhancing, and protecting avian habitats; providing education and outreach opportunities in urban and suburban communities; monitoring bird populations when appropriate; and creating and building career awareness and career development opportunities for young people (USFWS, 2014b).

Reptiles and Amphibians

A total of 21 native reptile and 19 amphibian species, such as turtles, snakes, and salamanders, are known to occur in the District (DDOE, 2015c). Species in both groups are most frequently found in forested and freshwater wetland habitats. Some reptiles and amphibians found in the District are generalists[88] and use a variety of habitats, while others are more specialized. Of the

[87] Breeding areas: "The area utilized by an organism during the reproductive phase of its lifecycle and during the time that young are reared." (USEPA, 2015d)
[88] Habitat generalist: "A species that is adaptable to a wide range of ecological conditions for survival, though it will exhibit lower populations in less than optimal conditions." (USFS, 2015)

40 species known to occur in the District of Columbia, 17 reptile species and 18 amphibian species are identified in the 2015 DC WAP as SGCN (DDOE, 2015c). However, there are no federally listed reptiles or amphibian species in the District.

Invertebrates

The District of Columbia is home to a large number of invertebrate species, including bees, hornets, wasps, butterflies, moths, beetles, flies, dragonflies, damselflies, spiders, mites, crustaceans, and nematodes. Some of these species are prolific pollinators and provide an abundant food source for mammals, birds, reptiles, amphibians, and other invertebrates. One-third of U.S. agricultural output depends on pollinators.[89] In natural systems, the size and health of the pollinator population is linked to ecosystem health, with a direct relationship between pollinator diversity and plant diversity (Audubon Society of Northern Virginia, 2005). "As a group, native pollinators are threatened by habitat loss, pesticides, disease, and parasites" (NRCS, 2009).

One endangered (Hay's spring amphiphod) and one candidate (Kenk's amphipod) invertebrate species are known to occur in the District. Section 5.1.6.6, Threatened and Endangered Species and Species of Concern, identifies and describes these protected species in more detail.

Invasive Wildlife Species

The District has not adopted regulations that prohibit or regulate the possession, transport, importation, sale, purchase, or introduction of invasive wildlife species. However, a number of invasive wildlife species are known to occur within the District. Examples include European starlings (*Sturnus vulgaris*) and House sparrows (*Passer domesticus*), which are aggressive, non-native birds that out compete native secondary cavity nesters[90] for breeding opportunities and will often kill nesting native species. (DDOE, 2015c)

In the District of Columbia, white-tailed deer (*Odocoileus virginianus*) are the most common nuisance mammals. While native species, they have become overabundant. They destroy native vegetation resulting in erosion and water resource concerns, and can carry/transmit disease to human beings. (DDOE, 2015c)

5.1.6.5. *Fisheries and Aquatic Habitats*

This section discusses the aquatic wildlife species in the District of Columbia, including fish and invertebrates. A summary of non-native and/or invasive aquatic species is also presented. A distinctive feature of the District's landscape with regard to aquatic wildlife are the Potomac and Anacostia Rivers. Some of the freshwater fish in these rivers are diadromous (i.e., anadromous[91]

[89] Pollinators: "Animals or insects that transfer pollen from plant to plant." (USEPA, 2015d)
[90] Cavity nesters excavate nesting holes, use cavities resulting from decay (natural cavities), or use holes created by other species in dead or deteriorating trees. The majority of cavity-nesting birds are insectivorous. (USFS, 1977)
[91] Anadromous: "Referring to the lifecycle of fishes, such as salmon, in which adults travel upriver from the sea to breed, usually returning to the area where they were born." (USEPA, 2015d)

and catadromous[92]), reflecting the District's connection to the Atlantic coast, which is approximately 30 miles to the east.

Freshwater Fish

The District is home to 78 species of freshwater fish, ranging in size from small minnows to larger diadromous species. They use a wide variety of aquatic habitats from the deep channel in the Potomac River to shallow vegetated wetlands and steep streams. The upper limit of tidal waters on the Potomac River are within the District. A number of anadromous fish species spawn in the Potomac and Anacostia Rivers and their tributaries, including striped bass (*Morone saxatilis*), white perch (*Morone americana*), American shad (*Alosa sapidissima*), hickory shad (*Alosa mediocris*), gizzard shad (*Dorosoma cepedianum*), blueback herring (*Alosa aestivalis*), and alewife (*Alosa pseudoharengus*) (DDOE, 2015c).

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 all freshwater fish species in North America are considered at risk or vulnerable to extinction[93] (National Fish Habitat Board, 2010) (USFWS, 2015c). Major threats to freshwater fish include habitat modification and destruction (dams, culverts, weirs, urban development, and agricultural practices), overfishing, invasive species, and environmental pollution and impaired water quality. Of the 78 species of fish known to occur in the District, 12 have been designated as SGCN.

The DDOE FWD develops and enforces licensing and regulations to allow for the effective protection of fish species and their habitats. Regulated species include channel catfish (*Ictalurus punctatus*), largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), walleye (*Sander vitreus*), and yellow perch (*Perca flavescens*). (DOEE, 2015b)

Shellfish and Other Invertebrates

Shellfish and other invertebrates known to occur in the tidal waters of the Potomac River as well as other aquatic habitats include freshwater invertebrates, whose adult forms are terrestrial insects (e.g., flies, beetles, etc.) crayfish, and freshwater mussels. Two invertebrates in the District are federally listed under the ESA: the endangered Hay's Spring amphipod[94] (*Stygobromus hayi*) and Kenk's amphipod (*Stygobromus kenki*), a candidate species. These species are described further in Section 5.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Invasive Aquatic Species

There are three invasive aquatic species known to occur in District of Columbia: the northern snakehead *(Channa argus)*, which is native to Asia; and the blue catfish *(Ictalurus furcatus)*, and flathead catfish *(Pylodictis olivaris)*, both of which are native to the Mississippi River basin.

[92] Catadromous: "An organism which lives in fresh water and goes to the sea to spawn, such as some eels." (USEPA, 2015d)
[93] Extinction: "The disappearance of a species from part or all of its range." (USEPA, 2015d)
[94] Amphipod: "A small, shrimp-like crustacean." (USEPA, 2015d)

These predatory fish are found in the Anacostia and Potomac Rivers, floodplain ponds, freshwater ponds at Kenilworth Aquatic Gardens, and tidal freshwater wetlands. These species prey on smaller fish, snails, and crayfish resulting in increased predation on some of the District's SGCN. Populations of these predators have reached historic highs and have reduced productivity for many species across all habitat types (DDOE, 2015c). The DDOE FWD specifically prohibits returning northern snakehead by-catch[95] (DDOE, 2015c).

5.1.6.6. *Threatened and Endangered Species and Species of Conservation Concern*

The USFWS is responsible for administering the ESA (16 U.S.C. §1531 *et seq*.) in the District. The USFWS has identified one endangered and one threatened species known to occur in the District (USFWS, 2015d). Of these two listed species, neither have designated critical habitat[96] within the District (USFWS, 2015e). One candidate species[97] is identified as occurring in the District of Columbia. (USFWS, 2015f). Candidate species are not afforded statutory protection under the ESA; however, the USFWS recommends considering these species during environmental planning because they could be listed in the future (USFWS, 2014c). The listed species are discussed in detail under the following sections. The northern long-eared bat occurs throughout the entirety of the District while the two amphipods are associated with freshwater springs and seeps along Rock Creek, in the northern region of the District.

Mammals

Research identified one federally protected mammal in the District, as summarized in Table 5.1.6-4. The species identified is the northern long-eared bat (*Myotis septentrionalis*), which is found throughout the District. Information on the habitat, distribution, and threats to the survival and recovery of the species provided below.

Table 5.1.6-4: Federally Listed Mammal Species of the District of Columbia

Common Name	Scientific Name	Federal Status [a]	Critical Habitat	Habitat Description
Northern Long-eared Bat	*Myotis septentrionalis*	T	No	Caves and tree crevices throughout the District of Columbia

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

[95] By-catch: A fish or other marine species that is caught unintentionally while catching certain target species and target sizes of fish.
[96] Critical habitat includes "the specific areas (i) within the geographic area occupied by a species, at the time it is listed, on which are found those physical or biological features (I) essential to conserve the species and (II) that may require special management considerations or protection; and (ii) specific areas outside the geographic area occupied by the species at the time it is listed upon determination that such areas are essential to conserve the species." (16 U.S.C. §1532(5)(A)) (USEPA, 2015d)
[97] Candidate species are plants and animals that the USFWS has "sufficient information on their biological status and threats to propose them as endangered or threatened under the ESA, but for which development of a proposed listing regulation is precluded by other higher priority listing activities." (USFWS, 2014c)

Northern Long-eared Bat. The northern long-eared bat is a brown furred, insectivorous[98] bat with long ears. Reaching a total length of approximately three to four inches. It is a medium size relative to other members of the genus *Myotis*. The northern long-eared bat was first proposed as endangered in 2013 (78 FR 61046, October 2, 2013), and then listed as threatened in 2015 (80 FR 17973 18033, April 2, 2015). In the United States, its range includes most of the eastern and north central states (USFWS, 2015g). Locally, the northern long-eared bat's range includes all of the District of Columbia (USFWS, 2015h).

Northern Long-eared Bat
Photo Credit: USFWS

This species hibernates in caves and mines that exhibit constant temperatures, high humidity, and no air currents. In the summer, individuals roost[99] 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[100], from which pregnant females then migrate to summer areas where they roost in small colonies. (USFWS, 2015g)

White Nose Syndrome is the leading cause for the decline of this species, as well as other bat species throughout the northeastern and eastern United States. The numbers of northern long-eared bats in hibernation sites (hibernacula) have decreased by up to 99 percent in the northeastern United States. 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,[101] and wind farm operations. (USFWS, 2015g)

Invertebrates

One endangered and one candidate invertebrate species are known to occur in the District of Columbia (Table 5.1.6-5). These two endemic[102] amphipods have been observed only within a limited selection of springs within the area. Further information on the habitat, distribution, and threats to the survival and recovery of protected invertebrate species within the District is provided below.

[98] Insectivorous: "An animal that feeds on insects." (USEPA, 2015d)
[99] Roost: "A place where a flying animal, usually a bird or bat, can sleep or rest, usually by perching or hanging." (USFWS, 2015i)
[100] Hibernation: "The act of passing the winter in a dormant state in which the metabolism is slowed to a tiny fraction of normal." (USFWS, 2015j)
[101] Fragmentation: "The breaking up of large and continuous ecosystems, communities, and habitats into smaller areas that are surrounded by altered or disturbed land or aquatic substrate." (USEPA, 2015d)
[102] Endemic: "A species that is restricted in its distribution to a particular locality or region." (USEPA, 2015d)

Table 5.1.6-5: Federally Listed Invertebrate Species of the District of Columbia

Common Name	Scientific Name	Federal Status [a]	Critical Habitat	Habitat Description
Hay's Spring Amphipod	*Stygobromus hayi*	E	No	Shallow groundwater zone that percolates among sand grains and gravel towards the surface. Known only to occur in five springs in Rock Creek.
Kenk's Amphipod	*Stygobromus kenki*	C	No	Prefers shallow groundwater zone, with decaying leaves in the waters of spring-seep outflows. Known to occur only within five spring-seep sites, four within Rock Creek Park.

[a] E = Endangered, C= Candidate

Source: (USFWS, 2015d) (USFWS, 2015f)

Hay's Spring Amphipod
Photo Credit: Smithsonian Institution, National Museum of Natural History

Hay's Spring Amphipod. The Hay's Spring amphipod (*Stygobromus hayi*) is both colorless and blind, and grows up to just under a half inch in length. The amphipod was first listed as endangered in 1982 (47 FR 5425 5427, February 2, 1982). First collected at the National Zoological Park in 1938, the species is endemic to the region and only known to occur in five springs along Rock Creek in the District. (Pavek, 2002) (USFWS, 2015k).

"We know little about Hay's Spring amphipod biology, its population dynamics, or the ecological community in which it lives. This tiny creature grows to only 0.4 inches (10 millimeters) in length and, because it lives primarily below the surface, is colorless and blind. We do not know whether it resides primarily in the flooded fractures of the park's metamorphic rock or only in the saturated overburden above the bedrock,or both. It appears that the Hay's Spring amphipod may spend its life in a shallow groundwater zone, moving in water that percolates among sand grains and gravel unless large volumes of water flush it up and out of an exit as a spring." (Pavek, 2002)

Current conservation measures in effect restrict activities in an area around the springs and in their recharge areas. The species is especially vulnerable provided its limited population[103]. Threats to this species are primarily related to degradation[104] to its specialized underground habitat, including groundwater pollution from toxic spills, land disturbances, sewer leaks, and excessive stormwater flows. (Pavek, 2002)

[103] 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, 2015d)
[104] Degradation: "The reduction of the capacity of the environment to meet social and ecological objectives, and needs. Potential effects are varied and may contribute to an increase in vulnerability and the frequency and intensity of natural hazards." (USEPA, 2015d)

Kenk's Amphipod. Dr. Roman Kenk first discovered the Kenk's amphipod (*Stygobromus kenki*) in dead leaves and fine soils in the waters of spring outflows in 1967. Similar to Hay's Spring Amphipod, Kenk's is also without color or eyes, but is slightly smaller, growing only as large as a quarter of an inch. Kenk's amphipod has a very limited habitat range, only known to occur within five spring-seep sites, four of which are within Rock Creek Park (Pavek, 2002). Provided its rarity and location specificity, this species is considered endemic to the area and was listed as a federal candidate species beginning in 2010. (75 FR 69222 69294, November 10, 2010) (USFWS, 2015l)

Kenk's Amphipod
Photo Credit: USFWS

Kenk's amphipod is believed to eat bacteria and fungi found on dead and decaying leaves in the waters of spring-seep outflows. The occurrence of Kenk's amphipod indicates good water quality, and threats to this vulnerable species are primarily related to degradation of groundwater. Other threats include habitat contamination, sewer leaks, and the accumulation of pollutants from development in the watershed, or changes in the volume of water flow, from either ground disturbance or climate change. (USFWS, 2010)

5.1.7. Land Use, Recreation, and Airspace

5.1.7.1. Definition of the Resource

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

Land Use and Recreation

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

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

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

Airspace

Airspace is generally defined as the space lying above the earth, above a certain area of land or water, or above a nation and the territories that it controls, including territorial waters (Merriam Webster Dictionary, 2015a). Airspace is a finite resource that can be defined vertically and horizontally, as well as temporally, when discussing it in relation to aircraft activities. Airspace management addresses how and in what airspace aircraft fly. Air flight safety considers aircraft flight risks, such as aircraft mishaps and bird/animal-aircraft strikes. The Federal Aviation Administration (FAA) is responsible for the safe and efficient use of the nation's airspace. They have 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 is the operational arm of the FAA responsible for providing safe and efficient air navigation services to approximately 30.2 million square miles of airspace. This represents more than 17 percent of the world's airspace and includes all of the United States and large portions of the Atlantic and Pacific Oceans and the Gulf of Mexico" (FAA, 2014a). The Air Traffic Organization includes Service Units (organizations) that support the operational requirements.

The FAA Air Traffic Services 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, 2015a). The FAA works with District aviation officials and airport planners, military airspace managers, and other organizations in deciding how best to use airspace.

5.1.7.2. Specific Regulatory Considerations

The DOEE and DC Office of Planning (DCOP) manage land use activities in the District of Columbia. These agencies use a number of laws and regulations to assist in and help guide land use management. The District also employs a comprehensive management plan that became effective in 2011 (DCOP, 2011). The Comprehensive Plan of the National Capital contains two parts, the District Elements and the Federal Elements. The National Capital Planning Commission develops the Federal Elements. The District's Comprehensive Plan constitutes the District Elements. The District Elements contain 13 Citywide Elements that provide goals, objectives, and policies for land use issues that affect the whole city (e.g. transportation, environment, parks and open space, arts and culture). There are also 10 Area Elements,[105] which provide goals, objectives, and policies that are specific to geographic areas of the city. Because federal laws govern the nation's airspace, there are no specific District of Columbia laws that would alter the existing conditions relating to airspace for this Draft PEIS.

Table 5.1.7-1: Relevant District of Columbia Land Use, Recreation, and Airspace Laws and Regulations

District Law/Regulation	Regulatory Agency	Applicability
Historic Landmark and Historic District Protection Act of 1978	District Historic Preservation Office (HPO)	This act provides for the preservation and protection of the District's historic landmarks. "The protection, enhancement, and perpetuation of properties of historical, cultural, and aesthetic merit are in the interests of the health, prosperity, and welfare of the people of the District of Columbia." (District of Columbia, 2015a)
49 U.S.C § 49104 Lease of Metropolitan Washington Airports and § 49106 Metropolitan Washington Airports Authority.	Department of Transportation and MWAA	Federal laws, as well as laws specific to the District govern the nation's airspace. The code outlines the roles and responsibilities of the Metropolitan Washington Airports.

The District of Columbia is composed of approximately 68.34 square miles, including 7.29 square miles of water and 61.05 square miles of land. Land use patterns, illustrated in Figure 5.1.7-1, reveal an expansive city "core" of approximately four square miles centered around the open spaces of the federal city. The core is surrounded by an inner ring of moderate to high density residential and mixed use neighborhoods, extending west to Georgetown, north to Columbia Heights and Petworth, east across Capitol Hill, and south to the Anacostia River and Near Southwest. Beyond the inner ring is an outer ring of less dense development, characterized largely by single-family housing and garden apartments.[106] The two rings generally correspond to historic development patterns, with most of the inner ring developed prior to 1910 and the outer ring developed after 1910.

5.1.7.3. Land Use and Ownership

For the purposes of this analysis, the District has been classified into three primary land use groups: forest and woodlands, agricultural, and developed; and two land ownership categories: private and federal.

Land Use

Table 5.1.7-2 identifies the major land uses in the District. Developed land is the largest portion of land use with approximately 76 percent of the District's total land occupied by this category (Table 5.1.7-2 and in Figure 5.1.7-1. Forest and woodland is the second largest area of land use with 13 percent of the land occupied for this use. Agricultural land accounts for a very small portion of land use at less than 0.1 percent of the total land area. The remaining percentage of

[105] The DC planning elements are available at http://planning.dc.gov/node/636902.

[106] A low-rise apartment complex with landscaped gardens or lawns or a ground-floor unit of an apartment building, with access to a garden or lawn.

land includes public land and other land covers, shown in Figure 5.1.7-1, that are not associated with specific land uses. (USGS, 2012c).

Table 5.1.7-2: Major Land Uses in District of Columbia

Land Use	Square Miles	Percent of Land
Forest and Woodland	8.76	13.0%
Agricultural Land	0.04	<0.1%
Developed Land	52.36	76.0%

Sources: (USGS, 2012c) (DDOE, 2015c)

Forest and Woodland

Forest and woodland areas are within federal and local parks and preservation areas. The largest concentrations of forest are in Rock Creek Park and the Potomac Parkway, both under the administration and management of the NPS (Figure 5.1.7-1). The 1890 law establishing Rock Creek Park states that the area is to “be perpetually dedicated and set apart as a public park or pleasure ground for the benefit and enjoyment of the people of the United States” (NPS, 2010). It specifies that the park is to “provide for the preservation from injury or spoliation of all timber, animals, or curiosities within said park, and their retention in their natural condition, as nearly as possible” (NPS, 2010). The law also instructs that park roads be established to provide for public recreation, specifically to “lay out and prepare roadways and bridle paths, to be used for driving and for horseback riding, respectively, and footways for pedestrians.” (NPS, 2005a).

Agricultural Land

Agricultural land is sparse and concentrated in preservation areas, parks, and private lands (Figure 5.1.7-1). Less than 0.1 percent of the District's total land area is classified as agricultural land (USGS, 2012c).

Developed Land

The majority of land within the District is developed (Figure 5.1.7-1) (USGS, 2012c). Federal government buildings, national museums and monuments, and residential, commercial, industrial, and recreational structures occupy approximately 76 percent of the District’s land area (DDOE, 2015c). Commercial uses represent less than five percent of the city's land area, and industrial uses represent just one percent. Dense neighborhoods exist around the city center, with even denser residential development along major corridors like Connecticut Avenue NW and 14th Street NW. Dense development also exists east of the Anacostia River, primarily associated with large low-rise garden apartment complexes. In contrast, areas like Woodridge, Burrville, and Shepherd Park have low population densities (District of Columbia, 2015a).

Land Ownership

Land ownership within the District has been classified into two main categories: private and federal (Figure 5.1.7-2).

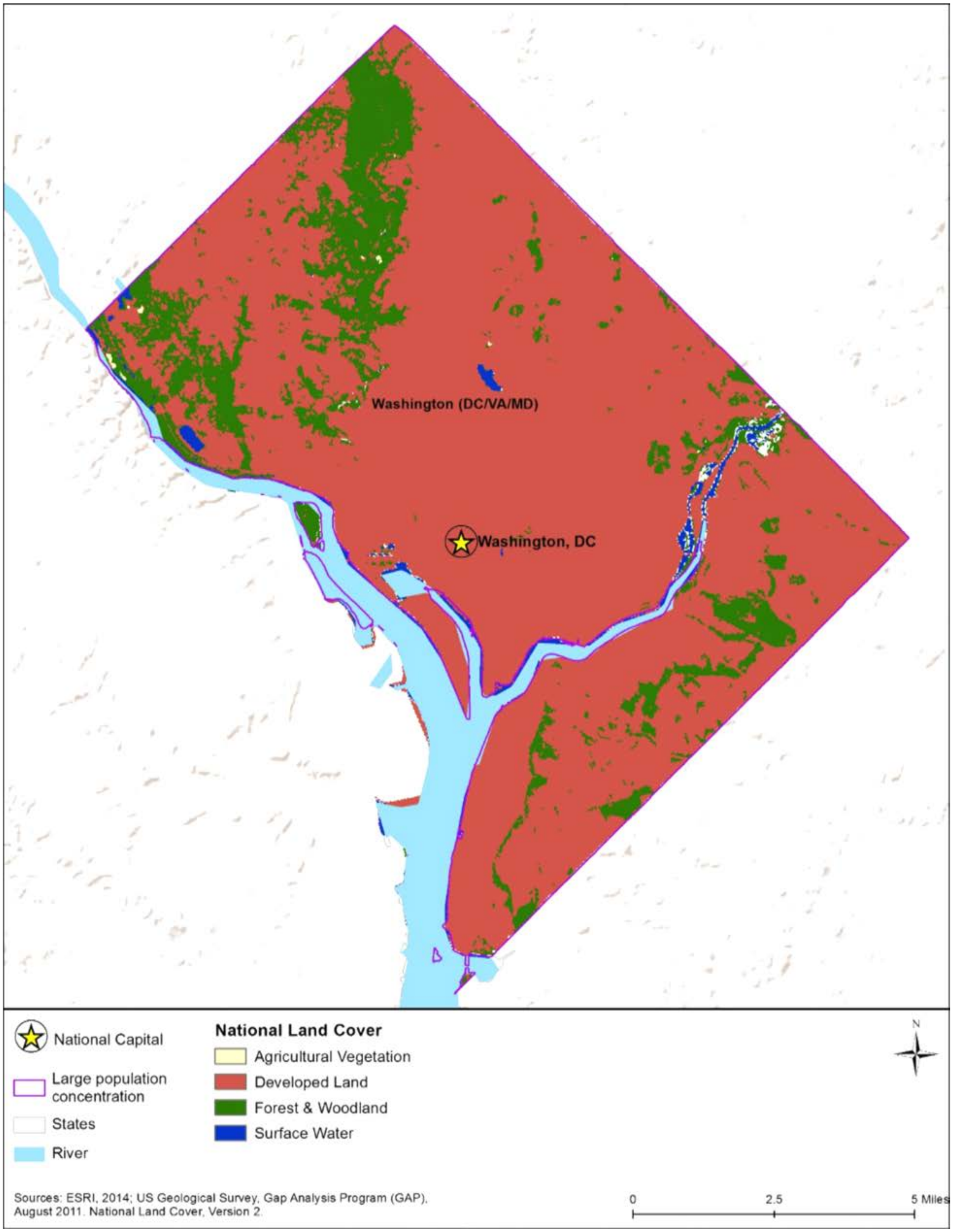

Figure 5.1.7-1: Major Land Use Distribution in District of Columbia

Private Land

The majority of land in the District is privately owned, with most of this land falling under the developed land use category. Private lands are primarily used for business and residential purposes. The city's transportation network has shaped land use patterns in the District. "Most of the commercial and higher density development beyond the core of the city hugs radial avenues like Connecticut Avenue NW and Pennsylvania Avenue SE. Most of the District's industrial development follows the railroad corridors running from Union Station east along New York Avenue and north to Silver Spring. The historic connection between transportation and land use continues to shape the city today, with Metrorail station areas emerging as the city's newest activity centers." (DC Regulations, 2016)

Federal Land

When streets and highways are subtracted out, the federal government owns about one-half of the land area of the District. The NPS, Department of Defense, and Department of Agriculture manage approximately 13.8 square miles within the District. Other federal agencies own and manage smaller parcels scattered throughout the District.[107] Table 5.1.7-3 identifies the federal agencies managing federal lands throughout the District. Additional information on lands managed by federal agencies is provided in Section 5.1.5, Wetlands, and Section 5.1.8, Visual Resources.

Table 5.1.7-3: Federal Land in District of Columbia

Agency[a]	Square Miles	Representative Type
Department of Defense	2.2	Military bases
NPS	10.9	Parks, monuments, historic sites
USDA	0.7	National Arboretum

[a] Table identifies land wholly managed by the Agency; additional properties may be managed by or affiliated with the Agency.

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

- Federal lands include nearly 2,000 buildings, with more than 95 million square feet of floor space;
- Federal uses occupy a range of physical settings, from self-contained enclaves like Bolling Air Force Base to large office buildings in the heart of Downtown Washington;
- Since federal lands are largely exempt from zoning, coordination and communication are particularly important to ensure land use compatibility;
- The Department of Defense manages the Joint Anacostia Naval Station – Bolling Air Force Base, and the Washington Naval Research Laboratory; and
- The NPS manages approximately 10.9 square miles, including Rock Creek Park, Glover Archbold Park, Montrose Park, Dumbarton Oaks Park, Meridian Hill Park, Battery Kemble Park, Palisades Park, and Whitehaven Park.

[107] Not all federal agency land is depicted in Figure 5.1.7-2 given the small size of some of the land acreage.

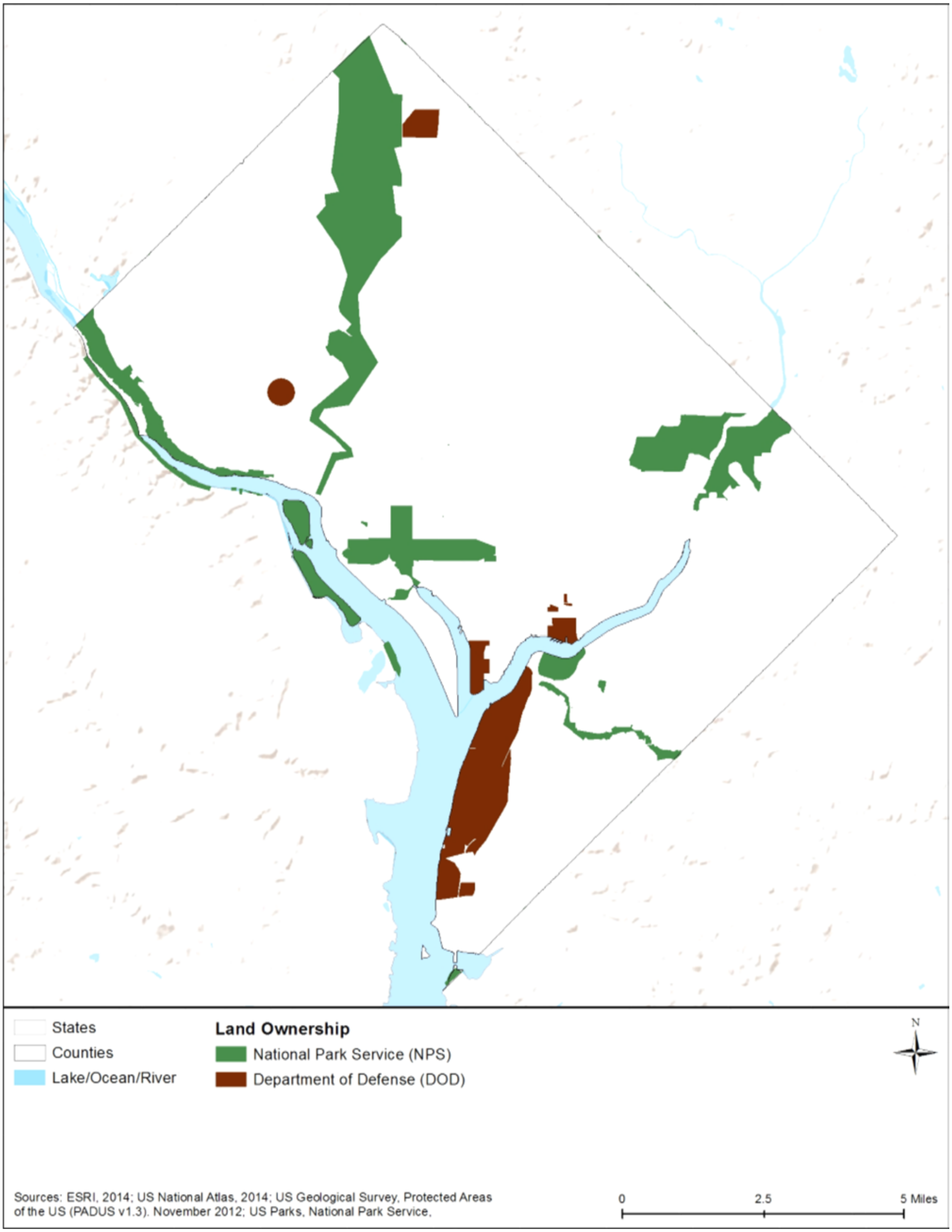

Figure 5.1.7-2: District of Columbia Land Ownership Distribution

5.1.7.4. Recreation

The District of Columbia is contains four geographic quadrants, which consist of neighborhood wards. Each ward has unique characteristics; some are primarily office buildings, others primarily residential. The Department of Parks and Recreation provides an assortment of indoor and outdoor recreational facilities, including athletic fields and courts, playgrounds, picnicking areas, indoor and outdoor pools, and community gardens in each ward. (District of Columbia, 2015b).

This section discusses recreational opportunities available at various locations throughout the District of Columbia. For information on visual resources, see Section 5.11, Visual Resources, and for information on the historical significance of locations, see Section 5.14, Cultural Resources.

The District of Columbia had 18.34 million domestic tourists in 2014, breaking the record for domestic visitors for the fifth year in a row (Washington DC Press, 2015). As the nation's capital, the District is a popular destination for those interested in politics, United States history, and museums.

The District contains a plethora of destinations related to United States politics. The White House is open for ticketed public tours, as are the U.S. Capitol Building grounds, corridors, and National Statuary Hall (The White House, 2015) (U.S. Capitol Visitor Center, 2015). The Supreme Court is open to the public, who may watch court sessions, see exhibitions, or take a walking tour of the building (Supreme Court of the United States, 2015).

Celebrating the country's founders, thinkers, shapers, and veterans, monuments, and memorials are throughout the District. The National Mall between the Potomac River and the U.S Capitol Building contains some of the nation’s most famous monuments and museums. Among the monuments are the Lincoln Memorial, The Washington Monument, the Vietnam Veterans Memorial Wall, the National World War II Memorial, and the Korean War Veterans Memorial. Across the Tidal Basin, which is home to the District's annual Cherry Blossom Festival, are the Jefferson Memorial, the Franklin Delano Roosevelt Memorial, and the Martin Luther King, Jr. Memorial (Recreation.gov, 2015).

Rock Creek Park is one of the first federally managed parks, and includes 32 miles of hiking trails; a planetarium; the Old Stone House, the oldest house in the District; the Meridian Hill Park, containing the James Buchanan Memorial; and the Francis Scott Key Park (NPS, 2015b).

There are 16 current and one planned Smithsonian museums in the District, many of which line the National Mall. All Smithsonian museums are free, but staff using hand-clickers tallied more than 28.2 million visits in 2015. The most popular Smithsonian museum is the National Air and Space museum, with 6.9 million visits, with exhibits including Charles Lindbergh's *Spirit of St. Louis*, the Apollo 11 command module, and an interactive exhibit with moon rocks (Smithsonian Institution, 2015) (Smithsonian Institution, 2014a). The second most visited is the Smithsonian's National Zoological Park in Woodley Park with 2.5 million visits, with exhibitions including a panda habitat, cheetah conservation station, and elephant trails (Smithsonian Institution, 2015) (Smithsonian Institution, 2014b). Other Smithsonian museums include the National Portrait

Gallery, National Museum of African Art, National Museum of American History, National Museum of Natural History, and the Freer Gallery of Art (Smithsonian Institution, 2015).

Figure 5.1.7-3 shows the general locations of historic and cultural areas and parks that serve as recreation resources across the District of Columbia.

5.1.7.5. 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 5.1.7-4 depicts the different classifications and dimensions for controlled airspace. Air Traffic Control (ATC)[108] service is based on the airspace classification." (FAA, 2008).

[108] ATC – Approved authority service to provide safe, orderly and expeditious flow of air traffic operations (FAA, 2015i).

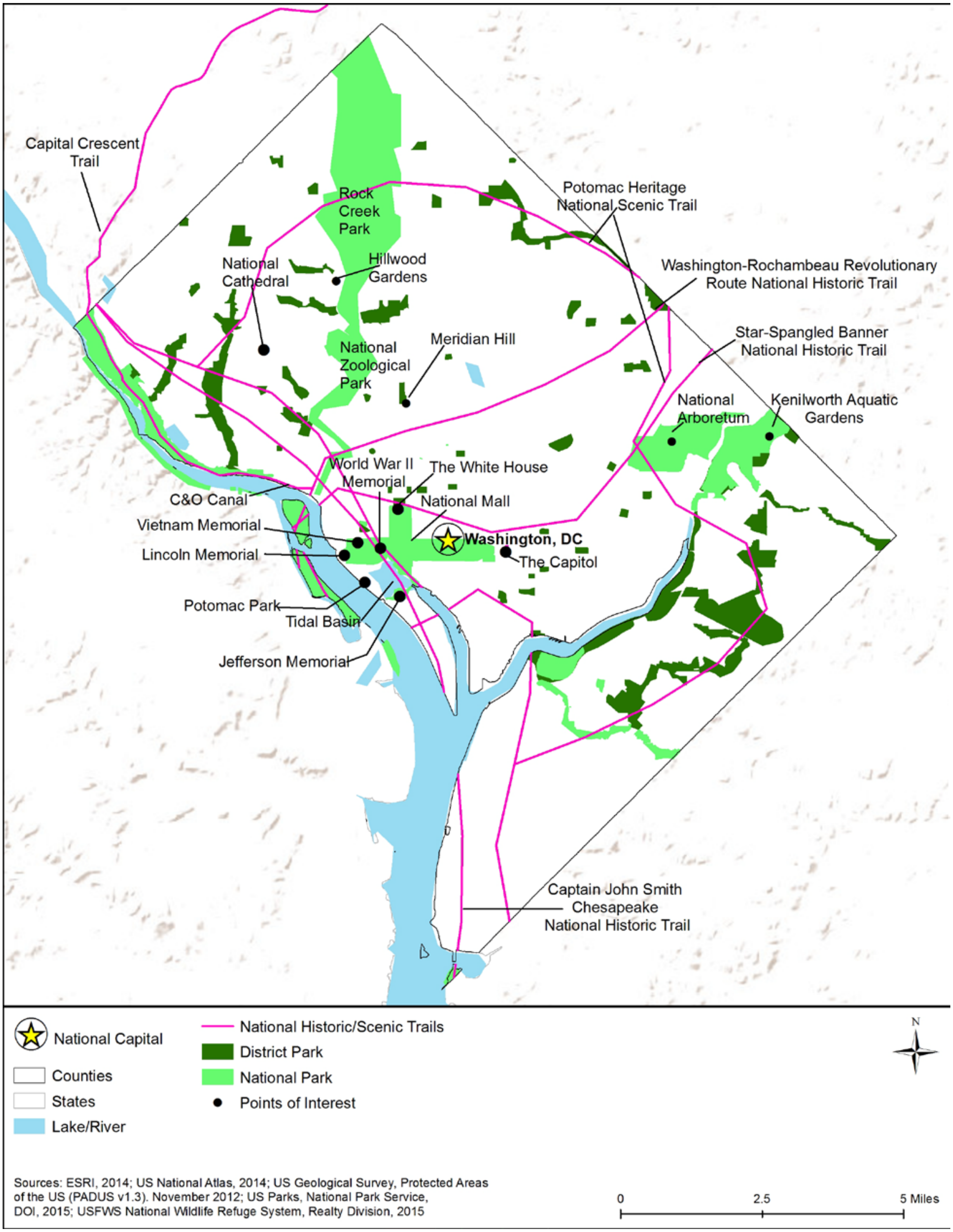

Figure 5.1.7-3: District of Columbia Recreation Resources

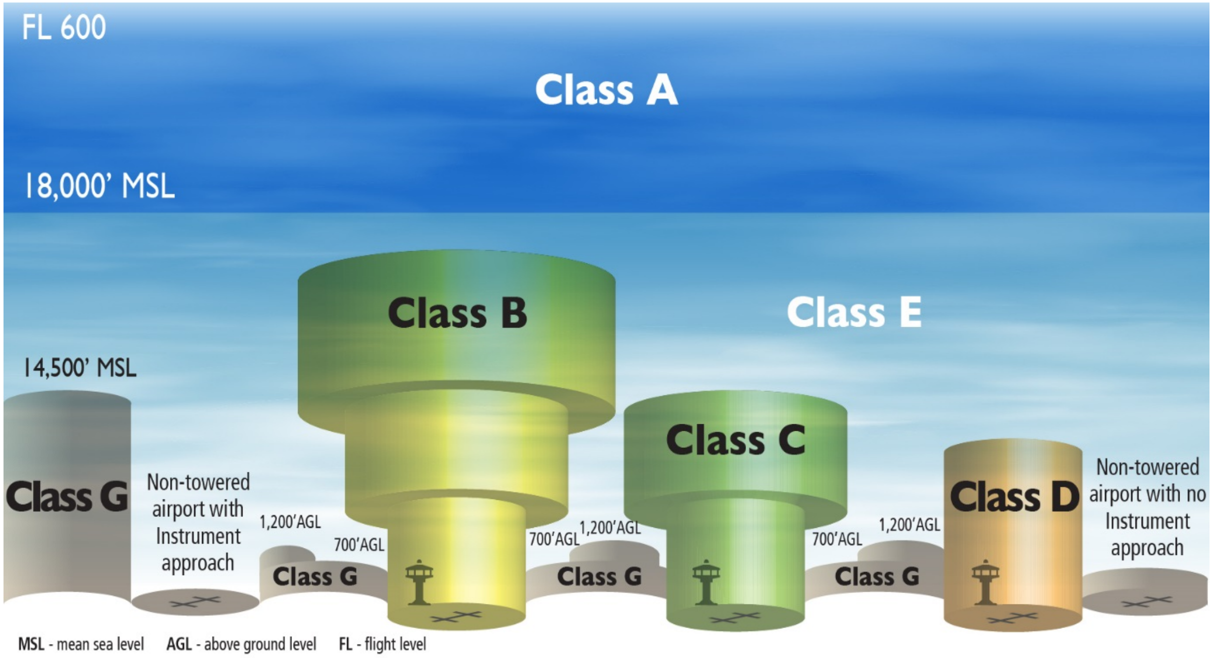

Figure 5.1.7-4: National Air Space Classification Profile

Source: Derived from (FAA, 2008)

Controlled Airspace

- **Class A:** Airspace from 18,000 feet to 60,000 feet Mean Sea Level (MSL).[109] 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).[110]
- **Class B:** Airspace from the surface, up to 10,000 feet MSL, near the busiest airports with heavy traffic operations. The airspace is tailored to the specific airport in several layers. An ATC clearance is required for all aircraft to operate in this area.
- **Class C:** Airspace from the surface to 4,000 feet above the airport elevation surrounding the airport. Applies to airports with an operational control tower, serviced by a radar approach control, and certain number of IFR operations or total number of passengers boarding aircrafts. Airspace is tailored in layers, but usually extends out to 10 NM from 1,200 feet to 4,000 feet above the airport elevation. Entering Class C airspace requires radio contact with the controlling ATC authority, and an ATC clearance is ultimately required for landing.
- **Class D:** Airspace from the surface to 2,500 feet above the airport elevation surrounding airports with an operational control tower. Airspace area is tailored. Aircraft entering the airspace must establish and maintain radio contact with the controlling ATC.

[109] 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)
[110] IFR – Rules for the conduct of flights under instrument meteorological conditions. (FAA, 2015c)

- **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 5.1.7-4).

Table 5.1.7-4: 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 3 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 Office, Airspace and Rules, and disseminated via Notices to Airmen. Inquiries about NSAs should be directed to Airspace and Rules."

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

Other Airspace Areas

Other airspace areas, explained in Table 5.1.7-5, 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 5.1.7-5: Other Airspace Designations

Type	Definition
Airport Advisory	There are 3 types: • Local Airport Advisory – Operated within 10 statute miles of an airport where there is a Flight Service Station (FSS) located on an airport, but no operational control tower. The FSS advises the arriving and departing aircraft on particular conditions. • Remote Airport Advisory – Operated within 10 statute miles for specific high activity airports with no operational control tower. • Remote Airport Information Service – Used for short-term special events.
MTRs	MTRs are for use by the military for training, specifically low level combat tactics where low altitudes and high speed are needed.
TFRs	TFRs are established to: • Protect people and property from a hazard; • Provide safety for disaster relief aircraft during operations; • Avoid unsafe aircraft congestion associated with an incident or public interest event; • Protect the U.S. President, Vice President, and other public figures; • Provide safety for space operations; and • Protection in Hawaii declared national disasters for humanitarian reasons. Only those TFRs annotated with an ending date and time of "permanent" are included in this Draft PEIS, since it indicates a longer, standing condition of the airspace. Other TFRs are typically a shorter duration of for a one-time specific event.
Parachute Jump Aircraft Operations	Parachute jump area procedures are in 14 CFR Part 105, while the U.S. parachute jump areas are contained in the regional Airport/Facility Directory.
Published VFRs and IRs	These are established routes for moving around and through complex airspace, like Class B airspace. VFRs are procedures used to conduct flights under visual conditions. IFRs are procedures used to conduct flights with instruments and meteorological conditions.
Terminal Radar Service Areas	Airspace areas that are not one of the established U.S. airspace classes. These areas provide additional radar services to pilots.

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

5.1.7.6. Aerial System Considerations

Unmanned Aerial Systems

Unmanned Aerial Systems (UASs) are widely used by the military, private entities, public service, educational institutions, federal/District/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 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 Sense and Avoid 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.

5.1.7.7. Obstructions to Airspace Considerations

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

- "Any construction or alteration exceeding 200 feet above ground level
- Any construction or alteration:
  - within 20,000 feet 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 feet
  - within 10,000 feet 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 feet
  - within 5,000 feet 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, 2015d)

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.

5.1.7.8. District of Columbia Airspace

The Metropolitan Washington Airports Authority's (MWAA) mission is to "plan, provide and actively manage world class access to the global aviation system in a way that anticipates and serves the needs of the National Capital area" (MWAA, 2015c). The MWAA furthers the implementation of FAA requirements specific to the District of Columbia. One FAA FSDO for the District of Columbia is in Herndon, Virginia (FAA, 2015a).

The MWAA oversees the two airports in the area for the mid-Atlantic region – Washington Dulles International Airport and Ronald Regan Washington National Airport (DCA). Authorized by the Metropolitan Washington Airports Act of 1986, Title VI of Public Law 99-50, the operation of these airports was transferred in June 1987 to the responsibility of the MWAA from the FAA. MWAA has a 50-year lease with the FAA (MWAA, 2015d), (U.S. House of Representatives, 2015). Figure 5.1.7-5 presents the different aviation airports/facilities in the District of Columbia area, while Figure 5.1.7-6 and Figure 5.1.7-7 present the breakout by public and private airports/facilities. There are 16 airports (public and private) within the District of Columbia area, as presented in Table 5.1.7-6 and Figure 5.1.7-5 through Figure 5.1.7-7 (DOT, 2015). The MWAA also oversees the operation, maintenance, and control of the Dulles Toll Road, which is a 23-mile highway system connecting to Interstate 66, leading to the District of Columbia. The MWAA also collaborates with the Metro Authority, which operates light rail passenger service along the Dulles Toll Road as part of the Metrorail system. The MWAA is directly responsible for funding the construction of the Dulles Corridor Metrorail Project in Virginia. This is a two-phase project: (1) extend the rail system out to Reston from the East Falls Church station (complete), and (2) continue the line to Route 772 in Loudoun County to include connecting the current line to the Main Terminal of Dulles International through Reston and Herndon (under construction) (MWAA, 2015d).

Table 5.1.7-6: Type and Number of District of Columbia Area Airports/Facilities

Type of Airport or Facility	Public	Private
Airport	3	0
Heliport	1	12
Seaplane	0	0
Ultralight	0	0
Balloonport	0	0
Gliderport	0	0
Total	4	12

Source: (DOT, 2015)

There are six Class B controlled airspace/airports for the District of Columbia area as follows:

- Andrews Air Force Base
- Baltimore-Washington International
- Ronald Reagan Washington National

- Washington Dulles International
- Armel
- Fort Meade (FAA, 2014b)

There are two prohibited SUA (P56A and B) as presented in Figure 5.1.7-8 (FAA, 2015e). There are two TFRs for the District. Only one (FDC 4/9152) is presented in Figure 5.1.7-8 because geographic information was not available for the other TFR (FAA, 2015f). There are no MTRs in the District.

UAS Considerations

Airspace in the District is heavily restricted with rules establishing a national defense airspace over the area after the September 2011 attacks. One example is designating the District of Columbia as a “No Drone Zone.” The zone applies to within the District, and the cities and towns in a 15-mile radius of the Ronald Reagan Washington National Airport (DCA). All aircraft operations are based on authorization from the FAA and Transportation Security Administration (FAA, 2015g).

The NPS signed a policy memorandum on June 24, 2014 that “directs superintendents nationwide to prohibit launching, landing, or operating unmanned aircraft on lands or waters administered by the National Park Service” (NPS, 2014b). There are 23 national parks within the District of Columbia that must comply with this agency directive (NPS, 2015c).

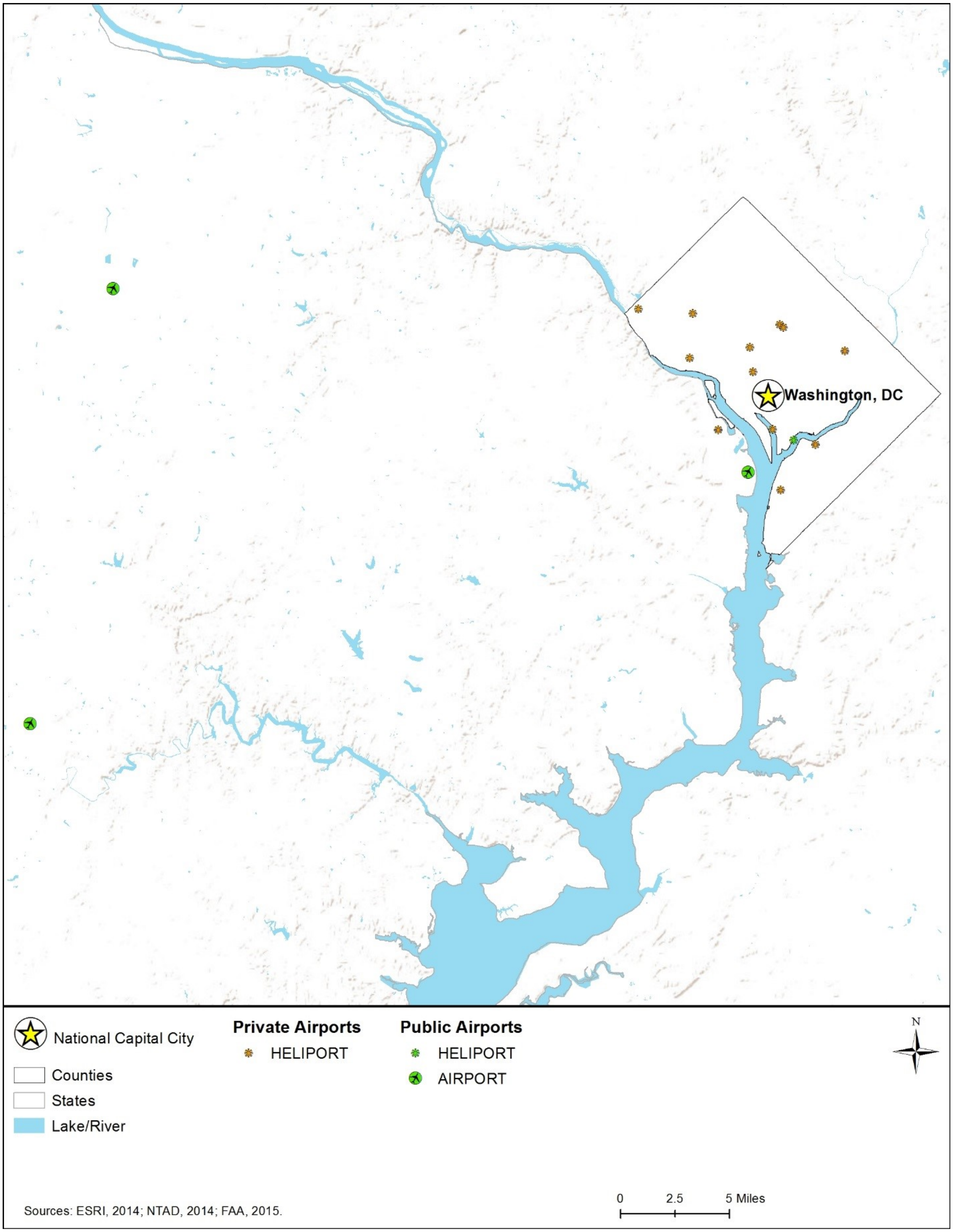

Figure 5.1.7-5: Private and Public Airports/Facilities in and around District of Columbia

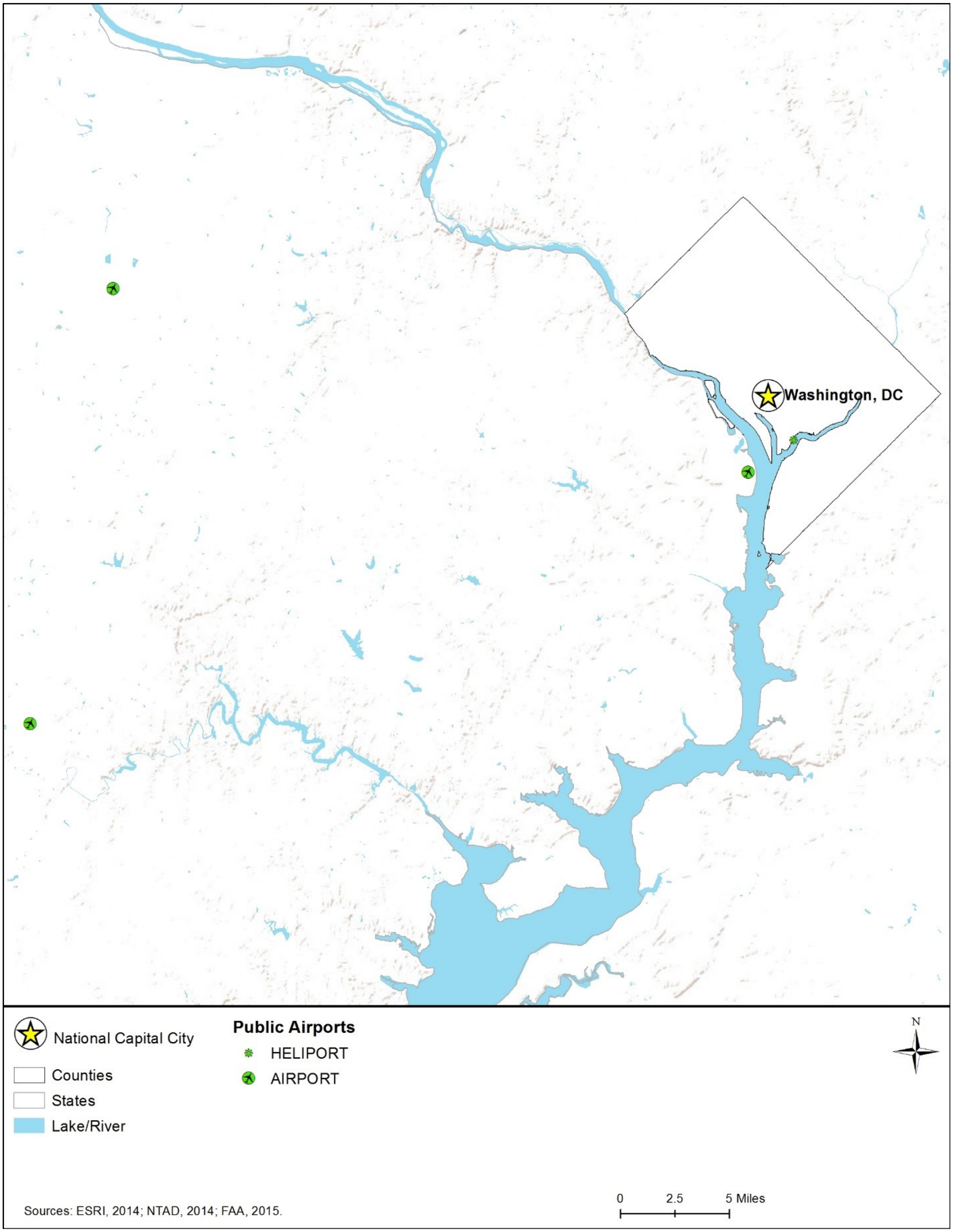

Figure 5.1.7-6: District of Columbia Public Airports/Facilities

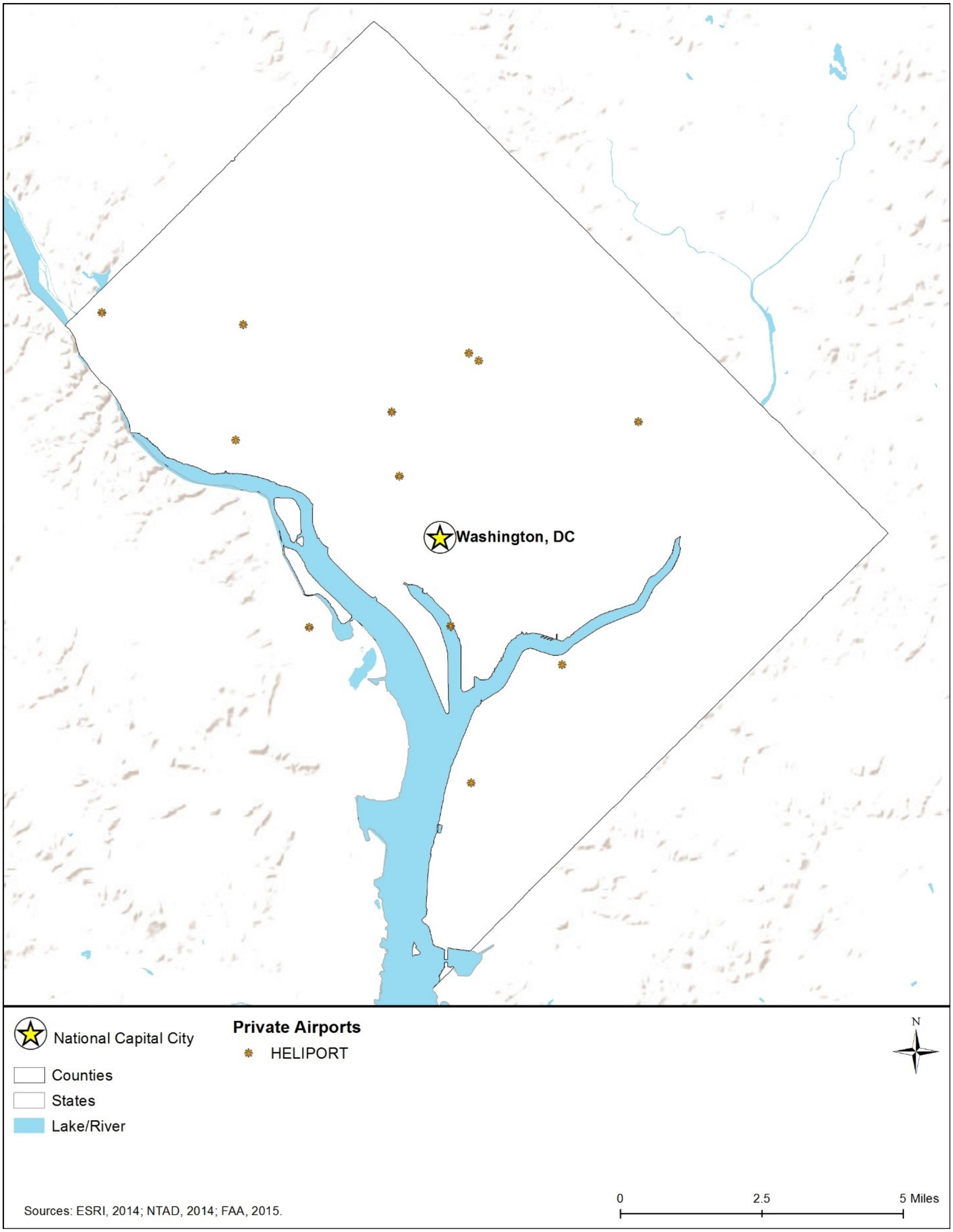

Figure 5.1.7-7: District of Columbia Private Airports/Facilities

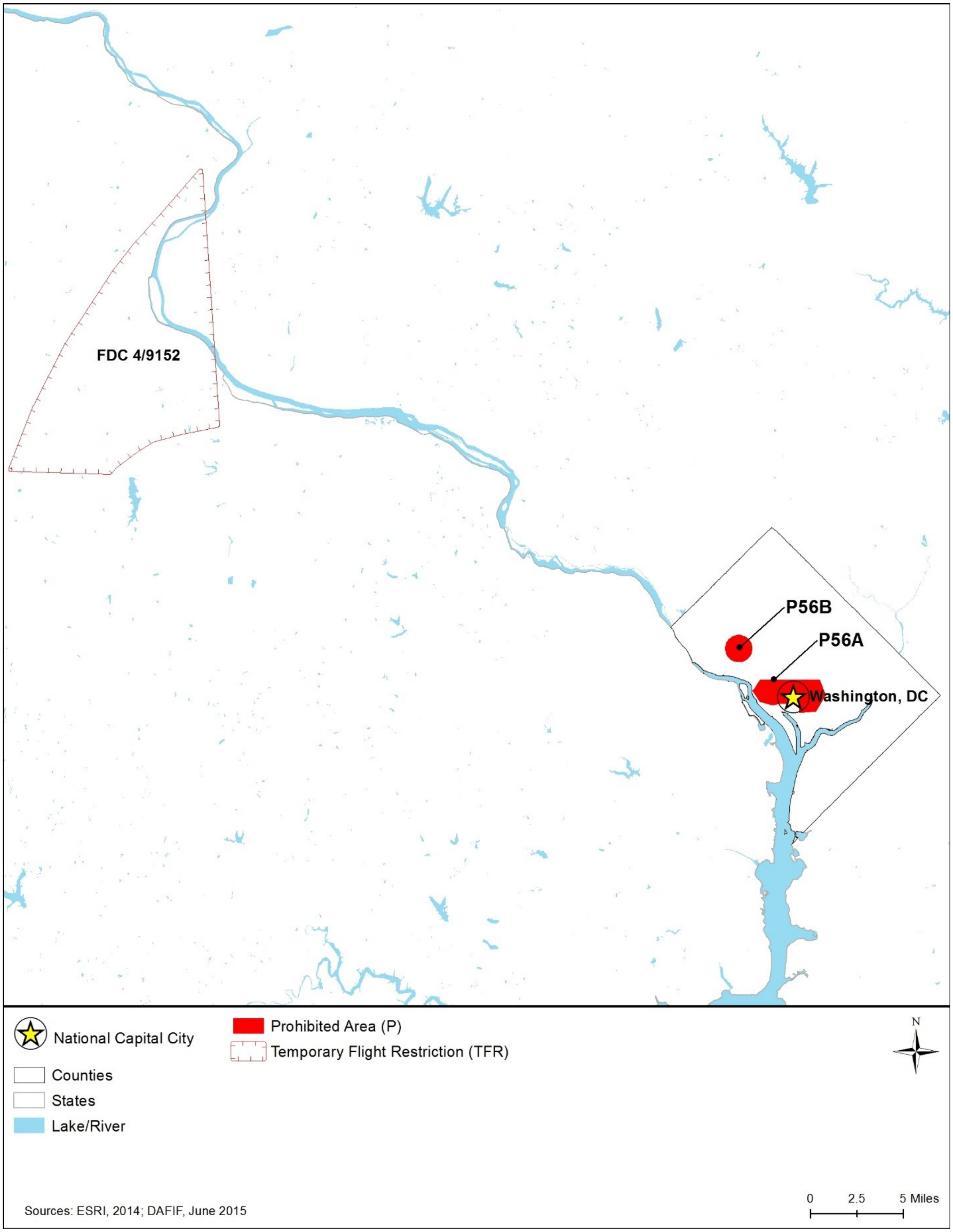

Figure 5.1.7-8: SUAs/TFR in District of Columbia

5.1.8. Visual Resources

5.1.8.1. Definition of the Resource

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

5.1.8.2. Specific Regulatory Considerations

Table 5.1.8-1 presents the District and local laws and regulations that relate to visual resources.

Table 5.1.8-1: Relevant District of Columbia Visual Resources Laws and Regulations

District Law/Regulation	Regulatory Agency	Applicability
Historic Landmark and Historic District Protection Act of 1978	District HPO	Established for "the protection, enhancement and perpetuation of properties of historical, cultural and aesthetic merit are in the interests of the health, prosperity and welfare of the people of the District of Columbia." (Council of the District of Columbia, 2013)
District of Columbia Municipal Regulations (DCMR), Title 10A, Historic Preservation	HPO and Historic Preservation Review Board	"These regulations govern implementation of the historic preservation programs of the District of Columbia, including activities conducted pursuant to both District and Federal law." (DCOP, 2002)

5.1.8.3. Character and Visual Quality of the Existing Landscape

The District of Columbia has a wide range of visual resources, including impressive architecture and remarkable scenery. In the District, the White House, the Washington Monument, and the U.S. Capitol building are urban vistas that are recognized all over the world. Although the urban areas of the District frequently come to mind, most of the District is characterized as parkland – almost 17 percent of the city's total area is parkland. There are more than 7,000 acres protected as national parks and more than 900 acres managed by the DC Department of Parks and Recreation. The approximate 68-square-mile city (land and surface water) has the "second highest amount of green space per capita of any city in the country." (DDOE, 2015c)

The District of Columbia is approximately 76 percent developed land, 13 percent undeveloped lands, and the remaining percentage as open waters (USGS, 2012c). Developed land covers the highest number of acres within the District. Scenic values may vary in these areas, which include industrial, commercial, and residential areas, as well as roads and paved areas. Forests and other undeveloped areas are the second most dominant landscape in the District and are found in three major areas: national park land in Rock Creek Park, National Capital Parks-East and Chesapeake and Ohio National Historical Park. Forested areas generally have continuous, natural looking cover; gradual transitions of line and color; and lack any disturbance or disruption of the landscape. Open waters cover the smallest area in the District, and are predominantly made up by the Anacostia and Potomac Rivers, along with several tributary creeks of these rivers. In these areas, unobstructed views from major constructed features are valued visual resources, along with supporting recreation, habitats, and wildlife viewing. (DDOE, 2015c)

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. The areas listed below have some measure of management, significance, or protection through District or federal policy, as well as being identified as a visually significant area.

5.1.8.4. Visually Important Historic Properties and Cultural Resources

Visual and aesthetic qualities of historic properties can contribute to the overall importance of a particular site. Such qualities relate to the integrity of the appearance and setting of these properties or resources. Viewsheds (the natural and manmade environment visible from one or more viewing points) can also contribute to the significance of historic properties or cultural resources. Viewsheds containing historic properties and cultural resources may be considered important because of their presence in the landscape. Figure 5.1.8-1 shows areas that are included in the National Register of Historic Places (NRHP) that may be considered visually sensitive. There are 580 NRHP listed sites in the District of Columbia, including 74 National Historic Landmarks (NHLs), 6 National Historical Sites, 1 National Historical Park, and 13 National Monuments (NPS, 2015d). Other historic sites may also be included in the NRHP, whereas others are not designated at this time. There are no National Heritage Areas in the District of Columbia (NPS, 2015e).

The NPS is required to protect all aspects of historic landscapes, such as forests, gardens, trails, structures, ponds, and farming areas using *The Secretary of the Interior's Standards for the Treatment of Historic Properties and the Guidelines for the Treatment of Cultural Landscapes.* The standards and guidelines "require retention of the greatest amount of historic fabric, including the landscape's historic form, features, and details as they have evolved over time," which directly protects the historic properties and the visual resources therein. (NPS, 1995)

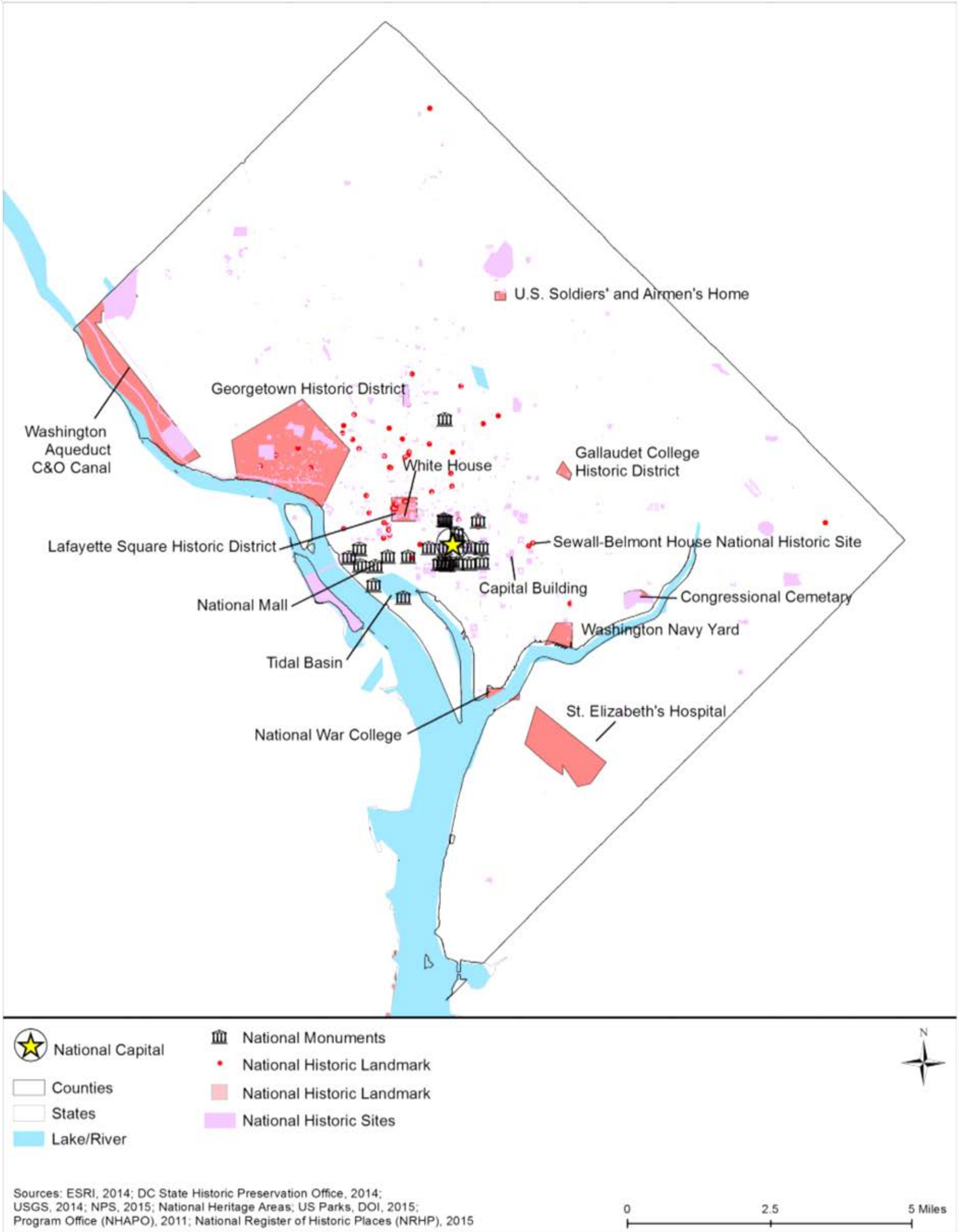

Figure 5.1.8-1: District of Columbia Cultural and Heritage Resources that May be Visually Sensitive

National Historic Landmarks

NHL are defined as “nationally significant historic places designated by the U.S. Secretary of the Interior because they possess exceptional value or quality in illustrating or interpreting the heritage of the United States” (NPS, 2015f). Generally, NHLs are historic buildings such as residences, churches, civic buildings, and institutional buildings. Other types of historic properties include battlefields and canals. The importance of NHL-designated properties can be attributed to scenic or aesthetic qualities that may be considered visual resources or visually sensitive at these sites. There are 74 NHLs in the District of Columbia, including sites such as the Georgetown Historic District, Library of Congress, Supreme Court Building, United States Capitol, and the White House. By comparison, there are more than 2,500 NHLs in the United States, less than 1 percent located in the District. (NPS, 2015g).

5.1.8.5. Parks and Recreation Areas

Park and recreation areas include District parks, National Recreation Areas, and National and District trails. Parks and recreation areas often contain scenic resources and tend to be visited partly because of their associated visual or aesthetic qualities. For additional information about recreation areas, including national and District parks, see Section 5.1.7, Land Use, Recreation, and Airspace.

National Park Service

National Parks are managed by NPS, contain natural, historic, cultural, visual, ecological, and recreational resources of significance to the nation, and are maintained for the public’s use. In the District of Columbia, there are 23[111] officially designated National Parks in addition to other NPS affiliated areas, such as National Memorials. There are 4 National Historic Sites, 1 National Historical Park, 12 Memorials, 2 National Historic Trails, 1 National Scenic Trail, and other NPS parks and structures (NPS, 2015c). Most of these sites are a part of the National Mall and Memorial Parks (Figure 5.1.8-2), which is approximately 1,000 acres of land along the Tidal Basin of the Potomac River. The National Mall and Memorial Parks is home to the world famous Japanese cherry trees and urban wildlife and habitats, with millions of visitors each year.

Table 5.1.8-2 identifies the National Parks and affiliated areas in the District. For additional information regarding parks and recreation areas, see Section 5.1.7, Land Use, Recreation, and Airspace.

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

Table 5.1.8-2: District of Columbia National Parks and Affiliated Areas

Area Name	
African American Civil War Memorial	Martin Luther King, Jr. National Memorial
Anacostia Park	Mary McLeod Bethune Council House National Historic Site
Capitol Hill Parks	Meridian Hill Park
Captain John Smith Chesapeake National Historic Trail	National Capital Parks – East
Carter G. Woodson Home*	National Mall & Memorial Parks
Chesapeake and Ohio Canal National Historical Park	Old Post Office Tower
Chesapeake Bay	Peirce Mill
Chesapeake Bay Gateways and Watertrails Network	Pennsylvania Avenue National Historic Site
Civil War Defenses of Washington	Potomac Heritage National Scenic Trail
Constitution Gardens	President’s Park (White House)
Ford’s Theatre National Historic Site	Rock Creek Park
Frank Delano Roosevelt Memorial	Star-Spangled Banner National Historic Trail
Frederick Douglass* National Historic Site	The Old Stone House
George Mason Memorial	Theodore Roosevelt Island
John Ericsson National Memorial	Thomas Jefferson Memorial
Kenilworth Park & Aquatic Gardens	Vietnam Veterans Memorial
Korean War Veterans Memorial	Washington Monument
Lincoln Memorial	Washington-Rochambeau National Historical Trail
Lyndon Baines Johnson Memorial Grove on the Potomac	World War II Memorial

*Also listed as a National Historic Landmark.

Source: (NPS, 2015c)

Figure 5.1.8-2: Lincoln Memorial and Washington Monument in the National Mall and Memorial Parks

Source: (NPS, 2015h)

NPS designates and manages the parkways, or roads, that are recognized for one or more archaeological, cultural, historic, natural, recreational, and scenic qualities. The District of Columbia has one parkway entirely within its borders and two parkways leading up to its boundary. Section 5.1.1, Infrastructure has additional information on the parkways from an infrastructure perspective (length and location).

- Rock Creek and Potomac Parkway (D.C.) was built from 1923 to 1936, listed on the NRHP in 2005 because it is a great example of "early motor parkway development" (NPS, 2005b).
- Baltimore-Washington Parkway (D.C., MD) has been a scenic route to and from the nation's capital since 1954 (NPS, 2016a).
- George Washington Memorial Parkway (VA) was designated for recreational driving while linking sites that commemorate important sites in American history (NPS, 2016b).

District and Federal Trails

The NPS administers the Potomac Heritage National Scenic Trail, an 830-mile-long trail connecting the upper Ohio and Potomac River Basins, including a segment that crosses through the District (Figure 5.1.7-3). Designated under Section 5 of the National Trails System Act (16 U.S.C. 1241-1251, as amended), National Scenic Trails are defined as extended trails that "provide for maximum outdoor recreation potential and for the conservation and enjoyment of the nationally significant scenic, historic, natural, or cultural qualities of the areas though which they pass" (NPS, 2012).

Three National Historic Trails also pass through the District: Captain John Smith Chesapeake Trail, Star-Spangled Banner Trail, and Washington-Rochambeau Trail (Figure 5.1.7-3). The National Trails System Act defines these trails as "extended trails which follow as closely as possible and practicable the original trails or routes of travel of national historic significance"

(NPS, 2012). The Captain John Smith Chesapeake National Historic Trail is the first national water trail (NPS, 2015i), while the Star-Spangled Banner National Historic Trail traverses both land and water (NPS, 2015j).

The 11-mile long Capital Crescent Trail is a popular hiking and cycling trail built on an abandoned segment of the B&O Railroad, between Georgetown (Washington, D.C.) and Silver Spring, MD. The Capital Crescent Trail is a maintained by a non-profit organization Coalition for the Capital Crescent Trail (Coalition for the Capital Crescent Trail, 2016).

5.1.8.6. Natural Areas

There are no National Wild, Scenic, or Recreational Rivers, National Wildlife Refuges, or National Natural Landmarks in the District of Columbia.

5.1.8.7. Additional Areas

District and National Scenic Byways

The U.S. Secretary of Transportation has not designated any of District of Columbia roads as National Scenic Byways or All-American Roads.

5.1.9. Socioeconomics

5.1.9.1.1. Definition of the Resource

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

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

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

Environmental justice is a related topic that specifically addresses the presence of minority populations (defined by race and Hispanic ethnicity) and low-income populations, in order to give special attention to potential impacts on those populations, per Executive Order 12898 (see Section 1.8). This PEIS addresses environmental justice in a separate section (Section 5.1.10). This PEIS also addresses the following topics, sometimes included within socioeconomics, in separate sections: land use and recreation (Section 5.1.7, Land Use and Recreation), infrastructure and public services (Section 5.1.1, Infrastructure), and aesthetic considerations (Section 5.1.8, Visual Resources).

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

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

5.1.9.2. Specific Regulatory Considerations

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

5.1.9.3. Communities and Populations

This section discusses the population and major communities of the District of Columbia. It includes the following topics:

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

District of Columbia Population and Population Growth

Table 5.1.9-1 presents the 2014 population and population density of the District of Columbia in comparison to the East region[112] and the nation. The estimated population of the District of

[112] The East region comprises the states of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Virginia, and West Virginia, as well as the District of Columbia.

Columbia in 2014 was 658,893. The population density was 10,793 persons per square mile (sq. mi.), which is higher than the population density of both the region (312 persons/sq. mi.) and the nation (90 persons/sq. mi.). In 2014, the District of Columbia was the 49th largest in population among the 50 states and the District of Columbia, 51st largest by land area, and had the highest population density (U.S. Census Bureau, 2015b; U.S. Census Bureau, 2015c).

Table 5.1.9-1: Land Area, Population, and Population Density of the District of Columbia

Geography	Land Area (sq. mi.)	Estimated Population 2014	Population Density 2014 (persons/sq. mi.)
District of Columbia	61.05	658,893	10,793
East Region	237,157	73,899,862	312
United States	3,531,905	318,857,056	90

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

Population growth is an important subject for this PEIS given FirstNet's mission. Table 5.1.9-2 presents the population growth trends of the District of Columbia from 2000 to 2014 in comparison to the East region and the nation. The District's annual growth rate more than quadrupled in the 2010 to 2014 period compared to 2000 to 2010, from 0.51 percent to 2.30 percent. The growth rate of the District of Columbia in the 2000 to 2010 period nearly matched the growth rate of the region, at 0.47 percent, and was less than the growth rate of the nation, at 0.93 percent. Both the region and nation showed significantly lower growth rates in 2010 to 2014 period than the District.

Table 5.1.9-2: Recent Population Growth of the District of Columbia

Geography	Population			Numerical Population Change		Rate of Population Change (AARC)[a]	
	2000	2010	2014 (estimated)	2000 to 2010	2010 to 2014	2000 to 2010	2010 to 2014
District of Columbia	572,059	601,723	658,893	29,664	57,170	0.51%	2.30%
East Region	69,133,382	72,444,467	73,899,862	3,311,085	1,455,395	0.47%	0.50%
United States	281,421,906	308,745,538	318,857,056	27,323,632	10,111,518	0.93%	0.81%

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

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

Demographers prepare future population projections using various population growth modeling methodologies. For this nationwide PEIS, it is important to use population projections that apply the same methodology across the nation. It is also useful to consider projections that use different methodologies, since no methodology is a perfect predictor of the future. The Census Bureau does not prepare population projections for the states. Therefore, Table 5.1.9-3 presents

Throughout the socioeconomics section, figures for the East region represent the sum of the values for all "states" (including the District of Columbia) in the region, or an average for the region based on summing the component parameters. For instance, the population density of the East region is the sum of the populations of all its states, divided by the sum of the land areas of all its states.

projections of the 2030 population from two sources that are national in scope and use different methodologies: the University of Virginia's Weldon Cooper Center for Public Service and ProximityOne, a private sector demographic and economic data and analysis service (ProximityOne, 2015) (University of Virgnia 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 the District of Columbia's population will increase by approximately 9,913 people, or 1.5 percent, from 2014 to 2030. This reflects an average annual projected growth rate of 0.09 percent, which is considerably lower than the historical growth rate from 2010 to 2014 of 2.30 percent. The projected growth rate of the District is also significantly lower than that of the region (0.57 percent) and the nation (0.80 percent). It is notable that the two sources for projected populations differ considerably in their 2030 projections.

Table 5.1.9-3: Projected Population Growth of District of Columbia

Geography	Population 2014 (estimated)	Projected 2030 Population			Change Based on Average Projection		
		UVA Weldon Cooper Center Projection	Proximity One Projection	Average Projection	Numerical Change 2014 to 2030	Percent Change 2014 to 2030	Rate of Change (AARC) 2014 to 2030
District of Columbia	658,893	573,240	764,371	668,806	9,913	1.5%	0.09%
East Region	73,899,862	78,925,282	82,842,294	80,883,788	6,983,926	9.5%	0.57%
United States	318,857,056	360,978,449	363,686,916	362,332,683	43,475,627	13.6%	0.80%

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

Sources: (UVA Weldon Cooper Center, 2015; ProximityOne, 2015; U.S. Census Bureau, 2015b)

Population Distribution and Communities

Figure 5.1.9-1 presents the distribution and relative density of the population of the District of Columbia. Each brown dot represents 500 people, and massing of dots indicates areas of higher population density. The map uses ACS estimates based on samples taken from 2009 to 2013 (U.S. Census Bureau, 2015e). The map also shows that all of the District of Columbia is considered a single population concentration according to U.S. Census Bureau urban area definitions and 2010 census (U.S. Census Bureau, 2012; U.S. Census Bureau, 2015f).

The somewhat sparsely populated area in the north central area of the District is Rock Creek National Park, and the sparsely populated area in center of the District is the National Mall area. For more information about Rock Creek National Park and the National Mall, see Section 5.1.7, Land Use, Recreation, and Airspace. The sparsely populated area along the Potomac River in the southern portion of the District consists of industrial areas and a military base, Joint Base Anacostia-Bolling.

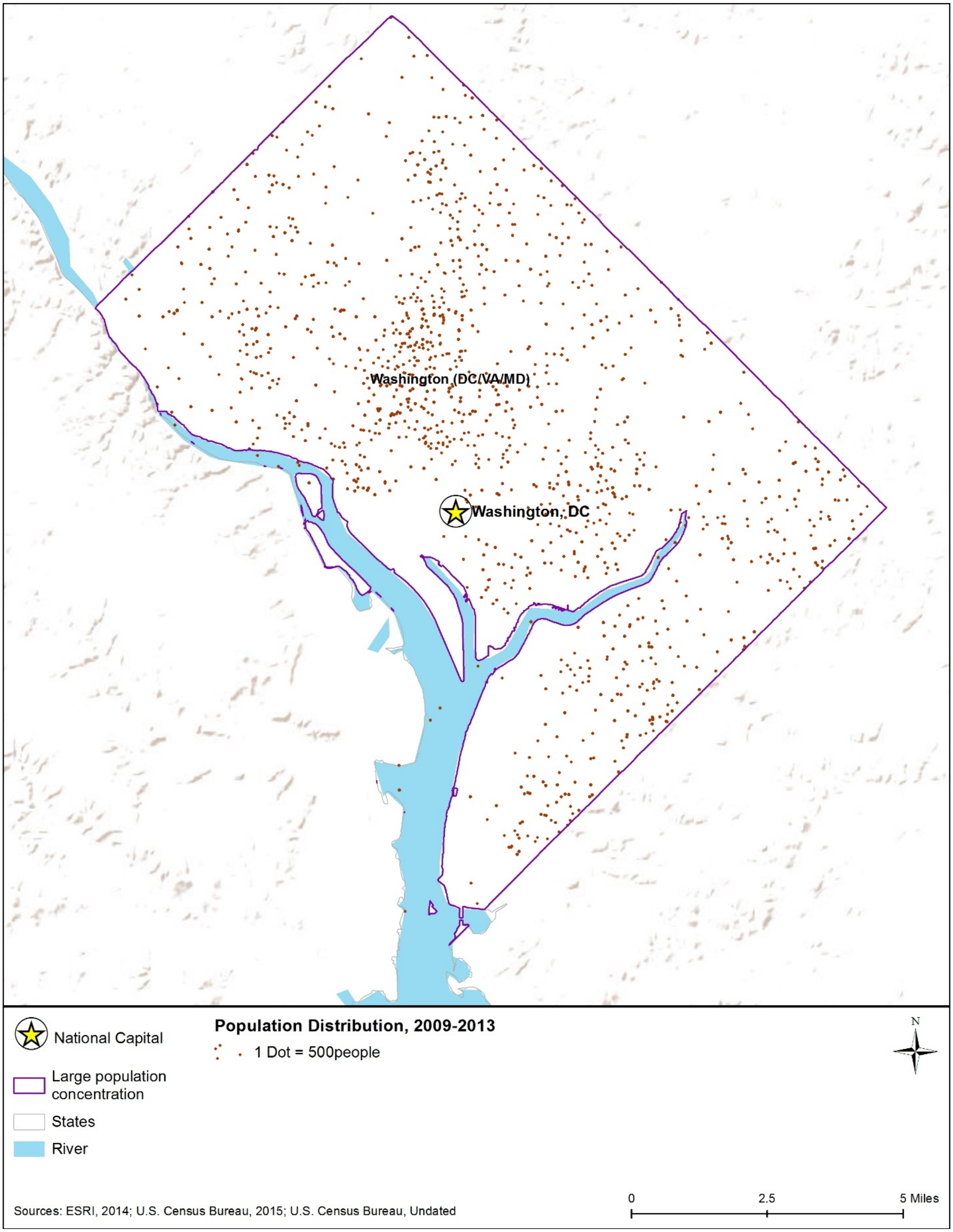

Figure 5.1.9-1: Population Distribution in the District of Columbia, 2009-2013

5.1.9.4. 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 District. The institutions most relevant to FirstNet projects are public services such as medical and emergency medical services and facilities. This PEIS addresses public services in Section 5.1.1, Infrastructure. Project-level NEPA analyses may need to examine other institutions, depending on specific locations and specific types of actions.

Economic Activity

Table 5.1.9-4 compares several economic indicators for District of Columbia to the East region and the nation. The table presents two indicators of income[113] – per capita and median household – as income is a good measure of general economic health of a region.

Per capita income is total income divided by the total population. As a mathematical average, the very high incomes of a relatively small number of people tend to bias per capita income figures upwards. Nonetheless, per capita income is useful as an indicator of the relative income level across two or more areas. As shown in Table 5.1.9-4, the per capita income in the District of Columbia in 2013 ($45,477) was $12,625 higher than that of the region ($32,852), and $17,293 higher than that of the nation ($28,184).

Household income is a useful measure, and often used instead of family income, because in modern society there are many single-person households and households composed of non-related individuals. Median household income (MHI) is the income at which half of all households have higher income, and half have lower income. Table 5.1.9-4 shows that in 2013, the MHI in the District of Columbia ($66,326) was $5,822 higher than that of the region ($60,504), and $14,076 higher than that of the nation ($52,250).

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

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

by the total number of individuals in the labor force. Table 5.1.9-4 compares the unemployment rate in the District of Columbia to the East region and the nation. In 2014, the District of Columbia's unemployment rate of 7.8 percent was higher than the rate for both the region (6.0 percent) and the nation (6.2 percent).[114]

Table 5.1.9-4: Selected Economic Indicators for the District of Columbia

Geography	Per Capita Income 2013	Median Household Income 2013	Average Annual Unemployment Rate 2014
District of Columbia	$45,477	$66,326	7.8%
East Region	$32,852	$60,504	6.0%
United States	$28,184	$52,250	6.2%

Sources: (BLS, 2015f; U.S. Census Bureau, 2015h; U.S. Census Bureau, 2015i; U.S. Census Bureau, 2015j)

Figure 5.1.9-2 and Figure 5.1.9-3 show visually how MHI in 2013 (U.S. Census Bureau, 2015h) and unemployment in 2014 (BLS, 2015f) for the District compared to national MHI and unemployment. The data for these figures are consistent with Table 5.1.9-4. Figure 5.1.9-2 shows that the District had a MHI above the national median ($52,250). Figure 5.1.9-3 shows a higher unemployment rate for the District than the national average (6.2 percent). These maps also incorporate the same population concentration data as Figure 5.1.9-1 (U.S. Census Bureau, 2012; U.S. Census Bureau, 2015f).

Detailed employment data provides useful insights into the nature of a local, District, or national economy. Table 5.1.9-5 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 was lower in the District of Columbia than in the East region and the nation. As would be expected for the nation's capital, the percentage of government workers was considerably higher in the District than in the region and nation. Self-employed workers were a slightly lower percentage in the District of Columbia than in the region and the nation.

By industry, the District of Columbia has a less diverse economic base than that of many states. Some notable figures in the table are as follows. The District of Columbia in 2013 had a considerably higher (more than double) percentage of persons working in "public administration" and "professional, scientific, management, administrative, and waste management services" than did the region and the nation. It also had a higher percentage of workers in "other services, except public administration" than both other geographies. It had a slightly higher percentage of workers in "information," and a similar percentage of workers in "arts, entertainment, and recreation, and accommodation and food services," compared to the region and the nation. The District had lower percentages (in some cases considerably lower) of persons working in all other industries than the percentages for the region and the nation.

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

Table 5.1.9-5: Employment by Class of Worker and by Industry, 2013

Class of Worker and Industry	District of Columbia	East Region	United States
Civilian Employed Population 16 Years and Over	333,111	35,284,908	145,128,676
Percentage by Class of Worker			
Private wage and salary workers	70.6%	79.3%	79.7%
Government workers	25.0%	15.1%	14.1%
Self-employed in own not incorporated business workers	4.3%	5.4%	6.0%
Unpaid family workers	0.1%	0.1%	0.2%
Percentage by Industry			
Agriculture, forestry, fishing and hunting, and mining	0.1%	0.9%	2.0%
Construction	2.5%	5.8%	6.2%
Manufacturing	1.3%	8.5%	10.5%
Wholesale trade	0.6%	2.5%	2.7%
Retail trade	5.4%	11.1%	11.6%
Transportation and warehousing, and utilities	2.4%	4.6%	4.9%
Information	3.2%	2.3%	2.1%
Finance and insurance, and real estate and rental and leasing	4.9%	7.3%	6.6%
Professional, scientific, management, administrative, and waste management services	24.0%	12.3%	11.1%
Educational services, and health care and social assistance	20.4%	25.6%	23.0%
Arts, entertainment, and recreation, and accommodation and food services	9.1%	8.9%	9.7%
Other services, except public administration	9.0%	4.9%	5.0%
Public administration	17.1%	5.5%	4.7%

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

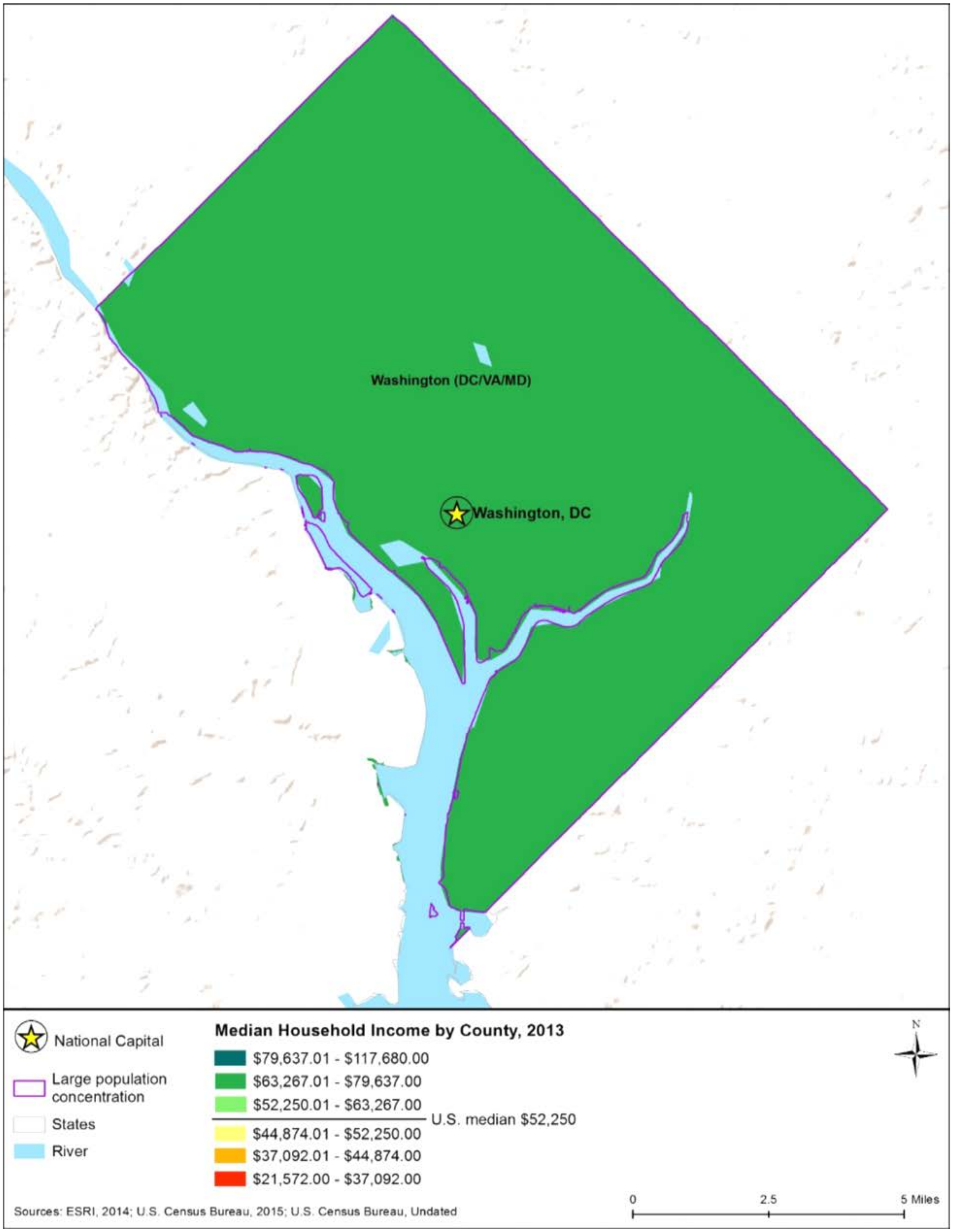

Figure 5.1.9-2: Median Household Income in the District of Columbia, 2013

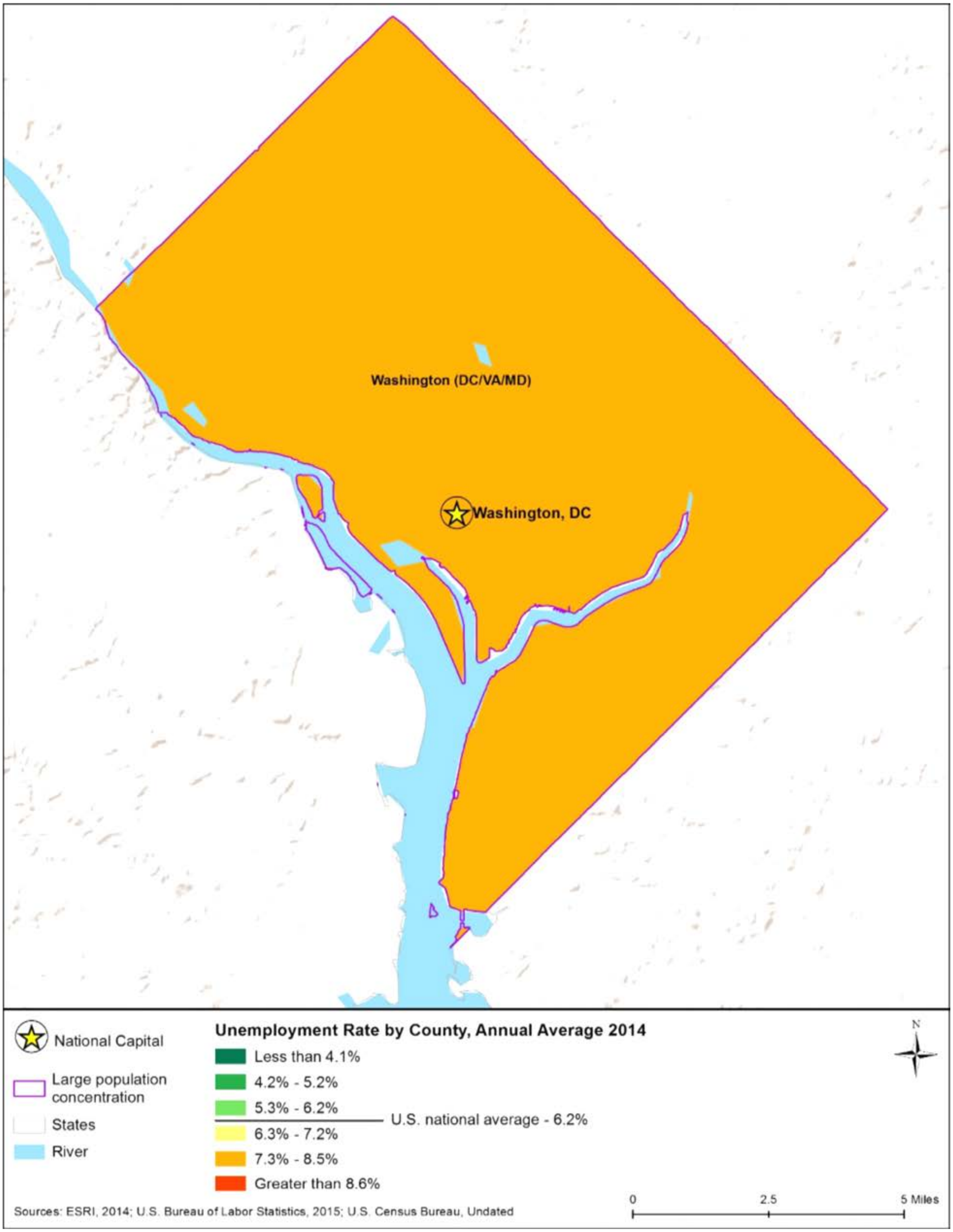

Figure 5.1.9-3: Unemployment Rates in the District of Columbia, 2014

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 5.1.9-6 compares the District of Columbia to the East region and nation on several common housing indicators.

As shown in this table, in 2013 the District of Columbia had a higher percentage of housing units that were occupied (89.7 percent) than the region (88.4 percent) or nation (87.5 percent). Of the occupied units, the District of Columbia had a considerably lower percentage of owner-occupied units (40.7 percent) than the region (62.8 percent) or nation (63.5 percent). The lower owner-occupied rate was probably due to large numbers of apartment and other rental units in the District. This is reflected in the far lower percentage of detached single-unit housing (also known as single-family homes) in the District in 2013 (11.8 percent) compared to the region (52.7 percent) and nation (61.5 percent). The homeowner vacancy rate in the District (1.4 percent) was lower than the rate for the region (1.6 percent) and the nation (1.9 percent). This rate reflects, "vacant units that are 'for sale only" (U.S. Census Bureau, 2015g). The vacancy rate among rental units was slightly higher in the District of Columbia (6.2 percent) than in the region (5.5 percent) and slightly lower than the national rate (6.5 percent).

Table 5.1.9-6: Selected Housing Indicators for District of Columbia, 2013

Geography	Total Housing Units	Housing Occupancy & Tenure				Units in Structure
		Occupied Housing	Owner-Occupied	Homeowner Vacancy Rate	Rental Vacancy Rate	1-Unit, Detached
District of Columbia	302,975	89.7%	40.7%	1.4%	6.2%	11.8%
East Region	31,108,124	88.4%	62.8%	1.6%	5.5%	52.7%
United States	132,808,137	87.5%	63.5%	1.9%	6.5%	61.5%

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

Property Values

Property values have important relationships to both the wealth and affordability of communities. Table 5.1.9-7 provides indicators of residential property values for the District of Columbia and compares these values to values for the East region and nation. The figures on median value of owner-occupied units are from the Census Bureau's ACS, based on owner estimates of how much their property (housing unit and land) would sell for if it were for sale. (U.S. Census Bureau, 2015g)

The table shows that the median value of owner-occupied units in the District of Columbia in 2013 ($470,500) was considerably higher than the corresponding values for the East region (nearly double compared to $249,074 for the region) and the nation (more than double compared to $173,900 for the nation).

Table 5.1.9-7: Residential Property Values in the District of Columbia, 2013

Geography	Median Value of Owner-Occupied Units
District of Columbia	$470,500
East Region	$249,074
United States	$173,900

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

Government Revenues

State and local governments obtain revenues from many sources. FirstNet projects may affect flows of revenue sources between different levels of government due to program financing and intergovernmental agreements for system development and operation. Public utility taxes are a subcategory of selective sales taxes that includes taxes on providers of land and mobile telephone, telegraph, cable, and internet services (U.S. Census Bureau, 2006). These service providers may obtain new taxable revenues from operation of components of the public safety broadband network. These revenue streams are typically highly localized and therefore are best considered in the deployment phase of FirstNet.

Table 5.1.9-8 presents total and selected District 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 were particularly useful in comparing the importance of certain revenue sources in the District 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.

The District of Columbia is not a state; it is a federal District. Therefore, Table 5.1.9-8 shows data for the District under the local government column. The District of Columbia received more total revenue (more than double) in 2012 on a per capita basis than state and local governments in the region and nation. Additionally, the District of Columbia had higher levels per capita of intergovernmental revenue[115] from the federal government. The District of Columbia obtained higher levels of property tax revenues per capita than state and local governments in the region or nation. General sales tax revenues were considerably higher on a per capita basis for the District of Columbia compared to state and local governments in the region and nation. Selective sales tax revenues for the District were similar per capita to such revenues for states in the region and nation, and considerably higher than such revenues for local governments in the region and nation. Public utility tax revenues, specifically, were pointedly higher for the District of Columbia on a per capita basis than for other governments in the region and nation. Individual and corporate income tax revenues, on a per capita basis, were higher for

[115] 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.

the District of Columbia (in many cases considerably so) than for state and local governments in the region and nation.

Table 5.1.9-8: State and Local Government Revenues, Selected Sources, 2012

Type of Revenue		District of Columbia		Region		United States	
		State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount
Total Revenue	($M)	$0	$13,099	$522,354	$431,898	$1,907,027	$1,615,194
	Per capita	$0	$14,284	$7,132	$5,897	$6,075	$5,145
Intergovernmental from Federal	($M)	$0	$3,474	$135,435	$20,289	$514,139	$70,360
	Per capita	$0	$3,788	$1,849	$277	$1,638	$224
Intergovernmental from State	($M)	$0	$0	$0	$120,274	$0	$469,147
	Per capita	$0	$0	$0	$1,642	$0	$1,495
Intergovernmental from Local	($M)	$0	$0	$9,810	$0	$19,518	$0
	Per capita	$0	$0	$134	$0	$62	$0
Property Taxes	($M)	$0	$1,878	$2,215	$144,319	$13,111	$432,989
	Per capita	$0	$2,048	$30	$1,971	$42	$1,379
General Sales Taxes	($M)	$0	$1,111	$49,123	$15,874	$245,446	$69,350
	Per capita	$0	$1,211	$671	$217	$782	$221
Selective Sales Taxes	($M)	$0	$428	$38,070	$5,996	$133,098	$28,553
	Per capita	$0	$467	$520	$82	$424	$91
Public Utilities Taxes	($M)	$0	$198	$4,314	$2,261	$14,564	$14,105
	Per capita	$0	$216	$59	$31	$46	$45
Individual Income Taxes	($M)	$0	$1,491	$102,813	$18,838	$280,693	$26,642
	Per capita	$0	$1,625	$1,404	$257	$894	$85
Corporate Income Taxes	($M)	$0	$466	$14,112	$6,733	$41,821	$7,210
	Per capita	$0	$508	$193	$92	$133	$23

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

5.1.10. Environmental Justice

5.1.10.1. 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 1.8.11). The fundamental principle of environmental justice is "fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies" (USEPA, 2016). 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 (Council on Environmental Quality, 1997). Additionally, the USEPA Office of Environmental Justice (USEPA, 2015e) offers guidance on Environmental Justice issues and provides an "environmental justice screening and mapping tool," EJSCREEN (USEPA, 2015f).

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

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

5.1.10.2. Specific Regulatory Considerations

The District of Columbia's environmental justice program was established in the Department of Health to ensure all District residents are considered fairly during the implementation of environmental health programs, issuance of permits, or enforcement of environmental health laws. The environmental justice program aims at reducing disproportionate impacts on low income and minority populations by focusing public attention on environmental health-related issues through education and outreach. Staffed by an Environmental Justice Coordinator, this program monitors the environmental review process, responds to public concerns, and educates residents on how to participate in the environmental decision making process. The Department of Health works with Advisory Neighborhood Commissions representing affected communities, as needed, to assess the demographics of potentially affected communities during project development. (University of California, Hastings College of Law, 2010)

5.1.10.3. Environmental Setting: Minority and Low-Income Populations

Table 5.1.10-1 presents 2013 data on the composition of District of Columbia's population by race and by Hispanic origin. The District's population has a substantially higher percentage of individuals who identify as Black/African American (48.8 percent) than the populations of the

East region (14.4 percent) and the nation (12.6 percent). The percentage of people in the District who identify as Asian (3.6 percent) or Some Other Race (3.4 percent) is slightly lower than that of the region and the nation. Those percentages are, for Asian, 5.8 percent and 5.1 percent respectively; and for Some Other Race, 4.8 percent and 4.7 percent respectively. The District's population of persons identifying as White (40.9 percent) is considerably smaller than that of the East region (72.1 percent) or the nation (73.7 percent).

The percentage of the population in the District of Columbia that identifies as Hispanic (10.1 percent) is somewhat smaller than in the East region (12.2 percent), and considerably smaller than in the nation (17.1 percent). Hispanic origin is a different category than race; persons of any race may identify as also being of Hispanic origin.

The category All Minorities consists of all persons who consider themselves Hispanic or of any race other than White. The District of Columbia's All Minorities population percentage (64.4 percent) is considerably higher (almost double) than that of the East region (34.0 percent) or the nation (37.6 percent).

Table 5.1.10-2 presents the percentage of the population living in poverty in 2013, for the District, region, and nation. The figure for the District of Columbia (18.9 percent) is considerably higher than that for the East region (13.3 percent) and for the nation (15.8 percent).

Table 5.1.10-1: Population by Race and Hispanic Status, 2013

Geography	Total Population (estimated)	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		
District of Columbia	646,449	40.9%	48.8%	0.2%	3.6%	0.0%	3.4%	3.2%	10.1%	64.4%
East Region	73,558,794	72.1%	14.4%	0.3%	5.8%	0.0%	4.8%	2.7%	12.2%	34.0%
United States	316,128,839	73.7%	12.6%	0.8%	5.1%	0.2%	4.7%	3.0%	17.1%	37.6%

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

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

Table 5.1.10-2: Percentage of Population (Individuals) in Poverty, 2013

	Percent Below Poverty Level
District of Columbia	18.9%
East Region	13.3%
United States	15.8%

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

5.1.10.4. 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 presents the methodology used in this PEIS to screen each state and the District of Columbia 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 5.1.10-1 visually portrays the results of the environmental justice population screening analysis for the District of Columbia. The analysis used block group data from the Census Bureau's American Community Survey 2009-2013 5-Year Estimates (U.S. Census Bureau, 2015e) (U.S. Census Bureau, 2015r; U.S. Census Bureau, 2015s; U.S. Census Bureau, 2015t). The map also shows that all of the District of Columbia is considered a single population concentration according to U.S. Census Bureau urban area definitions and 2010 census data (U.S. Census Bureau, 2012; U.S. Census Bureau, 2015f).

Figure 5.1.10-1 shows that most areas in the District of Columbia have High Potential or Moderate Potential for environmental justice populations. The High Potential areas mostly occur in the northeast, east, and southeast areas of the District, with scattered pockets of High Potential in the central and northwest portions of the District. The areas with Moderate Potential for environmental justice populations occur mostly in the central and northwest portions of the District.

It is very important to note that Figure 5.1.10-1 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 large block groups, the data may represent dispersed individuals of minority or low-income status rather than discrete, place-based communities. Second, the definition of the Moderate Potential category draws a wide net for potential environmental justice populations. As discussed in Appendix D the definition includes some commonly used thresholds for environmental justice screening that tend to over-identify environmental justice potential. Before FirstNet deploys projects, additional site-specific analyses to identify specific, localized environmental justice populations may be warranted. Such analyses could tier-off the methodology of this PEIS.

This map also does not indicate whether FirstNet projects would have actual impacts on environmental justice populations. An environmental justice effect on minority or low-income populations only occurs if the effect is harmful, significant (according to NEPA criteria), and "appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate comparison group" (Council on Environmental Quality, 1997). The Environmental Consequences section (Section 5.2.10) addresses the potential for disproportionately high and adverse environmental or human health impacts on environmental justice populations.

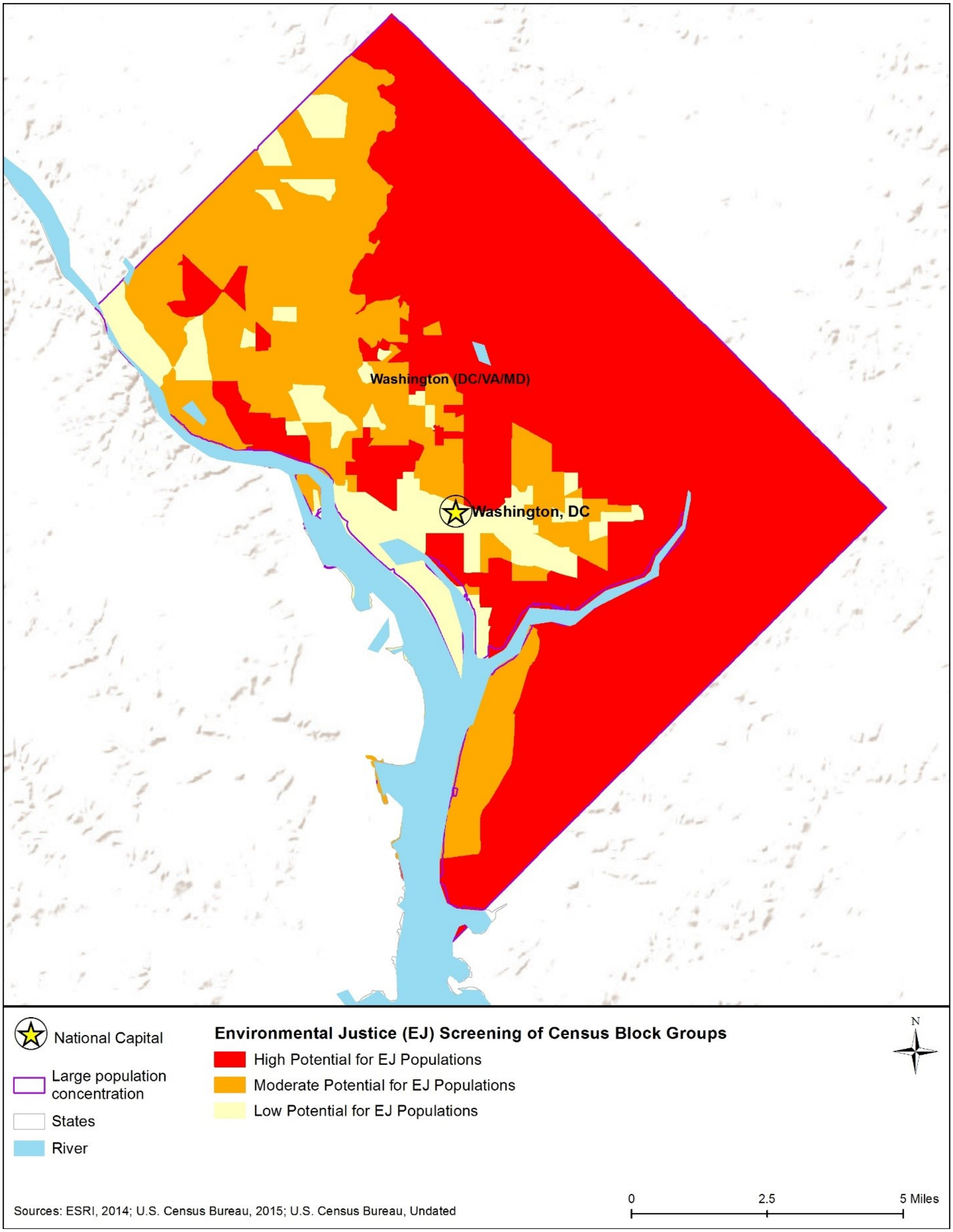

Figure 5.1.10-1: Potential for Environmental Justice Populations in the District of Columbia, 2009-2013

5.1.11. Cultural Resources

5.1.11.1. 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, 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, 25 U.S.C. 3001(3)(D) and 43 CFR 10.2(d);
- NPS program support of public and private efforts to identify, evaluate, and protect America's historic and archeological resources (NPS, 2015k); and
- Advisory Council on Historic Preservation's guidance for protection and preservation of sites and artifacts with traditional religious and cultural importance to an Indian tribes or Native Hawaiian organizations (Advisory Council on Historic Preservation, 2004)

5.1.11.2. 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), the American Indian Religious Freedom Act, Archaeological Resources Protection Act, and Native American Graves Protection and Repatriation Act. Appendix C summarizes these pertinent federal laws.

The District Historic Preservation Office (HPO) has laws and regulations that provide for reviews of non-federal projects for potential impacts to cultural resources (Table 5.1.11-1). However, federal laws and regulations supersede these regulations. While federal agencies may take into account compatible state and local laws and regulations, their actions that are subject to federal environmental review under NEPA and NHPA are not subject to compliance with such laws and regulations.

Table 5.1.11-1: Relevant District of Columbia Cultural Resources Laws and Regulations

District Law/Regulation	Regulatory Agency	Applicability
D.C. Historic Landmark and Historic District Protection Act	District HPO	This Act “requires D.C. government agencies to take into account the effects of their undertakings on properties listed or eligible for listing in the District of Columbia Inventory of Historic Sites, and to consult with and afford the DC State Historic Preservation Officer a reasonable opportunity to comment. ” (DC Historic Preservation Office, 2015)

5.1.11.3. Cultural and Natural Setting

Human beings have inhabited the District of Columbia region for some 12,000 years (Custer, 1984; Dent, 1991). The majority of the evidence comes from the study of archeological sites that provide important information about the District's pre-European contact and historic populations, and document various cultures, traditions, and human interactions with the environment. In many cases, archeological data are the only information available about the District's early peoples and places.

Many of the materials from archaeological sites in the District of Columbia and the surrounding region are housed at the Smithsonian National Museum of Natural History. Scientific collections include the Archaeology, Ethnology, and Physical Anthropology and the National Anthropological Archives of the National Museum of Natural History, and the National Museum of the American Indian (Smithsonian National Museum of Natural History, 2015a). Archeological sites within the District of Columbia and the surrounding regions may be found in a wide variety of settings, from forests and flood plains to waterways and mountaintops. Pre-European contact archeological sites range from temporary fishing encampments to large permanent villages (Moeller, 1980; Dent, 1991; Gallivan, 2011). There are also many "resource procurement sites" or areas where the activity appears to have consisted of a single action lasting for perhaps just a few hours, such as hunting sites where animals were killed and butchered. Other sites were established at waterfront locations where groups of people gathered for a limited time on a regular basis to catch and prepare fish. Most archeological sites are found in relatively shallow deposits, within one to two feet of the surface. However, in some cases, natural factors have caused sites to be buried beneath multiple layers of sediment, such as the deeply stratified floodplain deposits often found along streams and rivers. These deposits can be anywhere from one foot to more than 10 feet below the current surface. These sites are typically stratified in layers, with older sites lying in the deepest sediments and more recent deposits being closer to the surface. Areas in which there has been previous disturbances to the ground, such as in densely populated urban settings may contain archaeological resources within the deeper soils (Harris, 1979). Prehistoric and Post-European contact sites can be found throughout the District of Columbia area (Smithsonian National Museum of Natural History, 2015a).

The following sections provide additional detail about the District’s prehistoric periods (approximately 12000 B.C. to A.D. 1650) and the historic period since European colonization in the 1600s. Section 5.1.11.4 presents an overview of the initial human habitation in the region and the cultural development that took place prior to European contact. Section 5.1.11.5 discusses the federally recognized American Indian tribes with a cultural affiliation to the District. Section 5.1.11.6 provides a current list of significant archaeological sites in the District of Columbia and tools that the District has developed to ensure their preservation. Section 5.1.11.7 summarizes the historic context of the District since European contact, and Section 5.1.11.8 addresses the architectural context of the District during the historic period.

5.1.11.4. Prehistoric Setting

Three distinct periods associated with the prehistoric human populations that inhabited present day District of Columbia and the greater Northeast geography of North America. These are the Paleoindian period (12000 to 10000 B.C.), Archaic (10000 to 3000 B.C.), and Woodland (3000 B.C. to A.D. 1600) (Pauketat, Timothy R, 2012; Institute of Maritime History, 2015; Holiday, Johnson, & Stafford, 1999; Smithsonian National Museum of Natural History, 2015a). Figure 5.1.11-1 shows a timeline representing these periods of early human habitation in North America, including present day District of Columbia (Pauketat, Timothy R, 2012; Institute of Maritime History, 2015).

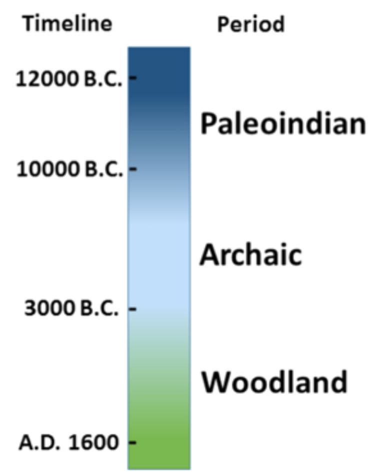

Figure 5.1.11-1: Timeline of Prehistoric Human Occupation in the District of Columbia Region

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

Paleoindian Period (12000 - 10000 B.C.)

The Paleoindian Period represents the earliest human habitation of the northeast United States. The earliest people to occupy the District were small groups of nomadic hunters and gatherers that used chipped-stone tools, including the "fluted javelin head" arrow and spear points, also referred to as the Clovis fluted point. Early hypotheses in American archaeology suggested that the Clovis fluted point was not invented until prehistoric people reached North America and began hunting the large game of that period (Ritchie, 1969) (Dent, 1991). However, studies that are more recent show that such technology was prevalent in northeastern Asia, the Arabian Peninsula, and Spain prior to human arrival into North America (Charpentier & Inizan, 2002). Most of the oldest known evidence of human settlement in the District of Columbia is based on the discovery of fluted points found in surface and shallow deposits in the region. Archaeologists hypothesize that the people of this period ranged across the region in small bands that followed migratory game. Early Paleoindian settlers used the Clovis fluted point technology to hunt large game such as mastodon, caribou, stag-moose, giant beaver, and California condor, to name a few species (Laub, 2000; Dent, 1991). These bands established seasonal camps, some of which likely became permanent settlements. No skeletal remains of these people have been identified to date in the District of Columbia or the surrounding region, so their appearance is unknown. It is assumed that they were related to people who migrated to North America via a land bridge at the Bering Strait during the latter part of the last ice age (Late Pleistocene epoch) (Ritchie, 1969; Laub, 2000; Robinson, 2011).

Archaic Period (10000 - 3000 B.C.)

During the Archaic Period, American Indian peoples lived in small family based units throughout present day District of Columbia, and especially along the Potomac River (DCOP, 2015; Dent, 1991; Smithsonian National Museum of Natural History, 2015a). As the climate warmed, ice sheets retreated into modern day Canada. Flora and fauna presently found in the District of Columbia began to be established, and the environment became increasingly more habitable for human groups and community formation. Like the Paleoindians that preceded them, Archaic Period people were hunter-gathers whose diet consisted of wild plants and animals. They gathered wild vegetable foods, hunted for game, and developed efficient fishing practices. Archaic Period inhabitants began building basic shelters (primitive houses) and developed more specialized stone weapons and stone tools. The discovery of shell ornaments, such as “triangular pendants” were being produced during the Archaic Period (Pauketat, Timothy R, 2012). However, in the District and throughout the northeastern United States, technology that is typically associated with agricultural practices—such as pottery and the smoking pipe—was not prevalent at this time (Levine, 2004; Manson, 1948; Sassaman, 1998).

As presented in the sections below, the Archaic Period is subdivided into the stages of cultural development — Early, Middle, and Late — largely defined by the warming climate, expanding food resources, increasing populations, and the development of sociocultural traditions from contact with other groups through travel or trade (Levine, 2004; Stewart, 1993; Manson, 1948).

In the Early Archaic Stage, trees that thrived in cold climates, such as spruce, deciduous trees, such as oak, chestnut, and maple were gradually replacing pine and hemlock. The semi-nomadic people of this stage began to populate the District of Columbia area and surrounding regions. The archaeological record indicates that the people had not developed very sophisticated means for storing food. Summer months were probably bountiful and groups up to 75 people lived together. As food became scarce in the winter, and with little means for storing items of subsistence, the large groups split into small bands that were better able to forage for scarce food resources. Archeological evidence of the Early Archaic Stage people in the District area consists primarily of the locations of occupation sites that once contained large campfires characterized by features containing organic remains and fire-cracked rocks, which support the hypothesis that the people were adept at hunting and large-scale cooking techniques. (Dent, 1991; Manson, 1948; Pauketat, Timothy R, 2012)

By the Middle Archaic Stage, the climate in the eastern part of the United States had moderated enough to support a temperate deciduous forest environment. The region had an abundance of food sources, including wild game, fowl, nuts, berries, tubers, roots, and herbs, which supported growing populations of semi-nomadic peoples (Gallivan, 2011; Manson, 1948; Pauketat & Loren, 2005).

Archaeological sites of the Late Archaic Stage are well documented throughout the eastern United States, including the District area. Hardwood forests dominated the region and the subsistence base included white tail deer, black bear, small game animals, and aquatic and wild vegetable food sources. The warmer climate, and abundance and variety of food sources, gave rise to population increases by new migration of groups from outside the region or increases of indigenous populations (Levine, 2004).

Both stone and bone tools have been documented in the archaeological record of this stage of human development in the eastern United States. Studies beginning in the early 1990s have revealed the presence of decorated soapstone artifacts, and have been dated to the late archaic period and into the terminal archaic. Steatite, also called soapstone because of its texture and talc-like surface, is a material found through the D.C, area and it could be transformed easily into vessels such as pots or cups. The people were able to mine this product, and much of it was ornately designed and traded throughout the region (Shaffer, 2008).

Woodland Period (3000 B.C. - A.D. 1600)

Similar to the Archaic Period, the Woodland Period is divided into three sequential stages: Early, Middle, and Late. The three stages are defined by phases of cultural development, based on archaeological evidence at temporal (place in time) locations. During the course of the Woodland Period, there is a gradual shift from a semi-nomadic to a more sedentary lifestyle based on horticulture or crop-growing practices, and different types of pottery used (Hart, Thompson, & Brumbach, 2003; Gallivan, 2011; Anacostia Waterfront, 2007).

Hunting and fishing was the predominant form of subsistence in the District of Columbia area during the Early Woodland Stage. A wider variety of materials was used in manufacturing tools than those used during the earlier Archaic Period, such as non-local stone, bone, ground stone, and some copper tools (Dent, 1991; Anacostia Waterfront, 2007). The main technology that differentiates the Woodland Period from the Archaic Period is the development and use of pottery, which spread northward from its origins during the late Archaic from the coastal Southeast to the northeastern part of the United States and elsewhere (Sassaman, 1998). The Early Woodland period in the District area is marked by “Marcey Creek’ pottery, which was made using soapstone or crushed steatite as a tempering material to strengthen the finished products, and eventually it was replaced by Accokeek wares that were tempered with sand quartz (Dent, 1991; Anacostia Waterfront, 2007; Manson, 1948). Stone tool technology continued to advance during this period, with the use of bone tools, such as deer antler (Custer, 1984; Dent, 1991).

The Middle Woodland Stage in the District of Columbia is distinguished by development of more ornate and varying types of pottery identified as “Popes Creek” and “Mockley” ceramics. The former ceramic type is thick-walled, tempered with sand, and bears net impressions, while the latter is tempered with oyster shells and bears cord and net designs (Gallivan, 2011; Anacostia Waterfront, 2007). The people of this stage also exhibited a wide range of burial practices, used exotic materials as grave goods, and left other cultural artifacts associated with increasingly sedentary patterns of existence (Anacostia Waterfront, 2007; Dent, 1991).

By the Late Woodland Stage, the archaeological record indicates a change of diet that resulted from a permanent shift to sedentary lifestyles for people in present day District of Columbia and surrounding regions. Evidence of longhouses are present, which were often protected by palisades (Kerber, 2012; Stewart, 1993; Gallivan, 2011; Anacostia Waterfront, 2007; Dent, 1991). Pottery of traditional classic Woodland lineage underwent progressive modifications (Veit & Bello, 2001; Anacostia Waterfront, 2007; Dent, 1991). There was an "increased dependence on horticulture, especially as it relates to the introduction of corn, maize, beans, and squash" (Kerber, 2012; Stewart, 1993). Coincident with these cultural changes, the practice of mortuary ceremonialism tapered to extinction during this stage (Kerber, 2012; Gallivan, 2011). American Indian tribes living in the area at the coming of Europeans were those that spoke Algonkian languages, including the 32 sub-chiefdoms that made up the Powhatan Confederacy during the early part of the 17th century (Virginia DHR, 2016).

5.1.11.5. Federally Recognized Tribes of the District of Columbia

According to the Bureau of Indian Affairs and the National Conference of State Legislators, there are no federally recognized tribes within the District of Columbia (NCSL, 2015; GPO, 2015).

5.1.11.6. Significant Archaeological Sites of District of Columbia

More than 400 archaeological sites that have been recorded in District region (DCOP, 2015). Five of these archaeological sites are listed on the NRHP. Table 5.1.11-1 lists the names of the sites, the city they are closest to, and type of site. The list includes both prehistoric and historic archaeological sites. The number of archaeological sites may increase with the discovery of new sites. A current list of NRHP sites can be found on the NPS NRHP website at http://www.nps.gov/nr/ (NPS, 2015d).

The District of Columbia Cultural Resources Database and Tools

District of Columbia's Historic Preservation Office (HPO)

The District of Columbia HPO is the source of information of the District's archaeological and historical resources. The HPO is the equivalent of the State Historic Preservation Office. "The HPO maintains information on sites and their locations, and a library of reports on the information recovered from sites. This information is managed electronically using a Geographic Information System, or GIS. The office also consults with the owners of archaeological sites and conducts reviews of projects that may harm known or potential sites." Their website at http://planning.D.C.gov/historicpreservation provides information on the guidelines for practicing archaeology in the District, archaeology web links, federal projects, basic principles of archaeology, and more. (DCOP, 2015)

Archaeological Institute of America (AIA)

The AIA was founded in 1879, and is the oldest organization in the United States devoted to the preservation of archaeological resources for the benefit of future generations. The AIA has a full-time staff dedicated to assist those in search of archaeological data for research and preservation, and materials can be accessed through their website at (https://www.archaeological.org/). The mission of the AIA is to promote "archaeological inquiry and public understanding of the material record of the human past to foster an appreciation of diverse cultures and our shared humanity. The AIA supports archaeologists, their research and its dissemination, and the ethical practice of archaeology. The AIA educates people of all ages about the significance of archaeological discovery and advocates the preservation of the world's archaeological heritage. (Archaeological Institute of America, 2015)

Smithsonian Museum of Natural History – Department of Archaeology

The Smithsonian Museum of Natural History – Department of Archaeology has various resources and materials that can be accessed through its website (http://anthropology.si.edu/). The website makes available a wide variety of materials and databases for those concerned about potential impacts to archaeological resources throughout the United States, including the District. The museum has a professional staff that can assist with research and responding to stakeholder questions. (Smithsonian National Museum of Natural History, 2015b)

Table 5.1.11-2: Archaeological Sites on the National Register of Historic Places in the District of Columbia

Closest City	Site Name	Type of Site
Washington D.C.	Chesapeake and Ohio Canal National Historical Park	Prehistoric
Washington D.C.	Civil War Fort Sites	Historic
Washington D.C.	Anthony Holmead Archeological Site	Historic
Washington D.C.	Potomac Palisades Site	Prehistoric
Washington D.C.	Glover-Archbold Park	Prehistoric

Source: (NPS, 2015d)

5.1.11.7. Historic Context

While the District of Columbia dates to the late 18th century, English settlers established neighboring Virginia at the beginning of the 17th century. The colony of Maryland was founded in 1634 as a haven for English Catholics seeking religious freedom, when a propriety charter was given to Cecil Calvert, Second Lord Baltimore, creating Maryland from Virginia. The part of Maryland that was ceded for the District of Columbia began to experience growth in the 18th century when tobacco inspection stations were created in Bladensburg and Georgetown (both in Maryland at the time), and in Alexandria, VA. In 1790, the District of Columbia was formally established on land ceded by Maryland and Virginia. (DC Historic Preservation Office, 2013)

In 1791, after selecting the location for the nation's new capital city, President George Washington commissioned Pierre Charles L'Enfant, the French-born military engineer who had served him during the American Revolution, to develop a city plan. The L'Enfant Plan included a series of "grand civic spaces, roundabouts, and broad, radial avenues," which were combined with a grid of cross streets (DC Historic Preservation Office, 2013). The National Mall, which sits at the center of the L'Enfant Plan, has evolved over the years, undergoing changes in appearance and use (National Capital Planning Commission, 2006). Construction on the White House started in 1792, the Capitol building in 1793, and in 1800 the government arrived and began operating in the District. For several years, those of Georgetown and Alexandria outpaced the population of the City of Washington. While Georgetown was eventually annexed into the City of Washington, it maintained its status as a separate municipality until the late 19th century. (DC Historic Preservation Office, 2013)

In 1814, British soldiers burned much of the capital city during the War of 1812. While portions of the city remained, much of it had to be rebuilt. Shortly thereafter, additional government buildings were commissioned, with the U.S. Treasury Building, Patent Office (now National Portrait Gallery), and General Post Office (now Hotel Monaco), all dating to the 1830s. Residential construction expanded to keep pace with the population, which expanded to support the government. The Maryland portion of the District of Columbia housed essentially all government buildings, and in 1847, Virginia, which had not experienced a commensurate level of growth, asked for their land to be retroceded to the state. (DC Historic Preservation Office, 2013)

During the first half of the 19th century, transportation improvements fueled growth in Washington City (the portion of the District encompassed by the L'Enfant Plan). Washington County (the portion of District outside Washington City and Georgetown), was transitioning into suburbs. During the Civil War, the District of Columbia became the most heavily fortified city in the country, with "nearly 100 detached batteries, and miles of rifle trenches and military roads" encircling Washington City (DC Historic Preservation Office, 2013). The construction of these fortifications resulted in the destruction and eventual redevelopment of many farms into the neighborhoods that exist today (DC Historic Preservation Office, 2013).

A large portion of District's residential buildings date to the late 19th century and are associated with growth following the Civil War. In 1900, the City Beautiful Movement led to the formation of the McMillan Commission, which worked to expand and reimagine the L'Enfant Plan. In an attempt to fashion the District of Columbia into an "international" city, brick structures were removed in favor of new construction using the white stone that is common today. Many famous monuments were built as a result of the McMillan Commission (DC Historic Preservation Office, 2013).

The 20th century brought almost continuous growth for the District of Columbia. During World War I, temporary structures were built on the National Mall to house the bureaucracy. New Deal programs encouraged growth despite the Great Depression, and World War II fueled further expansion. As with much of the country, the 1950s marked the beginning of an exodus of residents to the suburbs. In 1968, following the assassination of Dr. Martin Luther King Jr., riots erupted, resulting in property damage and the continued movement of residents out of the city. During the early 1970s, the implementation of “Home rule” sparked a turnaround for the District and people began moving back into the city. The application of home rule meant that Congress deferred much of its authority to the local government. (DC Historic Preservation Office, 2013)

The District of Columbia has 580 NRHP listed sites, as well as 74 NHLs (NPS, 2015g). The District of Columbia contains no National Heritage Areas (NPS, 2015e). Figure 5.1.11-2 shows the location of NRHP sites within the District of Columbia.[116]

5.1.11.8. Architectural Context

Architecture in the District of Columbia is dominated by its collection of classically inspired buildings and monuments, which represent more than two centuries of building design (Scott & Lee, 1993). When the location of the capital city was chosen in 1790, the area was mostly rural, with commercial activities split between Georgetown, MD, and Alexandria, VA. Freestanding structures that predated the District of Columbia would have been identical to 18th century architecture in Maryland and Virginia, exhibiting a heavy Georgian influence. Today, the oldest structures in the District are in Georgetown, where the Old Stone House (1765) remains the city’s oldest preserved building. Georgetown also contains a collection of early residential buildings, including freestanding houses and rowhouses dating from the late 18th century (DC Historic Preservation Office, 2013).

The L’Enfant Plan, which dates to 1791, was inspired by late-18th century European urban planning ideals and is one of the city’s most significant pieces of heritage. Construction on the White House and Capitol began immediately following the conception of the plan, and they remain the two oldest and most important civic structures in the city. Many of Washington’s notable buildings were designed by famous architects, including the White House by James Hoban; the Capitol Building by Benjamin Henry Latrobe and Charles Bulfinch; and the Treasury Building, Patent Office, General Post Office, and Washington Monument by Robert Mills (DC Historic Preservation Office, 2013).

[116] See Section 5.1.8 for more information on additional historic resources as they relate to recreational resources.

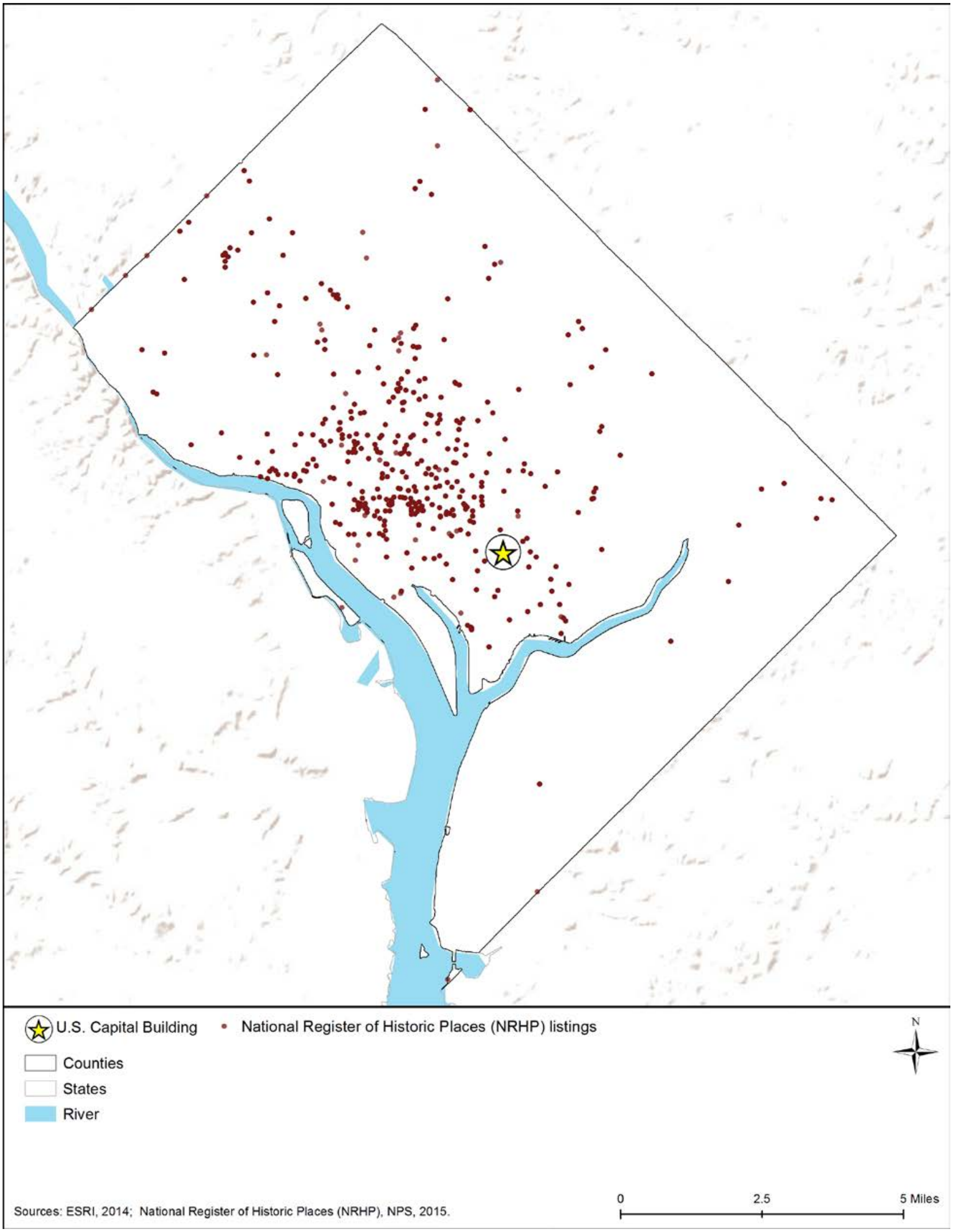

Figure 5.1.11-2: National Register of Historic Places Sites in the District of Columbia, 2015

Many of the city's in-town neighborhoods date to the late 19th and early 20th centuries when they were developed as streetcar suburbs in rural areas. Building types range from standalone houses to connected commercial, residential, and mixed-use structures. Building styles include Greek Revival, Italianate, Second Empire, and other Victorian Era styles. Colonial Revival, Craftsman, and modern styles were built during the 20th century. Many of city's public buildings date to the late 19th and early 20th centuries and were part of the McMillan Commission's effort to remake the city according to City Beautiful principles. The Federal Triangle is an example of a project that was completed in the early 1930s (DC Historic Preservation Office, 2013).

Transportation improvements were critical to fostering growth in the District. The Chesapeake and Ohio Canal (C & O Canal) was started in 1828, but was quickly rendered obsolete by railroad technology. The C & O Canal remains in place today, drawing tourists, sightseers, and joggers in the Georgetown area. The Baltimore and Ohio Railroad (1827), and later the Baltimore and Potomac Railroad, were two important lines that served the District of Columbia area during the 19th and 20th centuries. In the early 20th century, Daniel Burnham designed Union Station, which serves as the hub for rail activity in the District (DC Historic Preservation Office, 2013).

Government architecture includes buildings from the late 18th century up through the present. The government swelled during the Civil War, necessitating the expansion of government facilities; the Capitol building was expanded during this time. In 1871, ground was broken on the Eisenhower Executive Office Building (formerly the Old Executive Office Building, and prior to that the State, War, and Navy Building), which took nearly 20 years to complete. Because of the long period of construction, the building was considered unfashionable when it was finally completed. Today it is considered one of the most impressive structures in the city and a fine example of Second Empire architecture. During World War I and II, wartime activities necessitated the further expansion of federal facilities. (DC Historic Preservation Office, 2013)

Beginning in the early 20th century, apartment buildings began to replace rowhouses as the popular and affordable type of in-town residence for the middle and lower classes. In the 1930s and 1940s, garden apartments were very common, some of which were constructed as a part of New Deal work programs. Alley houses (in alleys behind rowhouses), were common for much of the city's history, but were labeled as slums and removed from the city. Modern apartment buildings were constructed as a part of the urban renewal movement, which continued into the mid-20th century. The southwest quadrant in particular was disproportionately affected by urban renewal, losing much of its history. (DC Historic Preservation Office, 2013)

The District contains several historic higher educational institutions including Georgetown University (1789), George Washington University (1821), American University (1893), Gallaudet University (1864), Catholic University (1887), Howard University (1867), and others. Several historic park spaces have been preserved, including Meridian Hill Park, civic squares and roundabouts, and the large nature preserve of Rock Creek Park. Many of the city squares and roundabout are populated with historic statuary, and examples of historic industrial buildings remain in select areas as well (Moeller Jr., 2006). The District imposes height limits for new buildings, which has resulted in development being low-scale compared to other large cities. Figure 5.1.11-3 shows representative architectural styles in the District.

Figure 5.1.11-3: Representative Architectural Styles of the District of Columbia

- Left – Washington Monument – (Highsmith, Washington Monument, Washington, D.C., 1980)
- Right Top – White House – (Highsmith, The White House, Washington, D.C., 2008)
- Left Bottom – United States Treasury Building – (Harris and Ewing, 1909)
- Center Bottom – Smithsonian Castle – (Highsmith, The Smithsonian Castle, Independence Ave. near 9th St., SW, Washington, D.C., 2010)
- Right Bottom – Rowhouses (1327 N Street NW) – (Historic American Buildings Survey, 1933)

5.1.12. Air Quality

5.1.12.1. Definition of Resource

Air quality in a geographic area is determined by the type and amount of pollutants emitted into the atmosphere, the size, and topography[117] 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)[118] or micrograms per cubic meter (μg/m^3) determined over various periods of time (averaging time).[119] This section discusses the existing air quality in the District of Columbia. The USEPA designates areas within the United States as

[117] Topography: The unique features and shapes of the land (e.g., valleys and mountains).
[118] Equivalent to 1 milligram per liter (mg/L).
[119] 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, 2015g)

attainment,[120] nonattainment,[121] maintenance,[122] or unclassifiable[123] depending on the concentration of air pollution relative to ambient air quality standards. Information is presented regarding national and District ambient air quality standards and nonattainment areas that would be potentially more sensitive to impacts from implementation of the Proposed Action or Alternatives.

5.1.12.2. Specific Regulatory Considerations

National and District 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 are various standards, either primary[124] or secondary,[125] for each pollutant with varying averaging times. Standards with short averaging times (e.g., 1-hour, 8-hour, and 24-hour) are meant 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. The District does not maintain separate ambient air quality standards and only uses the NAAQS.

In addition to the NAAQS, there are standards for hazardous air pollutants (HAP), which are those typically associated with specific industrial processes such as chromium electroplating (hexavalent chromium), dry cleaning (perchloroethylene), and solvent degreasing (halogenated solvents) (USEPA, 2011a). HAPs can have severe adverse impacts on human health and the environment, including increased risk of cancer, reproductive issues, or birth defects. HAPs are federally regulated under the CAA via the National Emission Standards for Hazardous Air Pollutants. USEPA developed the National Emission Standards for Hazardous Air Pollutants for sources and source categories emitting HAPs that pose a risk to human health (USEPA, 2015h).

Title V Operating Permits/District Operating Permits

The District has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in Title 40 CFR Part 70. The Title V program refers to Title V of the CAA that governs permitting requirements for major industrial air pollution sources and consolidates all CAA requirements for the facility into one permit (USEPA, 2015i). The overall goal of the Title

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

[121] Nonattainment areas: Any area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet) the national primary or secondary ambient air quality standard for the pollutant. (USEPA, 2015g).

[122] Maintenance areas: An area that was previously nonattainment, but has met the national primary or secondary ambient air quality standards for the pollutant, and has been designated as attainment. (USEPA, 2015g)

[123] Unclassifiable areas: Any area that cannot be classified on the basis of available information as meeting the national primary or secondary air quality standard for a pollutant. (USEPA, 2015g)

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

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

V program is to "reduce violations of air pollution laws and improve enforcement of those laws" (USEPA, 2015i). The District 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 5.1.12-1). The permit issued to a facility contains both District and federal portions and incorporates a reporting schedule (USEPA, 2014c).

Table 5.1.12-1: Major Air Pollutant Source Thresholds

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

Source: (USEPA, 2014c)

Exempt Activities

Section 12 of Chapter 20, Part 200 of the DCMR[126] dictates a permit is not required for "any fuel burning equipment which has a capacity of five million British thermal units (5,000,000 BTUs or 5 MMBtu) or less per hour of heat input and which uses for fuel only gaseous fuels or distillate oils" (DCMR, 1997). This exemption is not applicable to any major sources.

Temporary Emissions Sources Permits

Generators larger than five MMBtu/hour heat input must apply for a general permit within the District. Additionally, any generators used as part of a major source or New Source Review must be included in the permit application (DCMR, 1997).

Section 3 of Chapter 20, Part 200 of DCMR states, "[DDOE] may allow the temporary operation of a source for a period no longer than one (1) month. This period may be extended month-to-month, to enable the initial evaluation of the operation of a source or device granted a permit under subsection 200.1 [DCMR Chapter 20], or to enable the continued operation of a source for which an application for an operating permit under subsection 200.2 [DCMR Chapter 20] has been filed, but due to delays attributable to [DDOE] the permit has not been issued. Any temporary operation of a source shall be in accordance with the requirements of [DCMR Chapter 20]" (DCMR, 1997).

District Preconstruction Permits

Section 1 of Chapter 20, Part 200 of DCMR states, "a [construction] permit from [DDOE] shall be obtained before any person shall cause, suffer, or allow the construction of a new stationary source, or the modification of an existing stationary source, or the installation or modification of any air pollution control device on a stationary source" (DCMR, 1997). Construction permits are valid for the specified term but may be extended to up to five years. Owners are required to obtain a separate operating permit prior to commencing operation. (DCMR, 1997).

Part 204 of Chapter 20 of the D.C. Municipal Code contains specific statutes for constructing new major stationary sources or major modifications in nonattainment areas. Owners are

[126] DCMR: District of Columbia Municipal Regulations.

prohibited from beginning construction without obtaining a construction permit from DDOE that "incorporates the applicable control technology and offset requires as specific in subsection 204.18 and 204.19" of Chapter 20 of the D.C. Municipal Code. (DCMR, 2012)

Prior to applying for a construction permit, the applicant must determine which of the following items are applicable to the project and include such determinations on the permit applications:

- "A project is a major modification for a regulated [New Source Review] pollutant as defined in subsection 299;
- Determine whether the emissions increase from the project is significant as defined in subsection 299 by summing the potential to emit from each new emissions unit and the difference between the potential to emit for each existing unit affected by the project after the change and the actual emissions prior to the change;
- Determine whether the project results in a significant net emissions increase as defined in subsection 299;
- An emissions unit is considered affected by the project if an emissions increase from the unit would occur as a result of the project, regardless of whether a physical change or change in the method of operation will occur at the particular emissions unit; and
- Subsection 204.17 pertains to projects that result in a significant increase in a regulated [New Source Review] pollutant, but do not result in a significant net emissions increase." (DCMR, 2012)

Additionally, "a person shall not construct, modify, or operate or cause to be constructed, modified, or operated a New Source Performance Standard source which results or will result in violations of the provisions of Title 40 CFR Part 60, as in effect on September 30, 1997, with the terms used and defined in those provisions." (DCMR, 1998)

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, 2013d). An action in designated nonattainment and maintenance areas would be evaluated for the emission of those particular pollutants under the General Conformity Rule through an applicability analysis. Pursuant to Title 40 CFR 93.153(d)(2) and (e), federal actions "in response to emergencies which are typically commenced on the order of hours or days after the emergency" and actions "which are part of part of a continuing response to emergency or disaster" that are taken up to 6 months after beginning response activities, will be exempt from any conformity determinations (U.S. Government Publishing Office, 2010).

The estimated pollutant emissions are compared to *de minimis*[127] levels. These values are the minimum thresholds for which a conformity determination must be performed (see Table 5.1.12-2). The entire District lies in the Ozone Transport Region (OTR). As a result, lower *de minimis* thresholds for VOCs and NO_X could apply.

[127] Small amount or minimal.

Table 5.1.12-2: *De Minimis* Levels

Pollutant	Area Type	TPY
Ozone (VOC or NO_X)	Serious Nonattainment	50
	Severe Nonattainment	25
	Extreme Nonattainment	10
	Other areas outside an OTR	100
Ozone (NO_X)	Marginal and Moderate Nonattainment inside an OTR	100
	Maintenance	100
Ozone (VOC)	Marginal and Moderate Nonattainment inside an OTR	50
	Maintenance within an OTR	50
	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 5.1.12-2, then a conformity determination is not required. If the applicability analysis shows that the total direct and indirect emissions are above the *de minimis* levels in Table 5.1.12-2, then the action must undergo a conformity determination. The federal agency must first show that the action would meet all SIP control requirements and that any new emissions would not cause a new violation of the NAAQS. To demonstrate conformity[128], the agency would have to fulfill one or more of the following:

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

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

State Implementation Plan (SIP) Requirements

The District's SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. The District's SIP is a conglomeration of separate actions taken for each of the pollutants. All of District's SIP actions are codified under Title 40 CFR Part 52 Subpart HH. A list of all SIP actions for all six criteria pollutants can be found on DDOE Division of Air Quality's website (DDOE, 2015e).

5.1.12.3. Environmental Setting: Ambient Air Quality

Nonattainment Areas

The USEPA classifies areas as attainment, nonattainment, maintenance, or unclassifiable for six criteria pollutants. When evaluating an area's air quality against regulatory thresholds (i.e., permitting and general conformity), maintenance areas are often combined with nonattainment, while unclassifiable areas are combined with attainment areas. Table 5.1.12-3 and Figure 5.1.12-1 below present the nonattainment areas in the District as of January 30, 2015. Table 5.1.12-3 contains the current nonattainment status of each criteria pollutant for the entire District. The year(s) listed in the table for each pollutant indicate the date(s) when USEPA promulgated an ambient air quality standard for that pollutant. Note certain pollutants have more than one standard in effect (e.g., $PM_{2.5}$, O_3, and SO_x).

Table 5.1.12-3: District of Columbia Nonattainment and Maintenance Areas by Pollutant Standard and Area

Area	Pollutant and Year USEPA Implemented Standard										
	CO	Lead		NO_X	PM_{10}	$PM_{2.5}$		O_3		SO_X	
	1971	1979	2008	1971	1987	1997	2006	1997	2008	1971	2010
Entire District of Columbia	M					M		X-4	X-5		

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

Source: (USEPA, 2015j)

Air Quality Monitoring and Reporting

The DDOE measures air pollutants at five sites across the District as part of the National Air Monitoring Stations Network and the State and Local Air Monitoring Stations Network. The Ambient Air Quality Trend Reports are prepared, containing pollutant data summarized by region. The DDOE reports real-time pollution levels of O_3 on the AirNOW[129] website to inform the public, as O_3 is the main pollutant of concern in the District.

[129] AirNow (www.airnow.gov) is a government website that posts the current Air Quality Index for more than 400 U.S. cities.

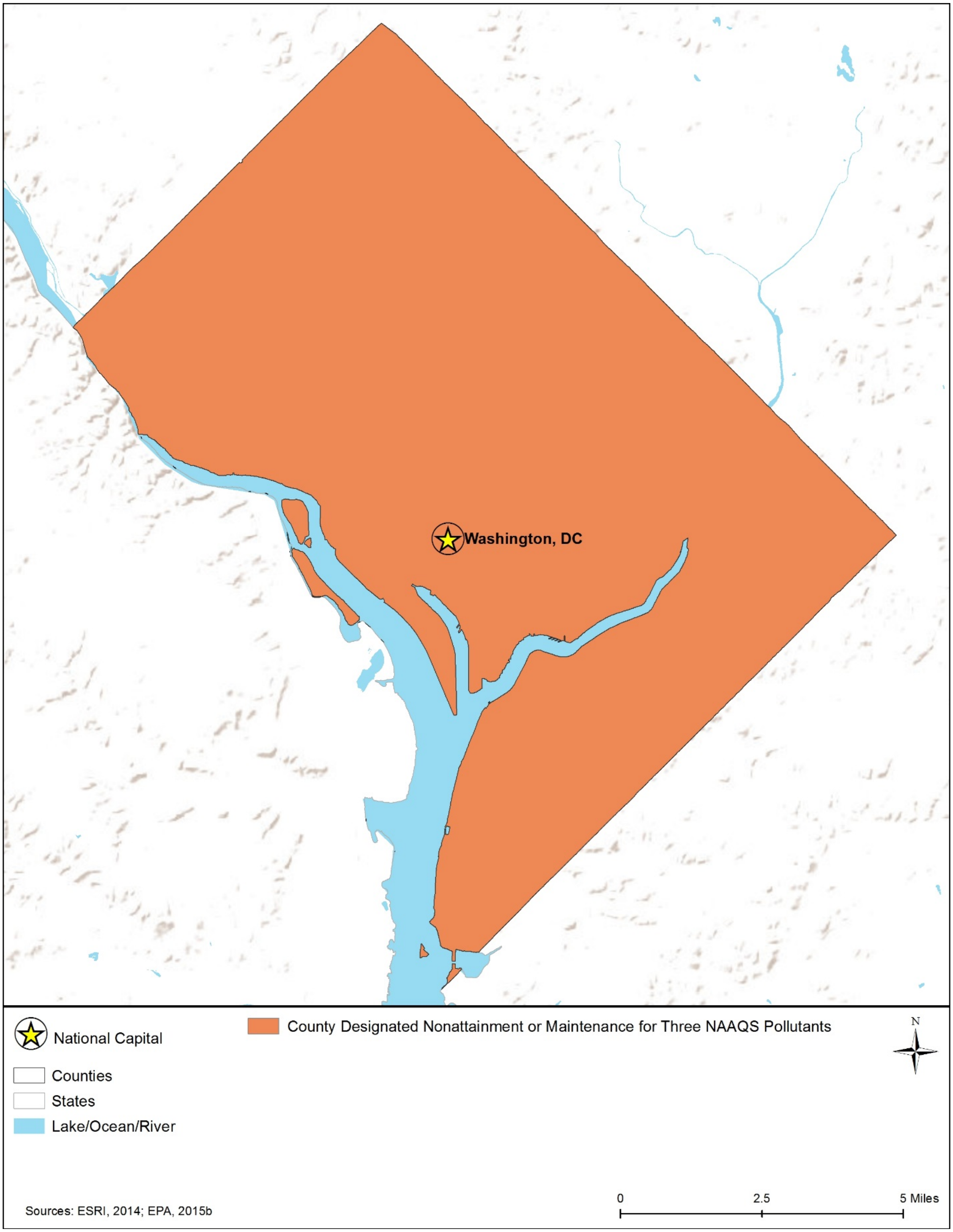

Figure 5.1.12-1: Nonattainment and Maintenance in the District of Columbia

Throughout 2014, O_3 measurements exceeded the federal standard of 0.075 ppm four times. According to the 2014 District of Columbia Ambient Air Quality Monitoring Report, "the McMillan station constantly measures the highest levels of O_3" (DDOE, 2014b). The number of exceedances is significantly less from previous years where the metropolitan region averaged 24 O_3 exceedance days between 2009-2012 (Metropolitan Washington Air Quality Committee, 2014).

Air Quality Control Regions

The USEPA classified all land in the United States as a Class I, Class II, or Class III federal Air Quality Control Region (AQCR). Class I areas include international parks, national wilderness areas which exceed 5,000 acres in size, national memorial parks which exceed 5,000 acres in size, and national parks which exceed 6,000 acres in size. Class I areas cannot be re-designated as Class II or Class III and are intended to maintain pristine air quality. Although USEPA developed the standards for a Class III AQCR, to date they have not actually classified any area as Class III. Therefore, any area that is not classified as a Class I area is, by default, automatically designated as a Class II AQCR (USEPA, 2013e).

In a 1979 USEPA memorandum, the Assistant Administrator for Air, Noise, and Radiation (Hawkins, 1979) advised USEPA Regional Offices to provide notice to the Federal Land Manager (FLM) of any facility subject to the Prevention of Significant Deterioration (PSD) permit requirements and within 100 kilometers[130] of a Class I area. "The EPA's policy is that FLMs should be notified by the Regional Office about any project that is within 100 kilometers of a Class I area. For sources having the capability to affect air quality at greater distances, notification should also be considered for Class I areas beyond 100 kilometers" (Page, 2012). The 2005 USEPA guidelines for air quality modeling do not provide a precise modeling range for Class I areas.

PSD applies to new major sources or major modifications at existing sources for pollutants where the source is in an attainment or unclassifiable area. An air quality analysis is required for sources subject to PSD requirements and generally consists of using a dispersion model to evaluate emission impacts to the area. "Historically, the EPA guidance for modeling air quality impacts under the PSD program has tended to focus more on the requirements for a Class II modeling analysis. Such guidance has provided that applicants need not model beyond the point of significant impact or the source or 100 kilometers[131] (the normal useful range of EPA-approved Gaussian plume models" (USEPA, 1992). The District does not contain any federal Class I areas; all land within the District is classified as Class II (USEPA, 2012a). If an action is considered major source and consequently subject to PSD requirements, the air quality impact analysis need only to analyze the impacts to air quality within 100 kilometers from the source (USEPA, 1992). There are also no other Class I areas within 100-kilometers of the District's border.

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

5.1.13. Noise

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

5.1.13.1. Definition of the Resource

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

The effects of noise can be classified into three categories:

- Noise events that result in annoyance and nuisance;
- Interference with speech, sleep, and learning; and
- Physiological effects such as hearing loss and anxiety (USEPA, 2015k).

Fundamentals of Noise

For environmental noise analyses, a noise metric refers to the unit that quantitatively measures the effect of noise on the environment. The unit used to describe the intensity of sound is the decibel (dB). Audible sounds range from 0 dB ("threshold of hearing") to about 140 dB ("threshold of pain"). The normal audible frequency range is approximately 20 Hz to 20 kHz (FAA, 2015h). The A-weighted scale, denoted as dBA, approximates the range of human hearing by filtering out lower frequency noises, which are not as damaging as the higher frequencies. The dBA scale is used in most noise ordinances and standards (OSHA, 2013).

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

- The vibration frequency characteristics of the sound, measured as sound wave cycles per second [Hertz (Hz)], determines the pitch of the sound.
- The total sound energy radiated by a source, usually reported as a sound power level.
- The actual air pressure changes experienced at a particular location, usually measured as a sound pressure level (the frequency characteristics and sound pressure level 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 5.1.13-1 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 (OSHA, 2013).

Figure 5.1.13-1: Sound Levels of Typical Sounds

Source: (Sacramento County Airport System, 2015)

Prepared by Booz Allen Hamilton, 2005.

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

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

- A 3-dB change in sound level is considered a barely noticeable difference;
- A 5-dB change in sound level will typically result in a noticeable community response; and
- A 10-dB change, which is generally considered a doubling of the sound level, almost certainly causes an adverse community response. (FTA, 2006)

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

5.1.13.2. Specific Regulatory Considerations

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

The District of Columbia has several District-wide noise laws that regulate the operation of various types of motor vehicle and mechanical equipment. Table 5.1.13-1 provides an overview of these relevant noise laws.

Table 5.1.13-1: Relevant District of Columbia Noise Laws and Regulations

District Law/ Regulation	Regulatory Agency	Applicability
Title 20	Secretary of the District of Columbia	Provides environmental guidelines and regulations for the District of Columbia
§ 2701.1	Secretary of the District of Columbia	Establishes maximum sound levels permissible
§ 2704.4	Secretary of the District of Columbia	Exempts noise limitations from authorized emergency vehicles acting in time of emergency
§ 2707.1	Secretary of the District of Columbia	Authorizes an individual to apply for a temporary lifting of noise limitations
§ 2801.2	Secretary of the District of Columbia	Defines noise levels not-to-exceed for the use of mechanical equipment
§ 2811.1	Secretary of the District of Columbia	Defines maximum noise levels for motor vehicles

Source: (DC Municipal Regulations, 1996)

5.1.13.3. Environmental Setting: Ambient Noise

The range and level of ambient noise in the District varies widely based on the area and environment of the area. The population of the District of can choose to live and interact in areas that are urban or suburban communities neighboring national and District parks. Figure 5.1.13-1 illustrates noise values for typical community settings and events that are representative of what the population of the District of may experience on a day-to-day basis. These noise levels represent a wide range and are not specific to the District. As such, this section describes the areas where the population of the District can potentially be exposed to higher than average noise levels.

- **Urban Environments:** Urban areas are likely to have higher noise levels on a daily basis due to highway traffic (70 to 90 dBA), construction noise (90 to 120 dBA), and outdoor conversations (e.g., small/large groups of people) (60 to 90 dBA) (U.S. Department of

Interior, 2008). The areas that are likely to have the highest ambient noise levels in the District are Wards 1, 2, and 6 as these are the most populated (DC Office of Planning, 2011).

- **Airports:** Areas surrounding airports tend to be more sensitive to noise due to aircraft operations that occur throughout the day. A jet engine aircraft can produce between 130 to 160 dBA in its direct proximity (FAA, 2007). However, commercial aircraft are most likely to emit noise levels between 70 to 100 dBA depending of the type of aircraft and associated engine (FAA, 2012). This noise will be perceived differently based on the altitude of the aircraft and its distance to the point of measurement. Airport operations are primarily arrivals and departures of commercial aircraft but based on the type of airport can include touch-and-go operations that are typical of general aviation airports and military airfields. The location of most commercial airports are in the proximity of urban communities; therefore, aircraft operations (arrivals/departures) can result in noise exposure in the surrounding areas to be at higher levels with the potential for increased noise levels during peak operation times (early morning and evenings), when there is an increase in air traffic. The noise levels in areas surrounding commercial airports can have significantly higher ambient noise levels than in other areas. Located across the Potomac River in Arlington County, VA, Ronald Reagan National Airport (DCA) has more than 287,000 annual operations (FAA, 2015a). Located in Dulles, VA, Washington Dulles International Airport (IAD) has nearly 290,000 annual operations (MWAA, 2015b). These operations result in increased ambient noise levels in the surrounding communities. See Section 5.1.7.5, Airspace, and Figure 5.1.7-5 for more information about airports near the District.
- **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, 2015b). There are a number of major highways within the District that may contribute to higher ambient noise levels for residents living in those areas. The major highways in the District tend to have higher than average ambient noise levels on nearby receptors, ranging from 52 to 75 dBA (FHWA, 2015b). See Section 5.1.1, Infrastructure, and Figure 5.1.1-1 for more information about the major highways in the District.
- **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, 2015). The District of Columbia has multiple rail corridors with high levels of commercial and commuter rail traffic. These major rail corridors extend from the District of Columbia to Baltimore, MD; the District of Columbia to Rockville, MD; District of Columbia to Manassas, VA, and District of Columbia to Fredericksburg, VA. There are also a number of other rail corridors that join these major rail lines and connect with other cities (DDOT, 2013). See Section 5.1.1, Infrastructure, and Figure 5.1.1-1 for more information about rail corridors in the area.
- **National and District Parks:** The majority of national and District parks are likely to have lower than average ambient noise levels given their size. National and District parks, historic areas, and monuments are protected areas with one aspect to "maintain the resilience of the

natural soundscape"[1] (Friemund 2015). These areas typically have lower noise levels, as low as 30 to 40 dBA (NPS, 2014c). The District of Columbia has 23 National Parks and 74 NHLs (NPS, 2015c). Visitors to these areas expect lower ambient noise conditions than the surrounding urban areas. See Section 5.1.8, Visual Resources for more information about national parks in the District of Columbia.

5.1.13.4. 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 wards in the District of Columbia have at least one school, church, or park, in addition to likely having other noise-sensitive receptors. There are most likely hundreds of sensitive receptors in the District of Columbia.

5.1.14. Climate Change

5.1.14.1. Definition of the Resource

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

Accelerated rates of climate change are linked to an increase in atmospheric concentrations of greenhouse gas (GHG) caused by emissions from human activities such as burning fossil fuels to generate electricity (USEPA, 2012c). The IPCC is now 95 percent certain that human activities are the primary cause of current global warming (IPCC, 2013). Human activities result in emissions of four main GHGs: 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 million metric tons of CO_{2e},[132] which equalizes for the different global warming potential of each type of GHG. Where this document references emissions of CO_2 only, the units will be in million metric tons (MMT) CO_2. Where the document references emissions of multiple GHGs, the units will be in MMT CO_{2e}.

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

[132] 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, 2015p)

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, will be considered in this PEIS (see Section 5.2.14, Environmental Consequences). Existing climate conditions in the project area are described first by District and sub-region, where appropriate, and then by future projected climate scenarios. The discussion will focus on the following climate change impacts: (1) temperature; (2) precipitation; (3) sea level; and (4) severe weather events (including tropical storms, tropical cyclones, and hurricanes).

5.1.14.2. Specific Regulatory Considerations

The pertinent federal laws relevant to the protection and management of climate change are summarized in Appendix C. The District of Columbia has established goals and regulations to reduce GHG emissions to combat climate change. As shown in Table 5.1.14-1, "Climate of Opportunity: A Climate Action Plan for the District of Columbia" is the primary policy driver on climate change preparedness and GHG emissions.

Table 5.1.14-1: Applicable District of Columbia Climate Change Statues and Regulations

District Law/Regulation	Regulatory Agency	Applicability
Climate of Opportunity: A Climate Action Plan for the District of Columbia	DDOE	"The District Government is committing to reduce its emissions by 20 percent below 2006 levels by 2012, 30 percent below 2006 levels by 2020, and 80 percent below 2006 levels by 2050." (DOEE, 2010)

5.1.14.3. District of Columbia Greenhouse Gas Emissions

Estimates of the District of Columbia's total GHG emissions vary. The Department of Energy's Energy Information Agency (EIA) collects and disseminates national-level emissions data on other GHGs such as CH_4 and NO_x, but these are not broken down by state (EIA, 2011). The USEPA also collects and disseminates national-level GHG emissions data, but by economic sector, not by state (USEPA, 2014d). Individual states have developed their own GHG inventories and these are updated with different frequencies and trace GHG in different ways.

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

According to the EIA, energy-related activities in the District of Columbia emitted 2.8 MMT of CO_2 in 2013 (a slight increase over 2012), with the transportation and commercial sectors being the largest emitters. Annual emissions between 1980 and 2013 are presented in Table 5.1.14-2 and Figure 5.1.14-1. Most of the source of CO_2 from these are natural gas and petroleum products (EIA, 2015e). The overall trend in emissions has been steadily downward, led primarily by reductions in the use of petroleum products by the transportation sector. The

District of Columbia has the lowest total CO_2 emissions compared to the 50 states, and the lowest per-capita emission as well (EIA, 2015f).

Table 5.1.14-2: District of Columbia CO_2 Emissions by Fuel Type and Source, 2013

Fuel Type (MMT)		Source (MMT)	
Coal	0.0	Residential	0.8
Petroleum Products	1.0	Commercial	1.0
Natural Gas	1.8	Industrial	0.0
		Transportation	1.0
		Electric Power	0.0
TOTAL	2.8	**TOTAL**	2.8

Source: (EIA, 2015e)

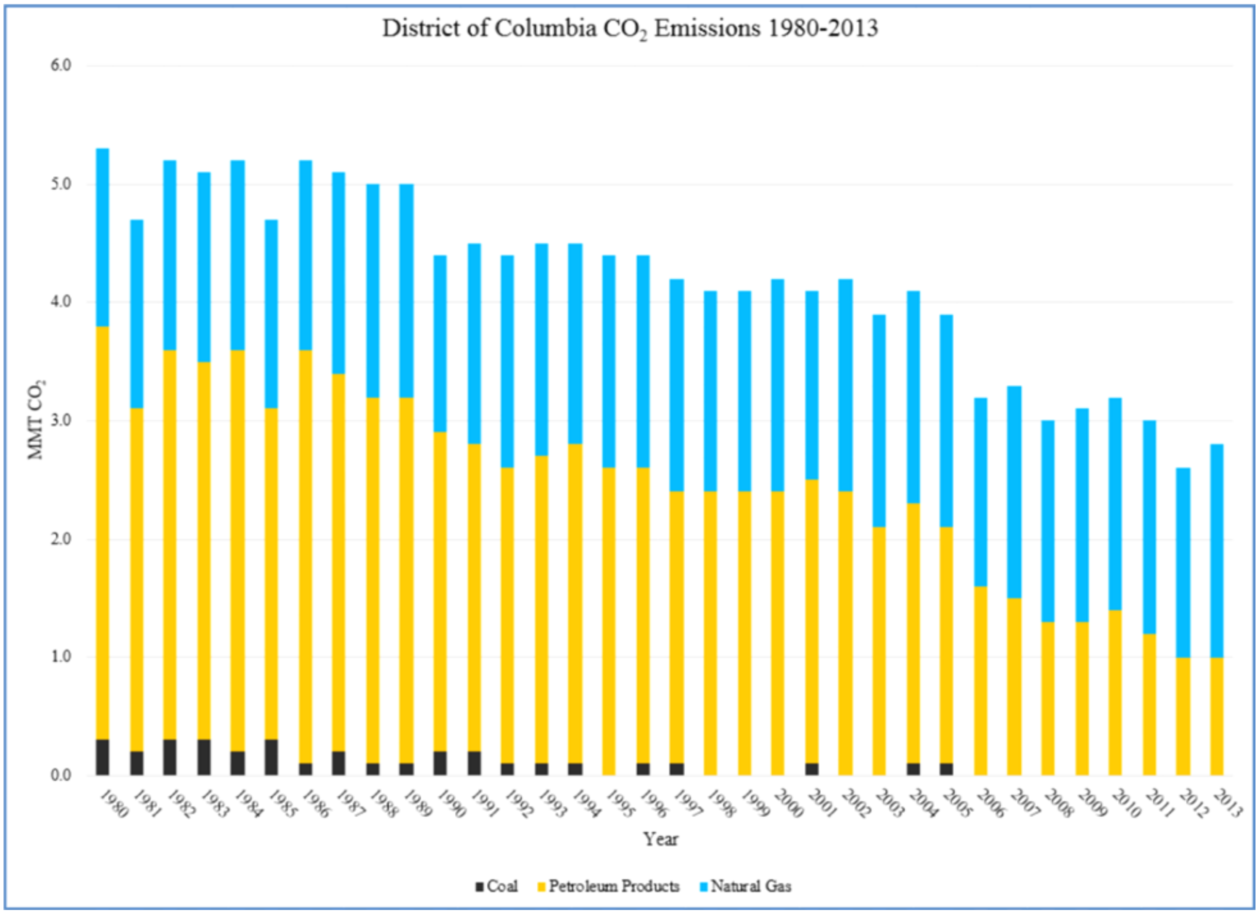

Figure 5.1.14-1: District of Columbia CO_2 Emissions from Fossil Fuels by Fuel Type 1980-2013

Source: (EIA, 2015e)

The District of Columbia maintains its own GHG inventory, which was most recently updated in 2011. The majority of GHG emissions is CO_2: other GHGs emitted in the District aside from CO_2 are methane (CH_4) and nitrous oxide (NO_x). Total U.S. GHG emissions were 6,673 million metric tons (14.7 trillion pounds) CO_2e in 2013 (USEPA, 2014d). The inventory divides these emissions into two categories: Community-Wide Inventory and Government Operations (DDOE, 2011).

The District of Columbia GHG inventory estimates that in 2006, the District of Columbia Government emitted 686,000 MT of CO_2e (DDOE, 2011). Emissions came from energy related activities across all sectors such as wastewater treatment, emissions from vehicles, and street lighting. Wastewater and facility emissions for government operations contributed the most GHG emissions at 22.9 percent and 55.9 percent, respectively. The District operates 550 government facilities and as a result, emissions from the non-residential sector is the largest category of energy use from buildings such as schools, recreation facilities, and police stations (DDOE, 2011). The District's Blue Plains Advanced Wastewater Treatment Facility treats and processes wastewater for roughly 2,153,368 people and was responsible for 152,000 metric tons of CO_2e in 2006. The Blue Plains Plant had major efficiency upgrades, which resulted in a 21 percent drop in emissions by 2011 (DC Water, 2015h).

In 2006, the District's government and commercial vehicle fleet emissions dropped 21 percent with the use of fuel efficient vehicles, despite the vehicle fleet growing from 5,540 to 6,587. The Department of Public Work's Fleet Management Administration reduced emissions to 6.7 metric tons of CO_{2e} per vehicle in 2011 by using fuel-efficient or alternative-fueled vehicles (DDOE, 2011).

The District of Columbia's community-wide GHG inventory was much higher at 10.2 MMT with the largest share of emissions is attributed to building energy use at 74 percent and vehicle use at 22 percent (DDOE, 2011).

5.1.14.4. Environmental Setting: Existing Climate

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

Across the United States, the five most common climate groups are (A), (B), (C), (D), and (E). The District of Columbia falls into climate group (C) (see Figure 5.1.14-2). Climates classified as (C) are generally warm, with humid summers and mild winters (NWS, 2011a) (NWS, 2011b). The District of Columbia's secondary classification indicates year-round rainfall, but it is highly variable; convective thunderstorms are dominant during summer months. During winter months, "the main weather feature is the mid-latitude cyclone" (NWS, 2011a) (NWS, 2011b).

The tertiary classification indicates mild, hot summers with average temperature of warm months over 72 °F. Average temperatures of the coldest months are under 64 °F (NWS, 2011a) (NWS, 2011b).

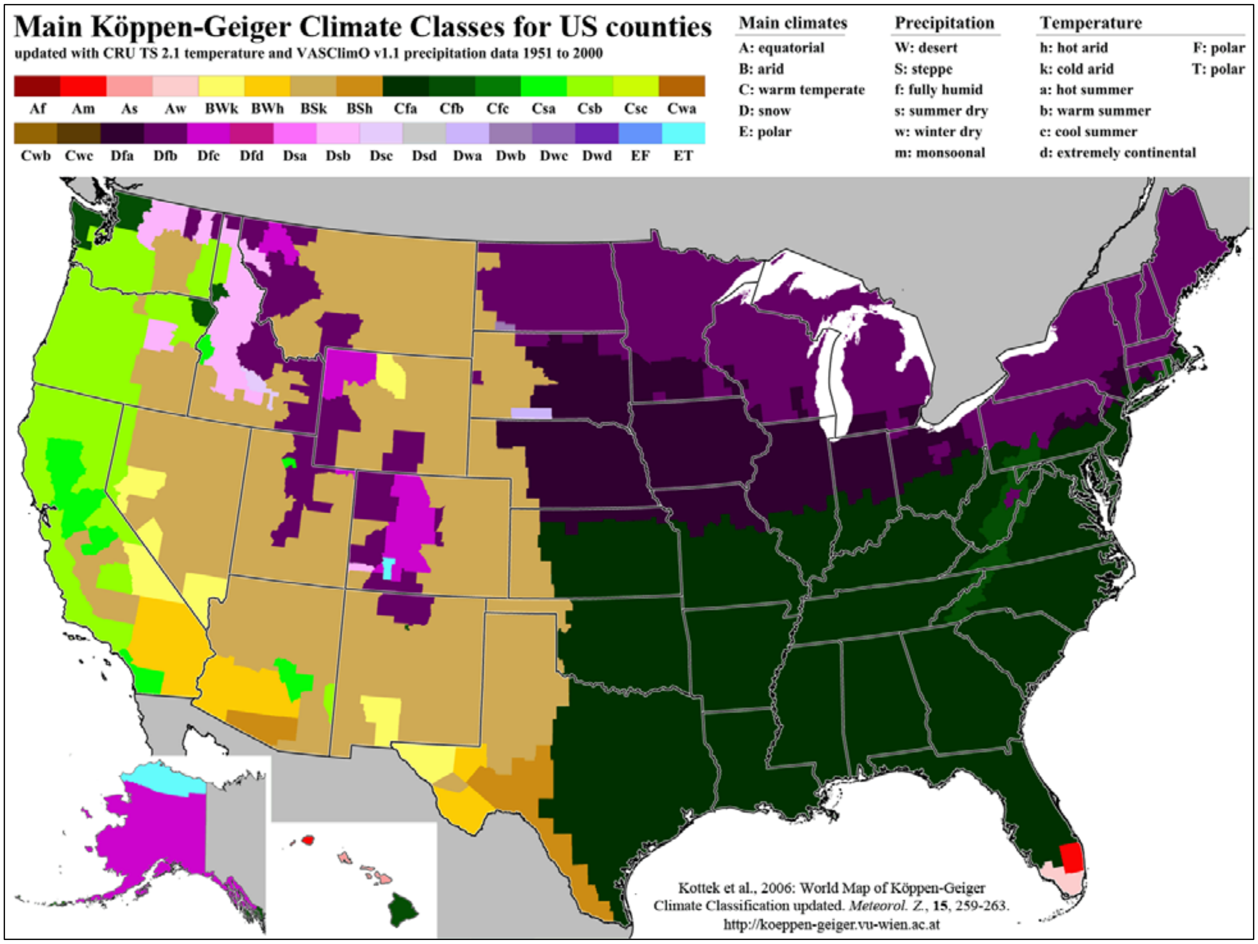

Figure 5.1.14-2: Köppen-Geiger Climate Classes for U.S. Counties

Source: (Kottek, Grieser, Beck, Rudolf, & Rubel, 2006)

This section discusses the current state of the District of Columbia's climate with regard to temperature, precipitation, sea level, stream flow, and extreme weather events (e.g., tropical storms, tropical cyclones, and hurricanes) in the District of Columbia's climate region, Cfa.

Air Temperature

Although the entirety of the District of Columbia is classified within the climate classification group Cfa, there are slight temperature variations within the District. Similar to Maryland, the District of Columbia varies greatly, 1 to 410[133] feet, in terms of topography and elevation (USGS, 2005b). "Temperate climates are noted for possessing four distinct seasons" (Maryland State Archives, 2015). Physically, the District of Columbia is along the Potomac River, the

[133] Other USGS sources (USGS, 2015a) identify Point Reno as 409 feet above MSL.

Anacostia River, and Rock Creek. The District is also near the Atlantic Ocean and the Blue Ridge Mountains. All of these geographic features play a role in the climate of the District (District of Columbia Open GIS Data, 2015).

The following paragraph describes temperatures in the District as they occur within a Cfa climate classification zone.

Cfa

The District of Columbia began reporting temperature values specific to the District in 1963. Since this time, annual temperatures in the District average approximately 54.6 °F (NOAA, 2015b). The National Arboretum is within the far northeastern corner of Washington, and has an average annual temperature of 57.5 °F (NOAA, 2015c). During winter months, the average annual temperature for the National Arboretum is 37.7 °F; 77.6 °F during summer months; 56.2 °F during spring months; and 59.2 °F during autumn months (NOAA, 2015c). The Dalecarlia Reservoir is in the far western corner of Washington, and the average annual temperature is 56.8 °F. During winter months, the average annual temperature for the Dalecarlia Reservoir is 36.5 °F; 76.4 °F during summer months; 55.6 °F during spring months; and 58.4 °F during autumn months (NOAA, 2015c). "Since 1907, average annual temperatures in the District have increased by approximately 3.3 °F" (DOEE, 2010).

Precipitation

Although the entirety of the District of Columbia is classified within the climate classification group Cfa, there are slight precipitation variations within the District.

Cfa

Topography within the District and its proximity to the several bodies of water and the mountains strongly influences the distribution of precipitation. In accordance with a temperate climate, the District of Columbia commonly has an even distribution of precipitation throughout the year, as there are no distinct wet or dry seasons. The District of Columbia began reporting precipitation values specific to the District in 1963. (NOAA, 2015b) Since this time, annual precipitation values in the District average approximately 41.38 inches. The National Arboretum, within the far northeastern corner of Washington, is within the climate classification group Cfa. The average annual precipitation accumulation for the National Arboretum is 43.53 inches (NOAA, 2015c). During winter months, the average annual precipitation accumulation for the National Arboretum is 9.19 inches; 11.81 inches during summer months; 11.51 inches during spring months; and 11.02 inches during autumn months (NOAA, 2015c). The Dalecarlia Reservoir, in the far western corner of Washington, is also within the climate classification group Cfa. The average annual precipitation accumulation for the Dalecarlia Reservoir is 45.66 inches. During winter months, the average annual precipitation accumulation for the Dalecarlia Reservoir is 9.27 inches; 12.66 inches during summer months; 12.10 inches during spring months; and 11.63 inches during autumn months (NOAA, 2015c).

In addition to rainfall, the District of Columbia commonly experiences snowfall accumulation during winter months, even if it is minimal. On average, the District receives 17.3 inches of total snowfall accumulation per year. The national average annual snowfall accumulation is 16.6 inches. In Dulles, Virginia (outside of the District of Columbia in northern Virginia), the average annual snowfall accumulation is 22.8 inches. January and February are typically the snowiest months in the District of Columbia, with 6.2 and 6.3 inches of average annual snowfall accumulation respectively. The earliest historical snowfall occurred on October 10, 1979 with a total accumulation of 0.03 inches. The latest historical snowfall occurred on April 28, 1898 with a total accumulation of 0.5 inches.

Sea Level

Globally, sea level is rising at approximately 0.08 inches per year (DOEE, 2010). A more rapid rise is occurring within the Chesapeake Bay, with approximately 0.14 inches of rise per year (DOEE, 2010). "The higher rate of sea level rise is the result of land subsidence or the erosion of land into the sea, which accounts for roughly half the Mid-Atlantic regional sea level rise" (DOEE, 2010). "The Potomac River has risen about one foot since 1933, most noticeably around the Tidal Basin" (DOEE, 2010). "Tropical Cyclone[134] Heat Potential has gone up more than 20% since 1900" (Holdren, 2015). "Many factors affect the formation and tracks of these storms, but, all else equal, a given cyclone will be more powerful in the presence of a warmer ocean and higher atmospheric water content than it would be otherwise" (Holdren, 2015). Consequently, "the higher local sea level rise, the worse the storm surge from any given cyclone will be" (Holdren, 2015). These risks, coupled with sea level rise and land subsidence, make the District of Columbia extremely vulnerable to increased flooding, storm surges, and inundation. Superstorm Sandy highlighted the risks and vulnerabilities of living near unprotected tidal shoreline (Holdren, 2015) (DOEE, 2010).

Severe Weather Events

Tornados, hurricanes, and tropical storms are all uncommon to the District of Columbia. The most common and destructive storms in the District of Columbia are Nor'easters" (NOAA, 2015d). Nor'easters develop when "dense cold air is unable to move west over the Appalachian Mountains and so it funnels south down the valleys and along the Coastal Plain" (NOAA, 2007). "East of the arctic air lies the warm water of the Gulf Stream" (NOAA, 2015d). This contrast, between "the cold air sinking into the Carolinas and warm air off the Carolina Coast creates a breeding ground for storms" (NOAA, 2015d). After this storm has developed, "it is quite common for the rain-snow line to fall right over the District" (NOAA, 2015d). "Heavy snow generally occurs in a narrow 50 mile-wide band about 150 miles northwest of the low pressures center" (NOAA, 2015d). "Perhaps the strongest nor'easter of this century struck on March 5-9, 1962" (NOAA, 2015d). This storm is referred to as the "Ash Wednesday Storm." Although this storm mostly affected the areas surrounding the District, the District still received heavy mixed precipitation. In total, this storm caused more than "$200 million (1962 dollars) in property damage and major coastal erosion from North Carolina to Long Island, NY." (NOAA, 2015d)

[134] The difference between hurricanes, cyclones, and typhoons is where the storm occurs. In the Atlantic and Northeast Pacific, the term "hurricane" is used. The same type of disturbance in the Northwest Pacific is called a "typhoon" and "cyclones" occur in the South Pacific and Indian Ocean (NOAA, 2014b). When speaking in general terms, cyclone is used.

Although ice storms are "more common in the valleys and foothills just east of the Appalachian Mountains then in Washington," damaging ice storms in the District do occur as well. For example, a particularly damaging storm occurred during January and February of 1994, and the District "was struck by a series of ice storms" (NOAA, 2015d). Due to this particular storm, many power lines were damaged or destroyed (NOAA, 2015d).

Other types of winter storm systems often bring one to four inches of total snowfall to the District. During the winter of 1996, following a nor'easter that left two feet of snow across much of the District, an unusually strong Alberta clipper passed through the metro area, dropping an additional four to five inches of snow. "The snow caused plows to move away from clearing secondary roads and residential areas and go back to plowing the main arteries and emergency routes." (NOAA, 2015d).

The biggest snowstorm to occur in the District of Columbia was on January 1922, with a total accumulation of 22 inches. Unofficially, the biggest snowstorm to occur in the District of Columbia was in January 1772, with a total accumulation of 36 inches. The snowiest month in the District of Columbia was February 1899, with a total accumulation of 35.2 inches. The snowiest season to occur in the District was during the winter of 2009 through 2010, with a total snowfall accumulation of 55.9 inches. (NOAA, 2015d)

5.1.15. Human Health and Safety

5.1.15.1. 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 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 RF radiation, vehicular traffic, or the transportation of hazardous materials and wastes. Vehicle traffic and the transportation of hazardous materials and wastes are evaluated in Section 5.1.1, Infrastructure.

5.1.15.2. Specific Regulatory Considerations

Federal organizations, such as the OSHA, USEPA, the U.S. Department of Health and Human Services, and others protect human health and the environment. In the District of Columbia, the DC Department of Employment Services (DOES) regulates public sector occupational safety, and DOEE regulates waste and environmental pollution.

Federal laws relevant to protecting occupational and public health and safety are summarized in Appendix C. Table 5.1.15-1 below summarizes the major District of Columbia laws relevant to the District's occupational health and safety, hazardous materials, and hazardous waste management programs.

Table 5.1.15-1: Relevant District of Columbia Human Health and Safety Laws and Regulations

District Law/Regulation	Regulatory Agency	Applicability
20 DCMR 42	DOEE	Standards for generators and transporters of hazardous waste, as well as release notification and record-retention requirements (20 DCMR 42, 2007)
D.C. Code §8-637.04	DOEE	Defines programs for voluntary cleanup of contaminated property, and details cleanup standards (D.C. Code, 2015).
D.C. Code §32-11	DOES	Regulations for enforcement of federal occupational safety and health standards, workplace inspections, and procedures to counteract immediate danger (D.C. Code, 2012).

5.1.15.3. Environmental Setting: Existing Telecommunication Sites

There are many inherent health and safety hazards at telecommunication sites. Telecommunication site work is performed indoors, below ground level, on building roofs, over waterbodies, and on communication towers. Tasks are often performed at dangerous heights, inside trenches or confined spaces, while operating heavy equipment, on energized equipment near underground and overhead utilities, and while using hazardous materials, such as flammable gases and liquids. Because telecommunication workers are often required to perform work outside, heat and cold exposure, precipitation, and lightning strikes also present hazard and risks depending on the task, occupational competency, and work-site monitoring (OSHA, 2016a). A summary description of the health and safety hazards present in the telecommunication occupational work environment is listed below.

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

Trenches and confined spaces – Installation of underground utilities, building foundations, and work in utility manholes[135] are examples of when confined space work is necessary. Installation of telecommunication activities involves laying conduit and in small trenches (generally 6 to 12 inches in width). Confined space work can involve poor atmospheric conditions, requiring

[135] 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.

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. (OSHA, 2016b)

Heavy equipment and machinery – New and replacement facility deployment and maintenance can involve the use of heavy equipment and machinery. During the lifecycle of a telecommunication site, heavy equipment such as bulldozers, backhoes, dump trucks, cement trucks, and cranes are used to prepare the ground, transport materials and soil, and raise large sections of towers and antennas. Telecommunication workers may be exposed to the additional site traffic and often work near heavy equipment to direct the equipment drivers and to accomplish work objectives. Accessory machinery such as motorized pulley systems, hydraulic metal shears, and air driven tools present additional health and safety risks as telecommunication work sites. These pieces of machinery can potentially sever skin and bone, or cause other significant musculoskeletal injuries to the operator. (OSHA, 2016b)

Energized equipment and existing utilities – Electrical shock from energized equipment and utilities is an elevated risk at telecommunication sites due to the amount of electrical energy required for powering communication equipment and broadcasting towers. Telecommunication cables are often co-located with underground and overhead utilities, which can further increase occupational risk during earth-breaking and aerial work. (International Finance Corporation, 2007)

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

Noise – Sources of excess noise at telecommunication sites include heavy equipment operation, electrical power generators and other small engine equipment, air compressors, electrical and pneumatic power tools, and road vehicles, such a diesel engine work trucks. The cumulative noise environment has the potential to exceed the OSHA acceptable level of 85 dB per 8-hour time weighted average (see Section 5.1.13, Noise) (OSHA, 2002). Fugitive noise may emanate beyond the telecommunication work site and affect the public living in the vicinity, observing the work, or transiting through the area. (OSHA, 2016b)

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

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

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

Telecommunication Worker Occupational Health and Safety

The 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 1 of 840 occupations. Telecommunications occupations are identified as telecommunication equipment installers and repairers, except line installers (SOC code 49-2022) or telecommunication line installers and repairers (SOC code 49-9052). Both occupations are reported under the installation, maintenance and repair occupations (SOC code 49-0000).

As of May 2014, the District of Columbia employed 480 telecommunication line installers and repairers, and 660 telecommunication equipment installers and repairers (BLS, 2015b). In 2013, the most recent data available, the District of Columbia had 0.8 reportable cases of nonfatal occupational injuries or illnesses in the telecommunications industry per 100 full-time workers (BLS, 2013a). By comparison, there were 2.1 nonfatal occupational injuries or illnesses reported nationwide per 100 full-time workers in the telecommunications industry (BLS, 2014a).

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

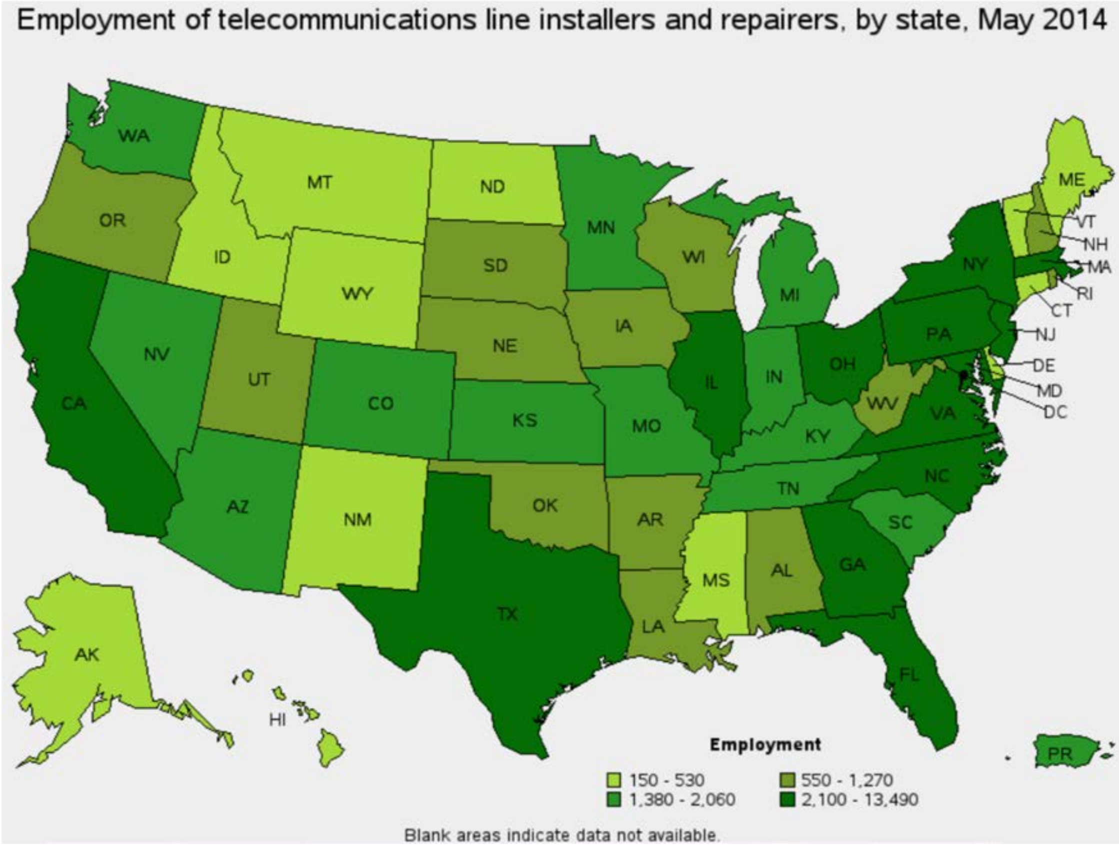

Figure 5.1.15-1: Number of Telecommunication Line Installers and Repairers Employed per State, May 2014

Source: (U.S. Census Bureau, 2013)

Public Health and Safety

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

5.1.15.4. Contaminated Properties at or near Telecommunication Sites

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

Contaminated property is typically classified by the federal environmental remediation or cleanup programs that govern them, such as sites administered through the Superfund Program[136] or listed on the National Priorities List, as well as the Resource Conservation and Recovery Act (RCRA) Corrective Action sites and Brownfields. These regulated cleanup sites are known to contain environmental contaminants at concentrations exceeding acceptable human health exposure thresholds. Contact with high concentrations of contaminated media can result in adverse health effects, such as dermatitis, pulmonary and cardiovascular events, organ disease, central nervous system disruption, birth defects, and cancer. It generally requires extended periods of exposure over a lifetime for the most severe health effects to occur.

The DOEE Remediation and Site Response Program is responsible for directing and assisting with cleanup at contaminated sites on District land, such as the Anacostia River, CSX Benning Yard, and Riggs Park. As of September 2015, the District of Columbia had two RCRA Corrective Action sites[137] (USEPA, 2015l) and one final Superfund/National Priority List site (USEPA, 2014e). Based on a September 2015 search of USEPA's Cleanups in My Community (CIMC) database, the District of Columbia has no Superfund sites where human exposure risk exists. Brownfield sites in the District of Columbia can enroll in the District's Voluntary Cleanup Program (VCP), designed to create incentives for the voluntary cleanup of contaminated brownfield properties (DOEE, 2015c). According to the DOEE, there are currently 20 active VCP sites and 15 completed VCP sites in the District (DOEE, 2015d).

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 of 1986. The TRI database is a measure of the industrial nature of an area and the over-all chemical use, and can be used to track trends in releases over time. The "releases" do not necessarily equate to chemical exposure by human beings 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 September 2015, the District of Columbia had 11 TRI reporting facilities. According to the USEPA, in 2013, the most recent data available, the District of Columbia released 773,327 pounds of toxic chemicals through onsite and offsite disposal, transfer, or other releases; 99.89 percent were from the Potomac Power Resources Benning Generating Station. While the District of Columbia only accounts for 0.02 percent of total nationwide TRI releases, it ranks as having the highest number of total releases per square mile of all 56 states and territories. (USEPA, 2014f)

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

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

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.

Spotlight on District of Columbia Superfund Sites: Washington Navy Yard

The Washington Navy Yard began as a shipbuilding facility in 1799, and currently occupies approximately 63 acres along the Anacostia River. The Navy Yard primarily produced ordinance until 1962, when most of the land was sold to the General Services Administration, and it became an administrative center. As the facility grew, more land was created by filling in areas along the Anacostia River. Multiple types of contamination have been confirmed at the site, resulting from historical and current industrial operations. In 1988, the Washington Navy Yard prepared a report detailing the presence of a petroleum release in soil and groundwater at the site. The Washington Navy Yard was listed on the National Priorities List in 1998, due to contamination detected in both the Anacostia River, and onsite soil and sediment. (ATSDR, 2010)

Figure 5.1.15-2: Washington Navy Yard Aerial View, Washington, D.C.

Source: (CNIC Commandant, Naval District Washington, 2015)

A major contaminant found on the site is lead, originating from lead-based paint peeling from the surface of onsite buildings. Other contaminants include trivalent and hexavalent chromium, PCBs, polycyclic aromatic hydrocarbons, mercury, dioxins, and volatile organic compounds. (USEPA, 2015n)

The National Institute of Health, U.S. National Library of Medicine, provides an online mapping tool called TOXMAP, which allows users to "visually explore data from the USEPA's TRI and Superfund Program" (National Institute of Health, 2015a). Figure 5.1.15-3 provides an overview of potentially hazardous sites in the District of Columbia.

In addition to hazardous waste contamination, another health and safety hazard includes surface and subterranean mines. Health and safety hazards known to be present at active mines and abandoned mine lands include falling into open shafts, cave-ins from unstable rock and decayed support, deadly gases and lack of oxygen inside the mine, unused explosives and toxic chemicals, horizontal and vertical openings, high walls, and open pits (Federal Mining Dialogue, 2015). Gradual settling or sudden sinking of the Earth's surface, also known as subsidence, presents additional risks and is further discussed in Section 5.1.3, Geology. As of May 2015, there were no high priority abandoned mine lands (sites posing health and safety hazards) in the District of Columbia. (DOI, Office of Surface Mining Reclamation and Enforcement, 2015).

Telecommunication Worker Occupational Health and Safety

Telecommunications sites may be on or near contaminated land, industrial discharge facilities, or sites presenting additional hazards. Occupational exposure to contaminated environmental media can occur during activities like soil excavating, trenching, other earthwork, and working over waterbodies. Indoor air quality may be impacted from vapor intrusion infiltrating indoors from contaminated soil or groundwater that are present beneath a building's foundation. The District of Columbia has not reported fatalities within the telecommunications industry or telecommunications occupations since 2003, when data are first available (BLS, 2015c). By comparison, BLS reported three fatalities in 2011 and three preliminary fatalities in 2014 nationwide within the telecommunications industry (NAICS code 517), due to exposure to harmful substances or environments (BLS, 2015d). In 2014, BLS also reported four preliminary fatalities within the telecommunications line installers and repairers occupation (SOC code 49-9052), and no fatalities within the telecommunications equipment installers and repairers occupation (SOC code 49-2022) due to exposure to harmful substances or environments (BLS, 2014b).

Public Health and Safety

As described earlier, access to telecommunication sites is nearly always restricted to occupational workers. Although site access control is one of the major reasons telecommunication sites present an inherent low risk to non-occupational workers, the public could be potentially exposed to contaminants and other hazards in a variety of ways. One example would be if occupational workers disturb contaminated soil while digging, causing hazardous chemicals to mix with an underlying groundwater drinking water sources. If a contaminant enters a drinking water source, the surrounding community could inadvertently ingest or absorb the contaminant when using that source of water for drinking, cooking, bathing, and swimming. By trespassing on a restricted property, a trespasser may come in contact with contaminated soil or surface water, or by inhaling harmful vapors. The DC Department of Health is responsible for collecting public health data resulting from exposure to environmental contamination, and provides publicly available health assessments (DC Department of Health, 2015).

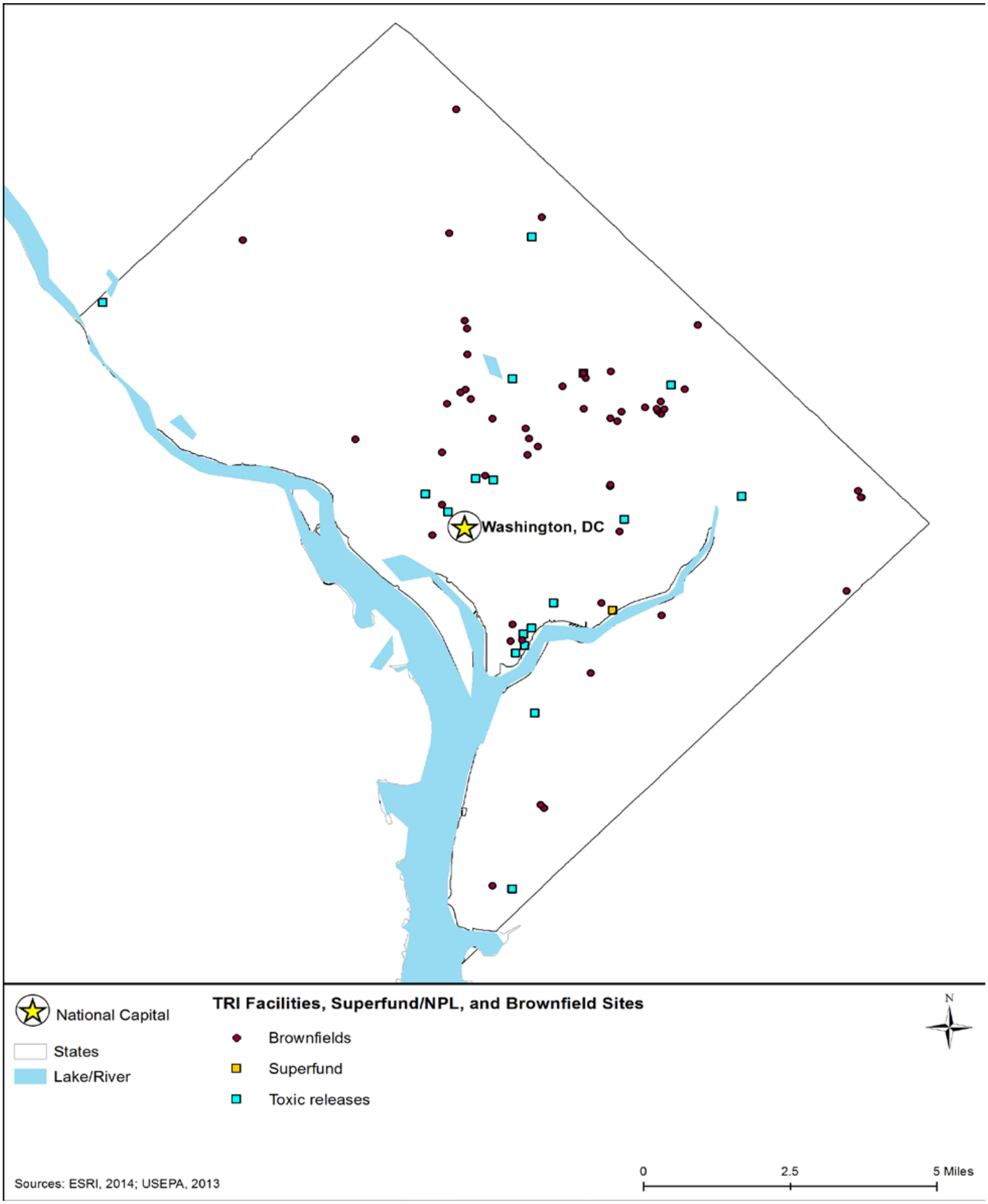


Figure 5.1.15-3: TOXMAP Superfund/National Priorities List and TRI Facilities in District of Columbia (2013)

Source: (National Institute of Health, 2015b)

5.1.15.5. Environmental Setting: Natural and Manmade Disaster Sites

Natural and manmade disaster events can create health and safety risks, as well as present unique hazards, to telecommunication workers and the public. Telecommunications, including public safety communications, can be unavailable (temporarily or permanently) during disaster events. Examples of manmade disasters are train derailments, refinery fires, or other incident involving the release of hazardous constituents. A common example of a natural disaster is flooding. Floodwaters damage transportation infrastructure (roads, railways, etc.) and utility lines (sewer, water, electric power, broadband, natural gas lines, etc.). Hazardous chemicals and sanitary wastes often contaminate floodwaters, which can cause headaches, skin rashes, dizziness, nausea, excitability, weakness, fatigue, and disease to exposed workers (OSHA, 2003). High-risk targets for terror attacks include government centers, military bases, industrial facilities, and airfields, etc. As such, the District of Columbia presents an inherent risk for this type of disaster.

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

Telecommunication Worker Occupational Health and Safety

Telecommunication workers are often early responders 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, DOES 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, 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. In June 2012 for example, during a contractor utility service operation (not telecommunications) in the District of Columbia, a natural gas service line exploded (cause unknown), resulting in road closures and a fire that hospitalizing four individuals (U.S. Coast Guard, 2012). Such incidents present potential unique, hazardous challenges to telecommunication workers responding during natural disasters.

Public Health and Safety

Hazards present during natural and manmade disasters are often ubiquitous, affecting large geographic areas and 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. According to the National Response Center, although not a telecom-related incident, an incident in the District of Columbia involved a release of refrigerant gas due to a tubing rupture in an air conditioning system. One person was killed from the release of approximately 200 pounds of gas (U.S. Coast Guard, 2012). The District of Columbia has not reported a weather-related fatality or injury since 2011 (one fatality due to a winter storm) (NWS, 2012a). For comparison, nationwide in 2011 there were 1,096 total reported weather-related fatalities (NWS, 2012b), 17 due to winter storms. (NWS, 2012a)

5.2. Environmental Consequences

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

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

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

5.2.1. Infrastructure

5.2.1.1. Introduction

This section describes potential impacts to infrastructure in the District of Columbia associated with construction, deployment, and operation of the Proposed Action and Alternatives. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

5.2.1.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on infrastructure were evaluated using the significance criteria presented in Table 5.2.1-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

5.2.1.3. 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 5.2.1-1, such impacts would be less than significant due to the temporary nature of the deployment activities, even if such impacts would be realized at one or more isolated locations. Such impacts would be noticeable during the deployment phase, but would be short-term, with no anticipated impacts continuing into the operational phase, unless any large-scale maintenance would become necessary during operations.

Table 5.2.1-1: Impact Significance Rating Criteria for Infrastructure

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Transportation system capacity and safety	Magnitude or Intensity	Creation of substantial traffic congestion/delay and/or a substantial increase in transportation incidents (e.g., crashes, derailments)	Effect that is potentially significant, but with mitigation is less than significant	Minimal change in traffic congestion/delay and/or transportation incidents (e.g., crashes, derailments)	No effect on traffic congestion or delay, or transportation incidents
	Geographic Extent	Regional impacts observed throughout the state/territory/District		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 or District)		Impacts only at a local/neighborhood level	NA
	Duration or Frequency	Duration is constant during construction and deployment phase		Rare event during construction and deployment phase	NA

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

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

NA = not applicable

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

The capacity of local health, public safety, and emergency response services would experience less than significant impacts during deployment or operation phases. During deployment and system optimization, existing services would likely remain operational in a redundant manner ensuring continued operations and availability of services to the public. The only potential impact would be extremely rare – and that is if emergency response services were using transportation infrastructure to respond to an emergency at the exact time that deployment activities were taking place. This type of impact would be isolated at the local or neighborhood level, and the likelihood of such an impact would be extremely low. Once operational, the new network would provide beneficial impacts to the capacity of first responders through enhanced communications infrastructure, thereby increasing capacity for and enhancing the ability of first responders to communicate during emergency response situations. Based on the impact significance criteria presented in Table 5.2.1-1, such potential negative and positive impacts would be less than significant.

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 5.2.1-1, 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, District and local public safety organizations would need to evaluate telecommunication practices and standard operating procedures (SOPs). FirstNet's mission is to compliment such practices and SOPs in a positive manner; therefore, only beneficial or complimentary impacts would be anticipated. Public safety communication capabilities and response times would be expected to also experience such beneficial impacts through enhance communications abilities. It is possible that FirstNet would be upgrading physical telecommunications infrastructure, thus such infrastructure would also experience a positive and beneficial impact. Disposal or reuse of old public safety communications infrastructure would also likely need to be considered once the specifics are known.

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

Commercial telecommunication systems, communications, or level of service would experience no impacts, as such commercial assets would be using a different spectrum for communications. FirstNet has exclusive rights to use of the assigned spectrum, and only designated public safety organizations would be authorized to connect to FirstNet's network. Depending on the use patterns of FirstNet's spectrum, such spectrum use may be over-built or under-utilized.[138] Such leases would then have less than significant positive impacts on commercial telecommunication systems, communications, or level of service, per the impact significance criteria presented in Table 5.2.1-1.

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

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

5.2.1.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to infrastructure and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to infrastructure under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to infrastructure resources since the activities that would be

[138] 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.

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 on infrastructure resources because there would be no ground disturbance and no interference with existing utility, transportation, or communication systems.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the use of portable devices that use satellite technology would not impact infrastructure resources because there would be no change to the built or natural environment from the use of portable equipment. Installation of satellite-enabled equipment would not be expected to have any impacts to infrastructure resources, given that construction activities would occur on existing structures, would not be expected to interfere with existing equipment, and transportation capacity and safety, and access to emergency services would not be impacted.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact infrastructure resources, it is anticipated that this activity would have no impact on infrastructure resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to infrastructure as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur as a result of direct interface with existing infrastructure, most notably existing telecommunication infrastructure. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to infrastructure include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of points of presence (POPs)[139], huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to infrastructure resources, depending on the specific assets connected on either end of the buried fiber. If a fiber optic plant is being used to tie into existing telecommunications assets, then localized impacts to telecommunications sites could occur during the deployment phase, however, it is anticipated that this tie-in would cause less than significant impacts as the activity would be temporary and minor.
  - New Build – Aerial Fiber Optic Plant: Installation of a new aerial fiber optic plant could impact new telecommunications infrastructure through the installation of new, or replacement of existing, telecommunications poles.

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

  - Collocation on Existing Aerial Fiber Optic Plant: Similar to new build activities (above), collocation on existing aerial fiber optic plant could include installation of new or replacement towers requiring ground disturbance.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water would not impact infrastructure resources because there would be no local infrastructure to impact, other than harbor operations. However, impacts to infrastructure resources could potentially occur as result of the construction of landings and/or facilities on shores or the banks of waterbodies 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 to 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 can enhance public safety infrastructure, and other telecommunications as the site could potentially be available for subsequent collocation.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to soils. However, if additional power units are needed, structural hardening, and physical security measures required ground disturbance, such as grading, or excavation activities, impacts to soil resources could occur, including soil erosion and topsoil mixing, as well as soil compaction and rutting associated with heavy equipment use.
  - Deployable Technologies: Deployable technologies such as COWs, COLTs, and SOWs are composed of cellular base stations, sometimes with expandable antenna masts, and generators that connect to utility power cables. Connecting the generators to utility power cables has the potential to disrupt electric power utility systems or cause power outages; however, this is expected to be temporary and minor. Some staging or landing areas (depending on the type of technology) could require minor construction and maintenance within public road ROWs and utility corridors, heavy equipment movement, and minor excavation and paving near public roads, which have the potential to impact transportation capacity and safety as these activities could increase transportation

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

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

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

Operation Impacts

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

Numerous beneficial impacts would be associated with operation of the NPSBN. The new system is intended to result in substantial improvements in public safety response times and the ability to communicate effectively with and between public safety entities, and would 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. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to further avoid or minimize potential impacts.

5.2.1.5. Alternatives Impact Assessment

The following section assesses potential impacts to infrastructure associated with the Deployable Technologies Alternative and the No Action Alternative.[140]

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to infrastructure as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to infrastructure even if deployment requires expansion of infrastructure, such as paving of previously unpaved surfaces or other new infrastructure built to support deployment. This is primarily due to the small amount of paving or new infrastructure that might have to be constructed to accommodate the deployables. The site-specific location of deployment would need to be considered, and any local infrastructure assets (transportation, telecommunications, or utilities) would need to be considered, planned for, and managed accordingly to try and avoid any negative impacts to such resources. Beneficial impacts could be realized, as deployable technologies are used when other infrastructure is impaired in some way; so deployable technologies could provide continuity of service during emergency events.

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

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to infrastructure resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment, as part of routine maintenance or inspection occurs off 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. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to further avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated deployment or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to infrastructure as a result of deployment and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 5.1.1, Infrastructure. The District also would not realize positive, beneficial impacts to infrastructure resources described above.

5.2.2. Soils

5.2.2.1. Introduction

This section describes potential impacts to soil resources in the District of Columbia associated with deployment and operation of the Proposed Action and Alternatives. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

5.2.2.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on soil resources were evaluated using the significance criteria presented in Table 5.2.2-1. As described in Section 5.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

5.2.2.3. 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 the District of Columbia and other areas with similar geography and weather patterns is the erosion of construction site soils to natural waterways, where the sediment can impair water and habitat quality, and potentially affect aquatic plants and animals (NRCS, 2000). Areas exist in the District of Columbia that have steep slopes (i.e., greater than 20 percent) or where the erosion potential is medium to high, including locations with Fluvents, Udepts, and Udults (see Section 5.1.2.3, Soil Suborders, and Figure 5.1.2-2).

Based on the impact significance criteria presented in Table 5.2.2-1, building of some of FirstNet's network deployment sites could cause potentially significant erosion at locations with highly erodible soil and steep grades. For the majority of projects, impacts to soils would be expected to be less than significant given the short-term and temporary duration of the activities.

To the extent practicable, FirstNet would attempt to minimize ground-disturbing construction in areas with high erosion potential due to steep slopes or soil type. Where construction is required in areas with a high erosion potential, FirstNet could implement BMPs and mitigation measures would, where practicable and feasible, be implemented to avoid or minimize impacts, and minimize the periods when exposed soil is open to precipitation and wind (see Chapter 17).

Topsoil Mixing

The loss of topsoil (i.e., organic and mineral topsoil layers) by mixing is a potential impact at all ground disturbing construction sites, including actions requiring clearing, excavation, grading, trenching, backfilling, or site restoration/remediation work.

Based on impact significance criteria presented in Table 5.2.2-1, and due to the relatively small-scale (less than 1 acre) of most FirstNet project sites.

Table 5.2.2-1: Impact Significance Rating Criteria for Soils

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Soil erosion	Magnitude or Intensity	Severe, widespread, and observable erosion in comparison to baseline, high likelihood of encountering erosion-prone soils	Effect that is potentially significant, but with mitigation is less than significant	Perceptible erosion in comparison to baseline conditions; low likelihood of encountering erosion-prone soil types	No perceptible change in baseline conditions
	Geographic Extent	State or territory		Region or county	NA
	Duration or Frequency	Chronic or long-term erosion not likely to be reversed over several years		Isolated, temporary, or short-term erosion that that is reversed over few months or less	NA
Topsoil mixing	Magnitude or Intensity	Clear and widespread mixing of the topsoil and subsoil layers	Effect that is potentially significant, but with mitigation is less than significant	Minimal mixing of the topsoil and subsoil layers has occurred	No perceptible evidence that the topsoil and subsoil layers have been mixed
	Geographic Extent	State or territory		Region or county	NA
	Duration or Frequency	NA		NA	NA
Soil compaction and rutting	Magnitude or Intensity	Severe and widespread, observable compaction and rutting in comparison to baseline	Effect that is potentially significant, but with mitigation is less than significant	Perceptible compaction and rutting in comparison to baseline conditions	No perceptible change in baseline conditions
	Geographic Extent	State or territory		Region or county	NA
	Duration or Frequency	Chronic or long-term compaction and rutting not likely to be reversed over several years		Isolated, temporary, or short term compaction and rutting that is reversed over a few months or less	No perceptible change in baseline conditions

NA = not applicable

Soil Compaction and Rutting

Soil compaction and rutting at construction sites could involve heavy land clearing equipment such as bulldozers and backhoes, trenchers and directional drill rigs to install buried fiber, and cranes to install towers and aerial infrastructure. Soils with the highest potential for compaction or rutting were identified by using the STATSGO2 database (see Section 5.1.2.3, Soil Suborders). Based on impact significance criteria presented in Table 5.2.2-1, the risk of soil compaction and rutting resulting from FirstNet deployment would be very low, since no soils with a high potential for compaction and rutting were identified in the District.

5.2.2.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could deploy various types of facilities or infrastructure. Depending on the physical nature and location of FirstNet facilities or infrastructure and the specific action, some activities would result in potential impacts to soil resources and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to soil resources under the conditions described below:

- Wired Projects
    - Use of Existing Conduit – New Buried Fiber Optic Plant: Installation of fiber optic cable in existing conduit through existing hand-holes, pulling vaults, junction boxes, huts, and POP structures and would not impact soil resources because it would not produce perceptible changes to soil resources.
    - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would be conducted electronically through existing infrastructure, with no impacts to soil resources. If physical access is required to light dark fiber, it would be through existing hand holes, pulling vaults, junction boxes, huts, and similar existing structures.
- Satellites and Other Technologies
    - Satellite-Enabled Devices and Equipment: Deployment of temporary or portable equipment that use satellite technology, including COWs, COLTs, SOWs, satellite

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

Activities with the Potential to Have Impacts

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

- Wired Projects
    - New Build – Buried Fiber Optic Plant: New fiber optic cable installation usually requires trenching, plowing (including vibratory plowing), or directional boring, as well as construction of hand holes, pulling vaults, junction boxes, huts, and POP structures that require ground disturbance. Impacts from fiber optic plant installation and structure construction, as well as associated grading and restoration of the disturbed ground when construction is completed, could result in soil erosion, topsoil mixing, or soil compaction and rutting.
    - New Build – Aerial Fiber Optic Plant: Installation of new utility poles, and replacement/upgrading of existing poles and structures could potentially impact soil resources resulting from ground disturbance for pole/structure installation (soil erosion and topsoil mixing), and heavy equipment use from bucket trucks operating on existing gravel or dirt roads (soil compaction and rutting). Potential impacts to soils are anticipated to be small-scale and short-term.
    - Collocation on Existing Aerial Fiber Optic Plant: Topsoil removal, soil excavation, and excavated material placement during the replacement of poles and structural hardening could result in soil erosion and topsoil mixing. Heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in soil compaction and rutting.
    - New Build – Submarine Fiber Optic Plant: Installation of fiber optic plants in limited nearshore and inland bodies of water could potentially impact soil resources at and near the landings or facilities on shores or the banks of waterbodies that accept 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 are needed, structural hardening, and physical security measures required ground disturbance, such as grading, or excavation activities, impacts to soil resources could occur, including soil erosion and topsoil mixing, as well as soil compaction and rutting associated with heavy equipment use.
  - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to soil resources depending on the technology and location for deployment. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, COLTs) occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in soil erosion and topsoil mixing. Heavy equipment use associated with these activities may result in soil compaction and rutting. In addition, implementation of deployable technologies themselves could result in soil compaction and rutting if deployed in unpaved areas. Where technologies such as COWs, COLTs, and SOWs are deployed on existing paved surfaces, there would be no impacts to soil resources because there would be no ground disturbance.

In general, the abovementioned activities could potentially involve land/vegetation clearing, topsoil removal, excavation, excavated material placement, trenching or directional boring, construction of access roads, and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to soil resources associated with deployment of this infrastructure could include soil erosion, topsoil mixing, or soil compaction and rutting. These impacts are expected to be less than significant as the activity would likely be short term, localized to the deployment locations, and would return to normal conditions as soon as revegetation occurs, often by the next growing season. It is expected that heavy equipment would utilize existing roadways and utility rights-of-way for deployment activities. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

Operation Impacts

As described earlier, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there would be no impacts to soil resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or corridors, or if the acceptable load of the surface is exceeded, soil compaction and rutting impacts could result as explained above. The impacts are expected to be less than significant due to the temporary nature and small-scale of operations activities with the potential to create impacts. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to further avoid or minimize potential impacts.

5.2.2.5. Alternatives Impact Assessment

The following section assesses potential impacts to soils associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to soil resources as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to soil resources if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. In addition, impacts to soils could occur on paved surfaces if the acceptable load of the surface is exceeded. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in soil erosion and topsoil mixing. Heavy equipment use associated with these activities may result in soil compaction and rutting. In addition, implementation of deployable technologies themselves could also result in soil compaction and rutting if deployed in unpaved areas. However, these potential impacts are expected to be less than significant due to the small-scale and short term nature of the deployment. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to soil resources associated with routine inspections of deployable assets, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or corridors, or if the acceptable load of the surface is exceeded, less than significant soil compaction and rutting impacts could result as previously explained above. Finally, if deployable technologies are parked and operated with air conditioning for extended periods, the condensation water from the air conditioner could result in minimal soil erosion. However, it is anticipated that the potential soil erosion would result in less than significant impacts as described above. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to 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 soil resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 5.1.2, Soils.

5.2.3. Geology

5.2.3.1. Introduction

This section describes potential impacts to District of Columbia geology resources associated with deployment and operation of the Proposed Action and Alternatives. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

5.2.3.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on geology resources were evaluated using the significance criteria presented in Table 5.2.3-1. As described in Section 5.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

5.2.3.3. Description of Environmental Concerns

Environmental concerns regarding geology can be viewed as two distinct types, those that would potentially provide impacts to the project, such as seismic hazards, landslides, and volcanic activity, and those that would be impacts from the project, such as land subsidence, mineral and fossil fuel resources, paleontological resources, surface geology, bedrock, topography, physiography, and geomorphology. These concerns and their impacts on geology are discussed below.

Seismic Hazard

As discussed in Section 5.1.3.8 (Figure 5.1.3-4), the District of Columbia is not at risk for significant earthquake events. Based on the impact significance criteria presented in Table 5.2.3-1, seismic impacts from deployment or operation of the Proposed Action would have no impact on seismic activity; however, seismic impacts to the Proposed Action could be potentially significant if FirstNet’s deployment locations were within high-risk earthquake hazard zones. Given the potential for minor earthquakes in or near the District, some amount of infrastructure could be subject to earthquake hazards, in which case BMPs and mitigation measures (see Chapter 17) could help avoid or minimize the potential impacts.

Landslides

Similar to seismic hazards, another concern would be placement of equipment in areas that are highly susceptible to landslides. Equipment that is exposed to landslides is subject to misalignment, alteration, or, in extreme cases, destruction; all of these activities could result in connectivity loss.

As discussed in Section 5.1.3.8, (Figure 5.1.3-5) portions of the District of Columbia are at high risk of experiencing landslide events. The highest potential for landslides in the District of Columbia is in the eastern portion of the city, particularly along the Anacostia River. Based on the impact significance criteria presented in Table 5.2.3-1, potential impacts to landslides from deployment or operation of the Proposed Action would have less than significant impacts as it is likely that the project would attempt to avoid areas that are prone to landslides; however, landslide impacts to the Proposed Action could be potentially significant if FirstNet's deployment locations were within areas in which landslides are highly prevalent. Where infrastructure is subject to landslide hazards, BMPs and mitigation measures, as discussed in Chapter 17, could help avoid or minimize the potential impacts.

Table 5.2.3-1: Impact Significance Rating Criteria for Geology

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

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Duration or Frequency	NA		NA	NA
Land Subsidence	Magnitude or Intensity	High likelihood that a project activity could be located within an area with a hazard for subsidence (e.g., karst terrain)	Effect that is potentially significant, but with mitigation is less than significant	Low likelihood that a project activity could be located within an area with a hazard for subsidence	Project activity located outside an area with a hazard for subsidence
	Geographic Extent	Areas with a high hazard for subsidence (e.g., karst terrain) are highly prevalent within the state/territory/District		Areas with a high hazard for subsidence occur within the state/territory/District, but may be avoidable	Areas with a high hazard for subsidence do not occur within the state/territory/District
	Duration or Frequency	NA		NA	NA
Mineral and Fossil Fuel Resource impacts	Magnitude or Intensity	Severe, widespread, observable impacts to mineral and/or fossil fuel resources	Effect that is potentially significant, but with mitigation is less than significant	Limited impacts to mineral and/or fossil resources	No perceptible change in mineral and/or fossil fuel resources
	Geographic Extent	Regions of mineral or fossil fuel extraction areas are highly prevalent within the state/territory/District		Mineral or fossil fuel extraction areas occur within the state/territory/District, but may be avoidable	Mineral or fossil fuel extraction areas do not occur within the state/territory/District
	Duration or Frequency	Long-term or permanent degradation or depletion of mineral and fossil fuel resources		Temporary degradation or depletion of mineral and fossil fuel resources	NA
Paleontological Resources impacts	Magnitude or Intensity	Severe, widespread, observable impacts to paleontological resources	Effect that is potentially significant, but with mitigation is less than significant	Limited impacts to paleontological and/or fossil resources	No perceptible change in paleontological resources.

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Geographic Extent	Areas with known paleontological resources are highly prevalent within the state/territory/District		Areas with known paleontological resources occur within the state/territory/District, but may be avoidable	Areas with known paleontological resources do not occur within the state/territory/District
	Duration or Frequency	NA		NA	NA
Surface Geology, Bedrock, Topography, Physiography, and Geomorphology	Magnitude or Intensity	Substantial and measurable degradation or alteration of surface geology, bedrock, topography, physiographic characteristics, or geomorphological processes	Effect that is potentially significant, but with mitigation is less than significant	Minor degradation or alteration of surface geology, bedrock, topography that do not result in measurable changes in physiographic characteristics or geomorphological processes	No degradation or alteration of surface geology, bedrock, topography, physiographic characteristics, or geomorphologic processes
	Geographic Extent	State/territory/District		State/territory/District	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

Land Subsidence

As discussed in Section 5.1.3.8, portions of the District of Columbia are vulnerable to land subsidence due compaction following retreat of the Ice Age glaciers. Based on the impact significance criteria presented in Table 5.2.3-1, potential impacts to soil subsidence from deployment or operation of the Proposed Action would have less than significant impacts. However, subsidence impacts to the Proposed Action could be potentially significant to the Proposed Action if FirstNet's deployment locations were within areas at high risk to inundation from long-term land subsidence; however, where infrastructure is subject to land subsidence hazards, BMPs and mitigation measures, as discussed in Chapter 17, could help avoid or minimize the potential impacts.

Mineral and Fossil Fuel Resource Impacts

As discussed in Section 5.1.3.7, the District of Columbia does not contain mineral and fossil fuel resources. Therefore, there would be no impacts to mineral and fossil fuel resources resulting from deployment.

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 5.2.3-1, impacts to paleontological resources could be potentially significant if FirstNet's buildout/deployment locations uncovered paleontological resources during construction activities. As discussed in Section 5.1.3.7, fossils exist in/near the District of Columbia. It is anticipated that potential impacts to specific areas known to contain paleontological resources would be avoided, minimized, or mitigated, and any potential impacts would be limited and localized. Potential impacts to fossil resources should be considered on a site-by-site basis, and BMPs and mitigation measures (see Chapter 17) could further help avoid or minimize the potential impacts.

Surface Geology, Bedrock, Topography, Physiography, and Geomorphology

Equipment installation and construction activities that degrade or alter surface geology, bedrock, or topography could cause measurable changes in physiographic characteristics of an area's geology, topography, physiography, or geomorphology. Based on the impact significance criteria presented in Table 5.2.3-1, impacts could be potentially significant if FirstNet's deployment were to cause substantial and measurable degradation or alteration of surface geology, bedrock, topography, physiographic characteristics, or geomorphological processes. Construction activities related to the Proposed Action and Alternatives are likely to be minor and less than significant as the proposed activities are not likely to require removal of significant volumes of terrain and any rock ripping would likely occur in discrete locations and would be unlikely to result in large-scale changes to the geologic, topographic, or physiographic characteristics. When ground disturbance is required, BMPs and mitigation measures (see Chapter 17) could be implemented to help avoid or minimize the potential impacts.

5.2.3.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

Implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities have the potential to be impacted by geologic hazards, some activities could result in potential impacts to geology, and other activities would have no impacts. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure development scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to geology under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. In most cases, there would be no impacts to geologic resources since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts on geologic resources because there would be no ground disturbance.
- Satellites and Other Technologies
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact geologic resources, it is anticipated that this activity would have no impact on geologic resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to geologic resources, or resulting from geologic hazards due to implementation of the Preferred Alternative, would encompass a range of impacts that could occur as a result of ground disturbance activities, including loss of mineral and fuel resources and paleontological resources. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to geologic resources, or impacts from geologic hazards, include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POP huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to geologic resources due to associated ground disturbance, such as impacts to fuel and mineral resources or paleontological resources. Where equipment is installed in locations that are susceptible to landslides, minor earthquakes, or land subsidence, 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, minor earthquakes, or land subsidence, it is possible that equipment could be affected by that hazard.
  - Collocation on Existing Aerial Fiber Optic Plant: Replacement of utility poles and structural hardening, and associated use of heavy equipment during construction, could result in potential impacts to geologic resources due to associated ground disturbance. Where equipment is installed in locations that are susceptible to landslides, minor earthquakes, or land subsidence, it is possible that equipment could be affected by that hazard.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore or inland bodies of water is not expected to impact geologic resources. However, where landings and/or facilities for submarine cable are installed at locations that are susceptible to landslides, minor earthquakes, or land subsidence, it is possible that equipment could be affected by that hazard.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require ground disturbance in locations that are susceptible to geologic hazards (e.g., land subsidence, landslides, or minor earthquakes), it is possible that they could be affected by that hazard.
- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to geologic resources. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the installation of new wireless towers and associated structures or access roads could result in erosion or perturbation of geologic resources. Where equipment is installed in locations that are susceptible to landslides, minor earthquakes, or land subsidence, it is possible that equipment could be affected by that hazard.

  - 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 are needed, 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, minor earthquakes, or land subsidence, it is possible that equipment could be affected by that hazard.
  - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to geologic resources depending on the technology and location proposed for deployment. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, COLTs) occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. Where deployable technologies would be implemented on existing paved surfaces, there would be no impacts to/from geologic resources because there would be no ground disturbance and mobile technologies could be moved to avoid geologic hazards.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: In most cases, the installation of permanent equipment on existing structures, adding equipment to satellites launched for other purposes, or the use of portable devices that use satellite technology would not impact geologic resources because those activities would not require ground disturbance. Where equipment is installed in locations that are susceptible to landslides, minor earthquakes, or land subsidence, it is possible that equipment could be affected by that hazard. The use of portable satellite-enabled devices would not impact geologic resources nor would it be affected by geologic hazards because there would be no ground disturbance nor any impact to the built or natural environment.

In general, the abovementioned activities could potentially involve ground disturbance resulting from land/vegetation clearing, topsoil removal, excavation, excavated material placement, trenching or directional boring, construction of access roads and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to geological resources associated with deployment could include minimal removal of bedrock or mineral resources, or adverse impacts to installed equipment resulting from geologic hazards (e.g., minor earthquakes, landslides, and land subsidence). Specific FirstNet projects are likely to be small-scale; correspondingly, disturbance to geologic resources for those types of projects with the potential to impact geologic resources is also expected to be small-scale as a result, these potential impacts are expected to be less than significant. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to further avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be no impacts to geology associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections.

The operation of the Preferred Alternative could be affected by to geologic hazards including minor seismic activity, landslides, and land subsidence. However, potential impacts would be anticipated to be less than significant as it is anticipated that deployment locations would avoid, as practicable and feasible, locations that are more likely to be affected by potential seismic activity, landslides, or land subsidence. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to further avoid or minimize potential impacts.

5.2.3.5. 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) occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These impacts are expected to be less than significant due to the minor amount of paving or new infrastructure needed to accommodate the deployables. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to geologic resources (or from geologic hazards) associated with routine inspections of the Preferred Alternative.

The operation of the Deployable Technologies Alternative could be affected by to geologic hazards including seismic activity, landslides, and land subsidence. However, potential impacts would be anticipated to be less than significant as the deployment would be temporary and likely would attempt to avoid locations that was subject to increased seismic activity, landslides, and land subsidence. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to 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 geologic resources (or from geologic hazards) as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 5.1.3, Geology.

5.2.4. Water Resources

5.2.4.1. Introduction

This section describes potential impacts to water resources in the District associated with construction/deployment and operation of the Proposed Action and Alternatives. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

5.2.4.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on water resources were evaluated using the significance criteria presented in Table 5.2.4-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

Table 5.2.4-1: Impact Significance Rating Criteria for Water Resources

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Water Quality (groundwater and surface water) - sedimentation, pollutants, nutrients, water temperature	Magnitude or Intensity	Groundwater contamination creating a drinking quality violation, or otherwise substantially degrade groundwater quality or aquifer; local construction sediment water quality violation, or otherwise substantially degrade water quality; water degradation poses a threat to the human environment, biodiversity, or ecological integrity. Violation of various regulations including: CWA, SDWA	Effect that is potentially significant, but with mitigation is less than significant.	Potential impacts to water quality, but potential effects to water quality would be below regulatory limits and would naturally balance back to baseline conditions.	No changes to water quality; no change in sedimentation or water temperature, or the presence of water pollutants or nutrients.
	Geographic Extent/Context	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Chronic and long term changes not likely to be reversed over several years or seasons		The impact is temporary, lasting no more than six months.	NA

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*	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, territory, or District.	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, territory, or District.	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

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
	Duration or Frequency	Impact occurs in perennial streams, and is ongoing and permanent		The impact is temporary, lasting no more than six months.	NA
Flow alteration	Magnitude or Intensity	Consumptive use of surface water flows or diversion of surface water flows such that there is a measurable reduction in discharge	Effect that is potentially significant, but with mitigation is less than significant.	Minor or no consumptive use with negligible impact on discharge.	Activities do not impact discharge or stage of waterbody
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Impact occurs in perennial streams, and is ongoing and permanent		Impact is temporary, not lasting more than six months.	NA
Changes in groundwater or aquifer characteristics	Magnitude or Intensity	Substantial and measurable changes in groundwater or aquifer characteristics, including volume, timing, duration, and frequency of groundwater flow, and other changes to the groundwater hydrologic regime.	Effect that is potentially significant, but with mitigation is less than significant.	Any potential impacts to groundwater or aquifers are temporary, lasting no more than a few days, with no residual impacts	Activities do not impact groundwater or aquifers
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Impact is ongoing and permanent		Potential impact is temporary, not lasting more than six months.	NA

* Since public safety infrastructure is considered a critical facility, project activities should avoid the 500-year floodplain wherever practicable, per the Executive Orders on Floodplain Management (EO 11988 and EO 13690).
NA = not applicable

5.2.4.3. 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 District. Section 303(d) of the CWA requires states to identify impaired waters. For these impaired waters, states must consider the development of a Total Maximum Daily Load or other strategy to reduce the input of the specific pollutant(s) restricting waterbody uses, in order to restore and protect such uses.

All of the District of Columbia's surface waterbodies (rivers, streams, lakes, and ponds) are impaired (see Table 5.1.4-2, Figure 5.1.4-2). The main causes of impairment are polychlorinated biphenyls (PCBs), most likely from illegal dumping or waste disposal, fecal coliform from nonpoint[141] and point source[142] pollution from stormwater, and sewer overflows. Groundwater quality within the District is generally not suitable for drinking. (DDOE, 2012b) (USEPA, 2015c)

Deployment activities can contribute pollutants in a number of ways but the primary manner is increased sediment in surface waters. Vegetation removal on site exposes soils to rain and wind that can increase erosion. Impacts to water quality may occur from post-construction vegetation management, such as herbicides, that may leach into groundwater or move to surface waters through soil erosion or runoff, spray drift, or inadvertent direct overspray. Fuel, oil, and other lubricants from equipment can contaminate groundwater and surface waters if carried in runoff. Other water quality impacts could include changes in temperature, pH, 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 USEPA NPDES Construction General Permit (CGP) would be required. As part of the permit application for the CGP, a stormwater pollution prevention plan would need to be prepared containing BMPs that would be implemented to prevent, or minimize the potential for, sedimentation and erosion. Adherence to the CGP and the BMPs would help prevent sediment and suspended solids from entering the waterways and ensure that effects on water quality during construction would not be adverse.

Deployment activities associated with the Proposed Action have the potential to increase erosion and sedimentation around construction and staging areas. Grading activities associated with construction would potentially result in a temporary increase in the amount of suspended solids running off construction sites. If a storm event were to occur, construction site runoff could

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

[142] A source of pollution that can be attributed to a specific physical location – an identifiable, end-of-pipe "point." (USEPA, 2015a)

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, District, 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 5.2.4-1, 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[143] 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 District of Columbia 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.

Trenching would not likely introduce new contamination in the District's aquifers. The Proposed Action and Alternatives are unlikely to cause new drinking water violations, or otherwise substantially degrade groundwater quality. Based on the impact significance criteria presented in Table 5.2.4-1, there would likely be less than significant impacts on groundwater quality. In areas where groundwater is close to the surface, then site-specific analysis, BMPs, and mitigation measures could be implemented to further reduce potential impacts.

Floodplain Degradation

Floodplains are low-lying lands next to rivers and streams. When left in a natural state, floodplain systems store and dissipate floods without adverse impacts on human beings, buildings, roads and other infrastructure. The 500-year floodplain is the area of minimal flood hazard, where there is a 0.2-percent-annual-chance flood. Some projects may be outside of a floodplain, but still be in an area with known flooding history.

Based on the impact significance criteria presented in Table 5.2.4-1, floodplain degradation impacts would be potentially less than significant since the majority of FirstNet's deployment, on the watershed or subwatershed level, would occur inside the 500-year floodplain, would use minimal fill, would not substantially increase impervious surfaces, structures would not impede

[143] 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).

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,[144] or occur only during an emergency.

Examples of activities that would have less than significant impacts include:

- Construction of any structure in the 500-year floodplain but is built above base flood elevation pursuant to floodplain management regulations.
- Land uses that include pervious surfaces such as gravel parking lots.
- Land uses that do not change the flow of water or drainage patterns.
- Limited clearing or grading activities.

Implementation of BMPs and mitigation measures would reduce the risk of additional impacts to floodplain degradation (see Chapter 17).

Drainage Pattern Alteration

Flooding and erosion from land disturbance can changes drainage patterns. Stormwater runoff causes erosion while construction activities and land clearing can change drainage patterns. Drainage can be directed to stormwater drains, storage, and retention areas designed to slow water and allow sediments to settle out. Improperly handled drainage can cause increased erosion, changes in stormwater runoff, flooding, and damage to water quality. Existing drainage patterns can be modified by channeling (straightening or restructuring natural watercourses); creation of impoundments (detention basins, retention basins, and dams); stormwater increases; or altered flow patterns.

According to the significance criteria in Table 5.2.4-1, any temporary (lasting less than six months) alterations to drainage patterns that are minor and mimic natural processes or variations within the watershed or subwatershed level would be considered less than significant.

Example of projects that could have minor changes to the drainage patterns include:

- Land uses with pervious surfaces that create limited stormwater runoff.
- Where stormwater is contained on site and does not flow to or impact surface waterbodies offsite on other properties.
- Activities designed so that the amount of stormwater generated before construction is the same as afterwards.
- Activities designed using low impact development techniques for stormwater.

Since the proposed activities would not substantially alter drainage patterns in ways that alter the course of a stream or river; create a substantial and measurable increase in the rate and amount of surface water; or change the hydrologic regime; and any effects would be short-term; impacts to drainage patterns would be less than significant. BMPs, mitigation measures, and avoidance could be implemented to further reduce any potentially significant impacts.

[144] 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, 2013a)

Flow Alteration

Flow alteration refers to the modification of flow characteristics, relative to natural conditions. Human activities may change the amount of water reaching a stream, divert flow through artificial channels, or alter the shape and location of streams. Surface water and groundwater withdrawals can alter flow by reducing water volumes in streams. Withdrawals may return to the surface/groundwater system at a point further downstream, be removed from the watershed through transpiration by crops, lawns or pastures, or be transferred to another watershed altogether (e.g., water transferred to a different watershed for drinking supply). Altered flow can increase flooding and introduce more erosion and potential for pollution. Alternatively, if water is diverted from its normal flow, the opposite may occur; wetlands and streams may not receive as much water as necessary to maintain the ecology and previous functions.

Activities that do not impact discharge or stage of waterbody (stream height) are not anticipated to have an impact on flow, according to Table 5.2.4-1. Projects that include minor consumptive use of surface water with less than significant impacts on discharge (do not direct large volumes of water into different locations) on a temporary (no more than six months) are likely to have less than significant impacts on flow alteration, on a watershed or subwatershed level. Examples of projects likely to have less than significant impacts include:

- Construction of any structure in a 100-year or 500-year floodplain but is built above base flood elevation pursuant to floodplain management regulations.
- Land uses that are maintaining or increasing pervious surfaces.
- Land uses that do not change the flow of water or drainage patterns off site or into surface waterbodies that have not received that volume of stormwater before.
- Minor clearing or grading activities.

Since the proposed activities would not likely alter flow characteristics or change the hydrologic regime, impacts would be less than significant impacts to flow alteration. BMPs, mitigation measures, and avoidance could be implemented to further reduce any impacts.

Changes in Groundwater or Aquifer Characteristics

As described in Section 5.1.4.7, District residents do not rely on groundwater since the water quality of the District's aquifers is not suitable for drinking and daily water needs due from previous and ongoing contamination. Once a groundwater supply is exhausted or contaminated, it is very expensive, and sometimes impossible, to replace.

Storage of generator fuel over groundwater or an aquifer would unlikely cause any impacts to water quality. Activities that may cause changes is groundwater or aquifer characteristics include:

- Excavation, mining, or dredging during or after construction.
- Any liquid waste, including but not limited to wastewater generation.
- Storage of petroleum or chemical products.

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

Deployment activities should be less than significant since they would not substantially deplete supplies of potable groundwater, as any construction dewatering would be short-term. The siting of deployment activities should be considered to avoid areas that would extract groundwater from potable groundwater sources in the area. According to Table 5.2.4-1, potentially significant impacts to groundwater or aquifer characteristics would only occur if actions resulted in substantial and measurable changes in groundwater or aquifer characteristics, including volume, timing, duration, and frequency of groundwater flow, and other changes to the groundwater hydrologic regime on a watershed or within multiple watersheds that is ongoing and permanent.

5.2.4.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to water resources and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to potentially significant impacts depending on the deployment scenario or site-specific conditions. The impact on the water resources that could be affected would depend on the watershed, duration (chronic or short-term), frequency (many years or a few months) the resource would be used, and the water resource’s current use (considered exceptional value for recreation, or provides critical habitat for a species).

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Infrastructure, the following are likely to have no impacts to water resources under the conditions described below:

- Wired Projects
  - *Use of Existing Conduit – New Buried Fiber Optic Plant:* Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to water resources since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
  - *Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable:* Lighting up of dark fiber would have no impacts on water resources because there would be no ground disturbance.

- Satellites and Other Technologies
    - *Satellite-Enabled Devices and Equipment:* It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact water resources because those activities would not require ground disturbance.
    - *Deployment of Satellites:* FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact water resources, it is anticipated that this activity would have no impact on water resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to water resources because of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including impaired water quality. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to water resources include the following:

- Wired Projects
    - *New Build – Buried Fiber Optic Plant:* Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to water resources. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Trenching would not be expected to occur near or below the existing water table (depth to water). Implementing BMPs and mitigation measures could reduce impact intensity.
    - *New Build – Submarine Fiber Optic Plant:* The installation of cables in limited nearshore and inland bodies of water would impact water resources from a short-term increase in suspended solids in the water. Site-specific impact assessment could be required to aquatic and shoreline environments prior to installation to fully assess potential impacts to lake or river coastal environments.
    - *New Build – Aerial Fiber Optic Plant:* Potential impacts would be similar to Buried Fiber Optic Plant. Ground disturbance activities could cause impacts to water quality from increased suspended solids; groundwater impacts from trenching activities are not expected. If a new roadway were built, additional impervious surface would not be expected to impact water resources or the overall amount of runoff and nonpoint pollution.

  - *Collocation on Existing Aerial Fiber Optic Plant:* Replacement of poles or structural hardening could result in ground disturbance that could cause impacts to water quality from increased suspended solids.
  - *Installation of Optical Transmission or Centralized Transmission Equipment:* If installation of transmission equipment required grading or other ground disturbance to install small boxes or huts, or access roads, there could potentially be direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Trenching would not be expected to occur near or below the existing water table (depth to water). If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance, there would be no impacts to water resources.
- Wireless Projects
  - *New Wireless Communication Towers:* Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security lighting, electrical feeds, and concrete foundations and pads) or access roads could result in potential direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Trenching would not be expected to occur near or below the existing water table (depth to water). Implementing BMPs could reduce impact intensity. If a new roadway were built, additional impervious surface would not be expected to impact water resources or the overall amount of runoff and nonpoint pollution.
  - *Deployable Technologies:* Implementation of land-based deployable technologies could result in potential impacts to water resources if deployment involves movement of equipment through streams, occurs in riparian or floodplain areas, occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in direct and indirect impacts to water quality from a temporary increase in suspended solids running off construction sites or deployment in unpaved areas. The amount of impact depends on the land area affected, installation technique, and location. Implementing BMPs and mitigation measures could reduce impact intensity. The activities could also result in indirect impacts on water quality if fuels leak into surface or groundwater. Where deployable technologies would be implemented on existing paved surfaces, or where aerial and vehicular deployable technologies may be used on existing paved surfaces, it is anticipated that there would be no impacts to water resources because there would be no ground disturbance.
  - Deployment of drones, balloons, blimps, or piloted aircraft could have indirect impacts on water quality if fuels spill or other chemicals seep into ground or surface waters. In general, the abovementioned activities could potentially involve land/vegetation clearing;

excavation and trenching; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to water resources associated with deployment of this infrastructure could include water quality impacts, but are expected to be less than significant. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

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

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities, and are expected to have no impacts as there would be no ground disturbing activity and it is likely routine maintenance activities would be conducted along exiting roads and utility rights-of way. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. Impacts to surface and groundwater quality from routine operations and maintenance, such as herbicide application to control vegetation, are not expected. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to further avoid or minimize potential impacts.

5.2.4.5. 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 occured on paved surfaces. Some staging or launching/landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving, however, these activities would be isolated and short term, and would likely return to baseline conditions once revegetation was complete. Additionally, project activities could result in direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites and from fuels leaking into surface or groundwater. However, spills from vehicles or machinery used during deployment tend to be associated with re-fueling operations, and as such, would likely be a few gallons or less in volume and would likely be easily contained or cleaned up. Implementing BMPs and mitigation measures identified in Chapter 17 could further avoid or reduce potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Deployable Technologies Alternative would consist of routine maintenance and inspection of the deployable technologies. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The water resources impacts would depend on the watershed, duration (chronic or short-term) and frequency (many years or a few months) the resource would be used, and the water resource’s current use (considered exceptional value for recreation, or provides critical habitat for a species).

It is anticipated that there would be less than significant impacts to water resources associated with routine inspections of the Deployable Technologies Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or corridors and near waterbodies, the resulting ground disturbance could increase sedimentation in waterbodies, potentially impacting water quality. It is assumed that routine maintenance would not include operation of vehicles or equipment in waterbodies. Finally, if ground-based deployable technologies are parked and operated with air conditioning for extended periods, the condensation water from the air conditioner could result in soil erosion that could potentially impact waterbodies if the deployables are located adjacent to waterbodies, however, due to the limited and temporary nature of the deployable activities, it is anticipated that these potential impacts would be less than significant. Site maintenance, including mowing or herbicides, may result in less than significant effects to water quality, due to the small-scale of expected FirstNet activities in any particular location. In addition, the presence of new access roads could increase the overall amount of impervious surface in the area, and increase runoff effects on water resources, as explained above.   See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to 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 water resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 5.1.4, Water Resources.

5.2.5. Wetlands

5.2.5.1. Introduction

This section describes potential impacts to wetlands in the District associated with construction/deployment and operation of the Proposed Action and Alternatives. Chapter 17 identifies BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

5.2.5.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on wetlands were evaluated using the significance criteria presented in Table 5.2.5-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

5.2.5.3. 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.

Table 5.2.5-1: Impact Significance Rating Criteria for Wetlands

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

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
(spills or sedimentation)	Duration or Frequency	Long-term or permanent alteration that is not restored within 2 growing seasons, or ever		Periodic and/or temporary loss reversed over 1-2 growing seasons with or without active restoration	NA
Indirect effects: [2] change in function(s)[3] change in wetland type	Magnitude or Intensity	Changes to the functions or type of high quality wetlands (e.g., those that provide critical habitat for sensitive or listed species, are rare or a high-quality example of a wetland type, are not fragmented, support a wide variety of species, etc.)	Effect that is potentially significant, but with mitigation is less than significant	Impacts to lower quality wetlands (e.g., not rare or unique, that have low productivity and species diversity, and those that are already impaired or impacted by human activity)	No changes in wetland function or type
	Geographic Extent	Watershed level, and/or within multiple watersheds		Watershed or subwatershed level	NA
	Duration or Frequency	Long-term or permanent		Periodic and/or temporary loss reversed over 1-2 growing seasons with or without active restoration	NA

NA – Not Applicable

[1] "Magnitude" is defined based on the type of wetland impacted, using USACE wetland categories (USACE 2014). Category 1 are the highest quality, highest functioning wetlands.
[2] Indirect effects are those resulting from direct effects, but they occur elsewhere in space and/or time. Includes indirect hydrologic effects (wetting or drying) that in turn alters wetland function or type.
[3] Wetland functions include hydrologic, ecological, geomorphic, and social functions typically assessed for wetlands as part of USACE compensatory mitigation planning. Typical functions assessed may include flood attenuation, bank stabilization, water quality, organic matter input/transport, nutrient processing, wildlife habitat, T/E species habitat, biodiversity, recreational/social value.

Wetlands regulate the quality and quantity of surface and groundwater supplies, reduce flood hazards by serving as retention basins for surface runoff, and maintain water supplies after floodwaters subside. If wetlands were filled, the entire area may be at risk for increased flooding. There could be a loss of open space to be enjoyed by the community, and decreased wildlife populations may be observed due to displacement and increased noise, light, and other human disturbance. To the extent practicable or feasible, FirstNet and/or its partners would avoid filling wetlands or altering the hydrologic regime so that wetlands would not be lost or converted to non-wetlands. Loss of high and low-quality wetlands would be less than significant given the amount of land disturbance associated with the project locations (generally less than an acre) and the short time-frame of deployment activities. Additionally, all site-specific locations will be subject to an environmental review to help ensure environmental concerns are addressed. Potential wetlands impacts can be further reduced by implementing BMPs and mitigation measures (see Chapter 17).

There are approximately 307 acres of palustrine, riverine, and lacustrine wetlands throughout the District of Columbia. (USFWS, 2014a). Palustrine (freshwater) wetlands are found on river floodplains in the District, primarily along the Anacostia and Potomac Rivers, as well as Theodore Roosevelt Island (as shown in Section 5.1.5, Figure 5.1.5-1)

Based on the impact significance criteria presented in Table 5.2.5-1, and given the temporary nature of most proposed activities, the deployment activities would most likely have less than significant direct impacts on wetlands. Additionally, deployment activities would not violate applicable federal (e.g., CWA Section 404), District, and local regulations.

As discussed in Section 5.1.5.3, Wetlands, there are no regulated wetlands of special value or concern (high quality) in the District of Columbia. However, there are vernal pools in the District, typically within federally protected land in woodland areas and along the Potomac River in rocky floodplain areas. Vernal pools are important to wildlife populations, and support plants, insects, crustaceans and amphibians (including the spotted salamander *[Ambystoma maculatum]* and wood frog *[Lithobates sylvaticus]*) found only in these wetlands. (DDOE, 2015c) Considering how few wetlands exist within the District, avoidance, BMPs and mitigation measures would be implemented to help mitigate deployment and impacts to all wetlands.

Potential Other Direct Effects

Direct impacts consist of altering the chemical, physical, or biological components of a wetland to the extent that changes to the wetland functions occur. However, direct impacts would not result in a loss of total wetland acreage. Changes, for example, could include conversion of a forested wetland system to a non-forested state through chemical, mechanical, or hydrologic manipulation; altered hydrologic conditions (increases or decreases) such as stormwater discharges or water withdrawals that alter the functions of the wetlands.

Based on the impact significance criteria presented in Table 5.2.5-1, construction-related deployment activities that result in long-term or permanent, substantial, and measurable changes to hydrological regime of the wetland (i.e., changes in salinity, pollutants, nutrients, biodiversity, ecological integrity, or water quality) may cause potentially significant impacts. In addition, introduction and establishment of invasive species to high quality wetlands within a watershed or multiple watersheds are potentially significant.

Examples activities that could have other direct effects to wetlands in the District include:

- *Vegetation Clearing:* removing existing vegetation by clearing forest and herbaceous vegetation during construction activities, grading, seeding, and mulching. Clearing and grading may include increased soil erosion and a decrease in the available habitat for wildlife.
- *Ground Disturbance:* Increased amounts of stormwater runoff in wetlands can alter water level response times, depths, and duration of water detention. Reduction of watershed infiltration capacity could cause wetland water depths to rise more rapidly following storm events.
- *Direct Hydrologic Changes (flooding or draining)*: Greater frequency and duration of flooding can destroy native plant communities, as can depriving them of their water supply. Hydrologic changes can make a wetland more vulnerable to pollution. Increased water depths or flooding frequency can 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 can lead to degradation of wetlands that have a specific pH range and/or other parameter.
- *Water Quality Degradation (spills or sedimentation):* The loss of wetlands results in a depletion of water quality both in the wetland and downstream. Filtering of pollutants by wetlands is an important function and benefit. High levels of suspended solids (sedimentation) can reduce light penetration, dissolved oxygen, and overall wetland productivity. Toxic materials in runoff can interfere with the biological processes of wetland plants, resulting in impaired growth, mortality, and changes in plant communities.

Indirect effects:[145] Change in Function(s)[146] or Change in Wetland Type

The construction of curb and gutter systems diverts surface runoff and can cause flooding or wetlands to dry out, depending on the direction of diversion. Indirect effects to high- and low-quality wetlands would be less than significant given the amount of land disturbance associated with the project locations (generally less than an acre) and the short time-frame of deployment activities and the application of federal, District, and local wetlands regulations. Additionally, all site-specific locations will be subject to an environmental review to help ensure environmental concerns are addressed. Potential wetlands impacts can be further reduced by implementing BMPs and mitigation measures (see Chapter 17). Examples of functions related to

[145] 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.

[146] 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.

wetlands in the District of Columbia that could potentially be impacted from construction-related deployment activities include:

Examples of functions related to wetlands in the District that could potentially be impacted from construction-related deployment activities include:

- *Flood Attenuation:* Wetlands provide flood protection by holding excess runoff after storms, before slowly releasing it to surface waters. While wetlands may not prevent flooding, they can lower flood peaks by providing detention of storm flows.
- *Bank Stabilization:* By reducing the velocity and volume of flow, wetlands provide erosion control, floodwater retention, and reduce stream sedimentation.
- *Water Quality:* Water quality impacts on wetland soils can eventually threaten a wetland's existence. Where sediment inputs exceed rates of sediment export and soil consolidation, a wetland would gradually become filled.
- *Nutrient Processing:* Wetland forests retain ammonia during seasonal flooding. Wetlands absorb metals in the soils and by plant uptake via the roots. They also allow metabolism of oxygen-demanding materials and reduce fecal coliform populations. These pollutants are often then buried by newer plant material, isolating them in the sediments.
- *Wildlife Habitat:* Impacts on wetland hydrology and water quality affect wetland vegetation. While flooding can harm some wetland plant species, it promotes others. Shifts in plant communities because of hydrologic changes can have impacts on the preferred food supply and animal cover.
- *Recreational Value:* Wetlands provide recreation opportunities for people, such as hiking, bird watching, and photography.
- *Groundwater Recharge:* Wetlands retain water, allowing time for surface waters to infiltrate into soils and replenish groundwater.

According to the significance criteria defined in Table 5.2.5-1, impacts to lower quality wetlands (e.g., not rare or unique, that have low productivity and species diversity, and those that are already impaired or impacted by human activity), would be considered potentially less than significant. Since the majority of the 307 acres of wetlands in the District are not considered high quality, deployment activities could have less than significant indirect impacts on wetlands in the District. Avoidance, BMPs, and mitigation measures could be implemented, as feasible and practicable, to reduce potential impacts to all wetlands.

5.2.5.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities. To determine the magnitude of potential impacts of site-specific activities, wetland delineations would be required to determine the exact location of all wetlands, including high quality wetlands, as well as a functional assessment by an experienced wetland delineator.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to wetlands and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to potentially significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to wetlands under the conditions described below:

- Wired Projects
  - *Use of Existing Conduit – New Buried Fiber Optic Plant:* Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to wetlands since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
  - *Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable:* Lighting up of dark fiber would have no impacts on wetlands because there would be no ground disturbance.
- Satellites and Other Technologies
  - *Satellite-Enabled Devices and Equipment:* It is anticipated that the installation of permanent equipment on existing structures, adding equipment to satellites being launches for other purposes, and the use of portable devices that use satellite technology is not likely to impact wetlands since there would be no ground disturbance.
  - *Deployment of Satellites:* FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact wetlands, it is anticipated that this activity would have no impact on wetlands

Activities with the Potential to Have Impacts

Potential deployment-related impacts to wetlands because of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct effects, other direct effects, and indirect effects on wetlands. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to wetlands include the following:

- Wired Projects
  - *New Build – Buried Fiber Optic Plant:* Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to wetlands. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct and indirect impacts to wetlands. The amount of impact depends on the land area affected, installation technique, proximity to wetlands, and type of wetland that could be affected (e.g., high quality). Any ground disturbance could cause direct and indirect impacts wetlands, depending on the proximity to wetlands and type of wetlands that could be affected. Implementing BMPs and mitigation measures could reduce impact intensity.
  - *New Build – Submarine Fiber Optic Plant:* The installation of cables in limited nearshore and inland bodies of water would potentially impact wetlands found along shorelines. Additional project-specific environmental reviews would be required to assess potential impacts to wetland environments, including coastal 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 are needed, structural hardening, and physical security measures required ground disturbance, such as grading, or excavation activities, impacts to wetlands could occur near wetlands, it could cause impacts on wetlands. Implementing BMPs and mitigation measures could reduce impact intensity.
- *Deployable Technologies:* Implementation of deployable technologies could result in potential impacts to wetlands if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. The amount of impact depends on the land area affected, installation technique, and location. Implementing BMPs and mitigation measures could reduce impact intensity. The activities could also result in other direct impacts on wetlands if fuels leak into nearby waterbodies or wetlands. Deployment of drones, balloons, or blimps piloted aircraft could have other direct impacts on wetlands if fuels spill or other chemicals seep into nearby waterbodies or wetlands.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Depending on the deployment activity for this infrastructure, potential impacts to wetlands may occur. The amount of impact depends on the land area affected, installation technique, proximity to wetlands, and type of wetland that could be affected (e.g., high quality). Any ground disturbance could cause direct and indirect impacts wetlands, depending on the proximity to wetlands and type of wetlands that could be affected. These impacts are expected to be less than significant due to the small about of land disturbance (generally less than one acre) and the short timeframe of deployment activities. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, District, and local permits. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to further avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there could be ongoing potential other direct impacts to wetlands if heavy equipment is used for routine operations and maintenance application of herbicides occurs to control vegetation along all ROWs and near structures, depending on the proximity to wetlands. The intensity of the impact depends on the amount of herbicides used, frequency, and location of nearby sensitive wetlands. These impacts are expected to be less than significant due to the limited nature of deployment activities. It is also anticipated that routine maintenance activities would be conducted on existing roads and utility ROW. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to further avoid or minimize potential impacts.

5.2.5.5. Alternatives Impact Assessment

The following section assesses potential impacts to water resources associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to wetlands as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to wetlands. Some staging or launching/landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in direct and indirect impacts to wetlands from a temporary increase in the amount of suspended solids running off construction sites to nearby surface waters. The amount of impact depends on the land area affected, installation technique, and proximity to wetlands, and wetland type; however, impacts are expected to be less than significant due to the small-scale and temporary duration of expected FirstNet deployment activities in any one location. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, District, and local permits. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to further avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Deployable Technologies Alternative would consist of routine maintenance and inspection of the deployable technologies. Any major infrastructure replacement as part of ongoing system maintenance could result in impacts similar to the abovementioned deployment impacts. The wetlands impacts would depend on the watershed, duration (chronic or short-term) and frequency (many years or a few months) the resource would be used, and the wetland's quality and function.

It is anticipated that there would be less than significant impacts to wetlands associated with routine inspections of the Deployable Technologies Alternative as it is likely existing roads and utility rights-of-way would be utilized for maintenance and inspection activities. Site maintenance, including mowing or herbicides, is anticipated to result in less than significant effects to wetlands due to the limited nature of site maintenance activities, including mowing and application of herbicides. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to 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 from construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 5.1.5, Wetlands.

5.2.6. Biological Resources

5.2.6.1. Introduction

This Chapter describes potential impacts to terrestrial vegetation, wildlife, fisheries and aquatic habitat, and threatened and endangered species in the District associated with deployment and operation of the Proposed Action and its Alternatives. BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize those potential impacts are identified in Chapter 17.

5.2.6.2. 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 5.2.1-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to terrestrial vegetation, wildlife, and fisheries and aquatic habitat addressed in Sections 5.2.6.3, 5.2.6.4, and 5.6.2.5, respectively, are presented as a range of possible impacts.

Refer to Section 5.2.6.6 for impact assessment methodology and significance criterial associated with threatened and endangered species in the District of Columbia.

Table 5.2.6-1: Impact Significance Rating Criteria for Terrestrial Vegetation, Wildlife, Fisheries, and Aquatic Habitats

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Direct Injury/Mortality	Magnitude or Intensity	Population-level or sub-population injury /mortality effects observed for at least one species depending on the distribution and the management of said species. Events that may impact endemics, or concentrations during breeding or migratory periods. Violation of various regulations including: Migratory Bird Treaty Act (MBTA), and Bald and Golden Eagle Protection Act (BGEPA).	Effect that is potentially significant, but with mitigation is less than significant.	Individual mortality observed but not sufficient to affect population or sub-population survival.	No direct individual injury or mortality would be observed.
	Geographic Extent	Regional effects observed within the District of Columbia for at least one species. Anthropogenic disturbances that lead to exclusion from nutritional or habitat resources, or direct injury or mortality of endemics or a significant portion of the population or sub-population located in a small area during a specific season.		Effects realized at one location when population is widely distributed, and not concentrated in affected area.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated or short-term effects that are reversed within one to three years.	NA

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Vegetation and Habitat Loss, Alteration, or Fragmentation	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species or vegetation cover type, depending on the distribution and the management of the subject species. Impacts to terrestrial, aquatic, or riparian habitat or other sensitive natural community vital for feeding, spawning/breeding, foraging, migratory rest stops, refugia, or cover from weather or predators. Violation of various regulations including 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 the District of Columbia for at least one species. Anthropogenic disturbances that lead to the loss or alteration of nutritional or habitat resources for endemics or a significant portion of the population or sub-population located in a small area during a specific season.		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated or short-term effects that are reversed within one to three years.	NA

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Indirect Injury/Mortality	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species depending on the distribution and the management of said species. Exclusion from resources necessary for the survival of one or more species and one or more life stages. Anthropogenic disturbances, including those from RF emissions, that lead to mortality, disorientation, the avoidance or exclusion from nutritional or habitat resources for endemics or a significant portion of the population or sub-population located in a small area during a specific season. Violation of various regulations including: MBTA, and BGEPA.	Effect that is potentially significant, but with mitigation is less than significant.	Individual injury/mortality observed but not sufficient to affect population or sub-population survival. Partial exclusion from resources in locations not designated as vital or critical for any given species or life stage, or exclusion from resources that takes place in important habitat that is widely distributed. Anthropogenic disturbances, including exposure to RF emissions, 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.

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Geographic Extent	Regional or site-specific effects observed within the District of Columbia for at least one species. Behavioral reactions to anthropogenic disturbances depend on the context, the time of year age, previous experience, and activity.		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated or short-term effects that are reversed within one to three years.	NA
Effects to Migration or Migratory Patterns	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species depending on the distribution and the management of said species. Temporary or long-term loss of migratory pattern/path, or rest stops due to anthropogenic activities. Violation of various regulations including MBTA, and BGEPA.	Effect that is potentially significant, but with mitigation is less than significant.	Temporary loss of migratory rest stops due to anthropogenic activities take place in important habitat that is widely distributed and there are no cumulative effects from additional projects.	No alteration of migratory pathways, no stress or avoidance of migratory paths/patterns due to project.

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Geographic Extent	Regional effects observed within the District of Columbia 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
Reproductive Effects	Magnitude or Intensity	Population or sub-population level effects in reproduction and productivity over several breeding/spawning seasons for at least one species depending on the distribution and the management of said species. Violation of various regulations including MBTA, and BGEPA.	Effect that is potentially significant, but with mitigation is less than significant.	Effects to productivity are at the individual rather than population level. Effects are within annual variances and not sufficient to affect population or sub-population survival.	No reduced breeding or spawning success.

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Geographic Extent	Regional effects observed within the District of Columbia for at least one species. Anthropogenic disturbances that lead to exclusion from prey or habitat resources required for breeding/spawning, or anthropogenic disturbances, including exposure to RF emissions, 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
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.

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Geographic Extent	Regional impacts observed throughout the District of Columbia.		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term changes not likely to be reversed over several years or seasons.		Periodic, temporary, or short-term changes that are reversed over one or two seasons.	NA

NA – Not Applicable

5.2.6.3. Terrestrial Vegetation

Potential impacts to terrestrial vegetation occurring in the District of Columbia 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 5.2.1-1, direct injury or mortality impacts could be significant if population-level or sub-population effects were observed for at least one species depending on the distribution and the management of the subject species. Although unlikely, direct mortality/injury to plants could occur in construction zones from land clearing, excavation activities, or vehicle traffic; however, these events are expected to be relatively small in scale. The implementation of BMPs and mitigation measures and avoidance measures would help to minimize or altogether avoid potential impacts to plant population survival.

Vegetation and Habitat Loss, Alteration, or Fragmentation

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

Construction of new infrastructure and long-term facility maintenance would result in the alteration of the type of vegetative communities in these localized areas, and in some instances the permanent loss of vegetation. Further, some limited amount of infrastructure may be built in sensitive or rare regional vegetative communities, in which case BMPs and mitigation measures would be recommended to minimize or avoid potential impacts.

Indirect Injury/Mortality

"Indirect effects" are effects that are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable (40 CFR 1508.8[b]). Indirect injury/mortality can include stress related to disturbance. The alteration of soils or hydrology within a localized area can result in stress or mortality of plants. Construction activities that remove large quantities of soil in the immediate vicinity of trees could cause undue stress to trees from root exposure, although this is unlikely to occur due to the small size of expected FirstNet activities. Increasing or decreasing hydrology in an area as an indirect effect, could lead to moisture stress and/or mortality of plant species that are adapted to specific hydrologic regimes. Indirect injury/mortality impacts vary depending on the species, time of year and duration of construction or deployment, though BMPs and mitigation measures could help to minimize or avoid the potential impacts.

Effects to Migration or Migratory Patterns

No effects to the long-term migration or migratory patterns for terrestrial vegetation (e.g., forest migration) are expected as a result of the Proposed Action, given the small-scale of deployment activities.

Reproductive Effects

No reproductive effects to terrestrial vegetation are expected as a result of the Proposed Action given the small-scale of deployment activities.

Invasive Species Effects

When human activity results in a species entering an ecosystem new to it, the species is classified as introduced or, depending on its ability to spread rapidly and outcompete native species, invasive. The introduction of invasive species can have a dramatic effect on natural resources and biodiversity.

When non-native species are introduced into an ecosystem in which they did not evolve, their populations sometimes increase rapidly. Natural or native community species evolve together into an ecosystem with many checks and balances that limit the population growth of any one species. These checks and balances include such things as predators, herbivores, diseases, parasites, and other organisms competing for the same resources and limiting environmental factors. However, when an organism is introduced into an ecosystem in which it did not evolve naturally, those limits may not exist and its numbers can sometimes dramatically increase. The unnaturally large population numbers can then have severe impacts to the environment, local economy, and human health. Invasive species can out-compete the native species for food and habitats and sometimes even cause their extinction. Even if natives are not completely eliminated, the ecosystem often becomes much less diverse. (USFWS, 2012)

The potential to introduce invasive plants within construction zones and during long-term site maintenance can occur from vehicles and equipment being transported from one region to another, or when conducting revegetation of a site after deployment activities are complete. BMPs and mitigation measures could help to minimize or avoid the potential for introducing invasive plant species during implementation of the Proposed Action.

Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to terrestrial vegetation resources and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range impacts, from no impacts to less than significant impacts, depending on the deployment scenario or site-specific conditions. The terrestrial vegetation that would be affected would depend on the ecoregion, the species' phenology[147], and the nature as well as the extent of the habitats affected.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are expected to have no impacts to terrestrial vegetation under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Although terrestrial vegetation could be impacted, it is anticipated that effects to vegetation would be minimal since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts on terrestrial vegetation because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures, attaching equipment to satellite launches for other purposes, and the use of portable devices that use satellite technology would not impact terrestrial vegetation because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact biological resources, it is anticipated that this activity would have no impact on terrestrial vegetation.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to terrestrial vegetation as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation; indirect injury/mortality; and invasive species effects. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to terrestrial vegetation include the following:

[147] Phenology is the seasonal changes in plant and animal lifecycles, such as emergence of insects or migration of birds. (USEPA, 2015d)

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to terrestrial vegetation. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects if BMPs and mitigation measures are not implemented.
  - New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public ROWs or private easements as well as the construction of access roads, POPs, huts, or facilities to house outside plant equipment could result in potential impacts to terrestrial vegetation. Impacts may vary depending on the number or individual poles installed, but could include direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects if BMPs and mitigation measures are not implemented.
  - Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water would not impact terrestrial vegetation. However, impacts to terrestrial vegetation could potentially occur as a result of the construction of landings and/or facilities on shores or the banks of waterbodies that accept the submarine cables could potentially occur as a result of land clearing, excavation activities, and heavy equipment use. Effects could include direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects if BMPs and mitigation measures are not implemented.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, such disturbance could result in direct or indirect injury to plants, the vegetation loss, and invasive species effects.
- Wireless Projects
  - New Wireless Communication Towers or Backhaul Equipment: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads), microwave facilities, or access roads could result in impacts to terrestrial vegetation. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or

access roads could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects.

- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to terrestrial vegetation. However, if additional power units are needed, replacement towers, structural hardening, and physical security measures require land clearing or excavation activities, impacts would be similar to new wireless construction.
- Deployable Technologies: Implementation of deployable technologies including COWs, COLTs, or SOWs could result in direct impacts to terrestrial vegetation if deployment occurs on vegetated areas, or the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects.

  Deployment of drones, balloons, blimps, or piloted aircraft could potentially impact terrestrial vegetation if launching or recovery occurs on vegetated areas. Impacts would be similar to deployment of COWs, COLTs, and SOWs.

In general, the abovementioned activities could potentially involve land/vegetation clearing; topsoil removal; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or cables; heavy equipment movement; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to terrestrial vegetation associated with deployment of this infrastructure, depending on their scale, could include direct or indirect injury/mortality to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species depending on the ecoregion, the species' phenology, and the nature and extent of the vegetation affected. These potential impacts are expected to be less than significant due to the small-scale of expected deployment activities. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The terrestrial vegetation that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

It is anticipated that there would no impacts to terrestrial vegetation associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Site maintenance, including mowing or herbicides, may result in less than significant effects due to the small-scale of expected activities. These potential impacts could result from accidental spills from maintenance equipment or release of herbicides and because these areas would not be allowed to revert to a more natural state. If usage of heavy equipment or land clearing activities occurs off established roads or corridors as part of routine maintenance or inspections, direct or indirect injury/mortality to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species could occur to terrestrial vegetation, however impacts are expected to be less than significant due to the small-scale of expected activities. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to further avoid or minimize potential impacts.

Alternatives Impact Assessment

The following section assesses potential impacts to terrestrial vegetation associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to terrestrial vegetation as a result of implementation of this alternative could be as described below.

Deployment Impacts

As described above, implementation of deployable technologies could result in less than significant impacts from land/vegetation clearing, excavation, and paving activities. These activities could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects. Greater frequency and duration of deployments could change the magnitude of impacts. However, impacts are expected to remain less than significant due to the relatively small-scale of FirstNet activities at individual locations. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

Operational Impacts

As described above, operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be less than significant impacts to terrestrial vegetation associated with routine operations and maintenance due to the relatively small-scale of likely FirstNet project sites. The impacts can vary greatly among species, vegetative community, and geographic region, but are expected to remain less than significant.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to terrestrial vegetation as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 5.1.6.3, Terrestrial Vegetation.

5.2.6.4. Wildlife

Impacts to amphibians and reptiles, terrestrial mammals, birds, and terrestrial invertebrates occurring in the District and its near offshore environment (i.e., less than two miles from the edge of the coast) 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 5.2.6-1, less than significant impacts would be anticipated given the anticipated small size and nature of the majority of the proposed deployment activities. Although anthropogenic disturbances may be measurable (although minimal) for some FirstNet projects, impacts to individual behavior of animals would be short-term and direct injury or mortality impacts at the population-level or sub-population effects would not likely be observed.

<u>Terrestrial Mammals</u>

Vehicle strikes are common sources of direct mortality or injury to both small and large mammals in the District. 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, 2015c). Individual injury or mortality as a result of vehicle strikes associated with the Proposed Action could occur.

Entanglement in fences or other barriers could be a source of mortality or injury to terrestrial mammals, though entanglements would likely be isolated, individual events.

If bats — particularly maternity colonies — are present at a site location, removal of trees during land clearing activities could result in direct injury/mortality if bats are utilizing them as roost trees or for rearing young. The scale of this impact would be expected to be small-scale and would be dependent on the location and type of deployment activity, and the amount of tree removal. Site avoidance measures could be implemented to avoid disturbance to bats.

Birds

Mortalities from collisions or electrocutions with manmade cables and wires are environmental concerns for avian species and violate MBTA and BGEPA. Generally, collision events occur to "poor" fliers (e.g., ducks), 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 can also result from vehicle strikes, although typically occur as isolated events.

Direct injury and mortality of birds can occur to ground-nesting birds when nests are either disturbed or destroyed during land clearing, excavation and trenching, and other ground disturbing activities. Removal of trees during land clearing activities could also result in direct injury/mortality to forest dwelling birds if they are utilizing them as roost trees for resting or shelter from predators and inclement weather, or as nest trees for rearing young. The scale of this impact would be associated with the amount of tree removal and the abundance of forest-dwelling birds roosting/nesting in the area. Direct injury/mortality are not anticipated to be widespread or affect bird populations due to the small-scale of likely FirstNet actions.

Direct mortality and injury to birds of the District of Columbia are not likely to be widespread or affect populations of species as a whole; individual species impacts may be realized depending on the nature of the deployment activity. If siting considerations, BMPs, and mitigation measures are implemented (Chapter 17), potential impacts could be minimized. Additionally, potential impacts under MBTA and BGEPA can be addressed through BMPs and mitigation measures developed in consultation with USFWS.

Reptiles and Amphibians

The majority of the District's amphibian and reptile species are widely distributed throughout the District. Either direct mortality to amphibians or reptiles could occur in construction zones by excavation activities or by vehicle strikes; however, these events are expected to be temporary and isolated, affecting only individual animals.

Terrestrial Invertebrates

The terrestrial invertebrate populations of the District of Columbia are so widely distributed that injury/mortality events are not expected to affect populations of species as a whole.

Vegetation and Habitat Loss, Alteration, or Fragmentation

Habitat impacts are primarily physical perturbations that result in alterations in the amount or quality of a habitat. As with all of the effects categories, the magnitude of the impact depends on the duration, location, and spatial scale of the system and associated activities. Habitat fragmentation is the loss or breaking down of continuous and connected habitat, and impeding access to resources and mates. There are areas in the District of Columbia that have experienced extensive land use changes from urbanization and agriculture. However, a few portions of the District are forested and remain relatively unfragmented.

Additionally, habitat loss can occur through exclusion, directly or indirectly, preventing an animal from accessing an optimal habitat (e.g., breeding, forage, or refuge), either by physically preventing use of a habitat or by causing an animal to avoid a habitat, either temporarily or long-term. It is expected that activities associated with the Proposed Action would cause exclusion effects only in very special circumstances, as in most cases an animal could fly, swim, or walk to a nearby area that would provide refuge.

Potential effects of vegetation and habitat loss, alteration, or fragmentation are described for the District of Columbia's wildlife species below.

Terrestrial Mammals

Mammals occupy a wide range of habitats throughout the District of Columbia and may experience localized effects of habitat loss or fragmentation. Removal or loss of vegetation may impact large mammals by decreasing the availability of forest for cover from predators or foraging. Loss of cover may increase predation on both breeding adults as well as their young. The loss, alteration, or fragmentation of forested habitat would also impact some small mammals that utilize these areas for roosting, foraging, sheltering, and for rearing their young. Loss of habitat or exclusions from these areas could be avoided or minimized by BMPs and mitigation measures.

Birds

The direct removal of most bird nests are prohibited under the MBTA. The USFWS and DDOE can provide regional guidance on the most critical periods (e.g., breeding season) to avoid vegetation clearing. The removal and loss of vegetation can affect avian species directly by loss of nesting, foraging, stopover, and cover habitat.

Noise disturbance and human activity, as discussed previously, could directly restrict birds from using their preferred resources. Greater human activity of longer duration would increase the likelihood that birds would avoid the area, possibly being excluded from essential *resources* (Hill, 1997).

The degree to which habitat exclusion affects birds depends on many factors. The impact to passerine[148] species from disturbance or displacement from construction activities is likely to be short-term with minor effects from exclusion. Exclusion from resources concentrated in a small migratory stop area during peak migration can have major impacts to species that migrate in large flocks and concentrate at stopovers (e.g., shorebirds). BMPs and mitigation measures, including nest avoidance during construction-related activities, could help to avoid or minimize the potential impacts to birds from exclusion of resources, as appropriate.

[148]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.

Reptiles and Amphibians

Important habitats for District of Columbia amphibians and reptiles typically consist of wetlands and, in some cases the surrounding upland forest. Impacts are expected to be less than significant. If proposed project sites were unable to avoid sensitive areas, BMPs and mitigation measures (see Chapter 17) would be implemented to avoid or minimize the potential impacts.

Filling or draining of wetland breeding habitat (see Section 5.2.4, Water Resources) and alterations to ground or surface water flow from development associated with the Proposed Action may also have effects to District amphibian and reptile populations, though BMPs and mitigation measures would help to avoid or minimize the potential impacts.[149]

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 District, therefore no significant effects to terrestrial invertebrates are expected. Impacts to sensitive invertebrate species are discussed below in Section 5.2.6.6, 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.

Terrestrial Mammals

Stress from repeated disturbances during critical periods (e.g., roosting and mating) can reduce the overall fitness and productivity of young and adult terrestrial mammals. Indirect effects could occur result to roosting bats from noise, light, or human disturbance causing them to leave their roosting locations or excluding them from their summer roosting/maternity colony roosts. For example, some bat species establish summer roosting or maternity colonies in the same general area that they return to year and after year. The majority of FirstNet deployment activities would be short-term in nature; therefore, repeated disturbances would not occur. Depending on the project type and location, individual species may be disturbed resulting in less than significant impacts.

Birds

Repeated disturbance, especially during the breeding and nesting season, can cause stress to individuals lowering fitness and productivity. The majority of FirstNet deployment activities would be short-term in nature; therefore, repeated disturbances would not occur. Depending on the project type and location, individual species may be disturbed resulting in less than significant impacts.

[149] See Chapter 17, Wetlands, for a discussion of BMPs for wetlands.

Reptiles and Amphibians

Changes in water quality and quantity, especially during the breeding seasons, can cause stress resulting in lower productivity. The majority of FirstNet deployment activities would be short-term in nature; therefore, repeated disturbances would not occur. Depending on the project type and location, individual species may be disturbed resulting in less than significant impacts.

Terrestrial Invertebrates

Invasive species can cause chronic stress to terrestrial invertebrates, either by changes in habitat composition or competition for resources, resulting in lower productivity. Due to the large number of invertebrates distributed throughout the District, and given the short-term nature of most of the deployment activities, this impact would likely be less than significant.

Effects to Migration or Migratory Patterns

Migration is the regular movement of animals from one region to another and back again. Migratory patterns vary by species and sometimes within the same species. Potential effects to migration patterns of the District's amphibians and reptiles, terrestrial mammals, birds, and terrestrial invertebrates are described below.

Terrestrial Mammals

Deer have well-defined migratory routes. Route knowledge is passed on from one generation to the next and includes important feeding and calving areas. Small mammals also have migratory routes that include spring and fall roosting areas between their summer maternity roosts and hibernacula. Any clearance, drilling, and construction activities needed for network deployment, including noise associated with these activities, has the potential to divert mammals from these migratory routes. Impacts can vary depending on the species, time of year of construction/operation, and duration, but are generally expected to be less than significant. BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Birds

Because many birds have extremely long migrations, protection efforts for critical sites along migratory routes must be coordinated over vast distances often involving many different countries. For example, as a group, shorebirds migrating through the District undertake some of the longest-distance migrations of all animals. The District of Columbia is within the Atlantic Flyway, which spans more than 3,000 miles the Arctic tundra and the Caribbean. The District of Columbia is in the Atlantic Flyway and has some stopover areas for migratory birds (National Audubon Society, Inc., 2015b). Many migratory routes are passed from one generation to the next. Impacts can vary (e.g., mortality of individuals or abandonment of stopover sites by whole flocks) depending on the species, time of year of construction/operation, and duration, and impacts are expected to be less than significant. BMPs and mitigation measures could help to further avoid or minimize effects to migratory pathways.

Reptiles and Amphibians

Several species of mole salamanders and the wood frog are known to migrate seasonally in the District of Columbia. These amphibians often travel by the hundreds on their migration pathway that often crosses roadways. Mole salamanders are typically found in burrows in the forest floor. Wood frogs use diverse vegetation types from grassy meadows to open forests. After they emerge from dormancy, wood frogs migrate up 900 feet to breeding pools, where they breed rapidly in early spring in permanent or ephemeral water (Homan, Atwood, Dunkle, & Karr, 2010). However, (Berven & Grudzien, 1990) found that a small percentage of juvenile wood frogs could migrate more than 1.5 miles from natal ponds, suggesting juveniles may be capable of migrating relatively long distances. Mortality and barriers to movement could occur as result of the Proposed Action (Calhoun & DeMaynadier, 2007).

Species that use streams as dispersal or migratory corridors may be impacted if these waterways are restricted or altered, but and impacts are expected to be less than significant. BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Terrestrial Invertebrates

The proposed deployment activities would be expected to be short-term or temporary in nature. No effects to migratory patterns of the District of Columbia's terrestrial invertebrates are expected as a result of the Proposed Action.

Reproductive Effects

Reproductive effects are considered those that either directly or indirectly reduce an animal's ability to produce offspring or reduce the rates of growth, maturation, and survival of offspring, which can affect the overall population of individuals.

Terrestrial Mammals

Restricted access to important winter hibernacula or summer maternity roosts for bats has the potential to negatively affect body condition and reproductive success of mammals in the District. Disturbance from deployment and operations could also result in the abandonment of offspring leading to reduced survival, although these activities are expected to be small-scale and impacts are expected to be less than significant. Reproductive effects as a result of displacement and disturbance could be minimized through the use of BMPs and mitigation measures.

Birds

Impacts due to Proposed Action deployment and operations could include abandonment of the area and nests due to disturbance. Disturbance (visual and noise) may displace birds into less suitable habitat and thus reduce survival and reproduction. The majority of FirstNet deployment or operation activities are likely to be small-scale in nature. BMPs and mitigation measures as defined through consultation with USFWS, if required, could help to avoid or minimize any potential impacts.

Reptiles and Amphibians

Reproductive effects to reptile nests may occur through direct loss or disturbance of nests. For example, the spotted turtle (*Clemmys guttata*), a resident in the District's wetlands, leaves its breeding pool in May and travels to its nesting site.

Reproductive effects to sub-populations of amphibians and reptiles may occur through the direct loss of vernal pools as breeding habitat if deployment activities occur near breeding pools, alter water quality through sediment infiltration, or obstruction of natural water flow to pools, though BMPs and mitigation measures would help to avoid or minimize the potential impacts.

Terrestrial Invertebrates

The majority of FirstNet deployment or operation activities are likely to be short-term in nature; no reproductive effects to terrestrial invertebrates are expected as a result of the Proposed Action.

Invasive Species Effects

When human activity results in a species entering an ecosystem new to it, the species is classified as introduced or invasive. The introduction of invasive species can have a dramatic effect on natural resources.

FirstNet deployment or operation activities could result in short-term or temporary changes to specific project sites; these sites are expected to return to their natural state in a year or two. Invasive species are not expected to be introduced to project sites as part of the deployment activities from machinery or construction workers.

Potential invasive species effects to the District of Columbia's wildlife are described below.

Terrestrial Mammals

In the District of Columbia, white-tailed deer are the most common nuisance mammals. They destroy native vegetation resulting in erosion and water resource concerns, and can carry/transmit disease to livestock and human beings. This, in turn, can seriously reduce native populations of animals and lead to the degradation of their habitat.

FirstNet deployment activities are not expected to introduce terrestrial mammal species to project sites as these activities are temporary and would not provide a mechanism for transport of invasive terrestrial mammals to project sites from other locations. Invasive species effects to terrestrial mammals could be minimized following BMPs in Chapter 17 to reduce the introduction potential from heavy equipment or laborers.

Birds

In the District of Columbia, European starlings (*Sturnus vulgaris*) and House sparrows (*Passer domesticus*) are invasive bird species. These two bird species can out compete native secondary cavity nesters for breeding opportunities (DDOE, 2015c)

FirstNet deployment activities could result in short-term or temporary changes to specific project sites; these sites are expected to return to their natural state in a year or two. Invasive bird species are not expected to be introduced at project sites as part of the deployment activities.

Reptiles and Amphibians

No invasive reptiles or amphibians are regulated in the District of Columbia, although non-native reptiles and amphibians are known to occur there. Non-native reptiles and amphibians tend to be highly adaptable and can threaten native wildlife by competing with them for food sources and spread disease. Proposed FirstNet deployment activities near water would likely occur onshore with limited activities in the water; therefore, the introduction of non-native species would be limited. Invasive terrestrial reptile or amphibian species are not expected to be introduced at project sites from machinery or laborers.

Terrestrial Invertebrates

Terrestrial invertebrate populations are susceptible to invasive plant species that may change or alter the community composition of specific plants on which they depend. Effects from invasive plant species to terrestrial invertebrates would be similar to those described for habitat loss and degradation.

Invasive insects in particular pose a large threat to the District's forest and agricultural resources. Species such as the gypsy moth (*Lymantria dispar*), hemlock woolly adelgid (*Adelges tsugae*), Asian longhorn beetle (*Anoplophora glabripennis*), and emerald ash borer (*Agrilus planipennis*) are of particular concern in the District of Columbia, and are known to cause irreversible damage to native forests. Emerald ash borer and Asian longhorn beetle are regulated in the District. The potential to introduce invasive invertebrates within construction zones and during long-term site maintenance can occur from vehicles and equipment being transported from one region to another, or when conducting revegetation of a site after deployment activities are complete. BMPs and mitigation measures could help to avoid or minimize the potential for introducing invasive plant species during implementation of the Proposed Action. Invasive species effects related to terrestrial invertebrates could be minimized with the implementation of BMPs and mitigation measures.

Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to wildlife resources and others would not. In addition, and as described in this section, infrastructure developed under the Preferred Alternative could result in a range of impacts, from no impacts to less than significant impacts, depending on the deployment scenario or site-specific conditions. The wildlife that would be affected would depend on the ecoregion, the species' phenology and the nature and extent of the habitats affected.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are expected to have no impacts to wildlife resources under the conditions described below.

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Noise generated by equipment required to install fiber would be infrequent and of short duration, and unlikely to produce measurable changes in wildlife behavior. It is anticipated that effects to wildlife would be temporary and would not result in any perceptible change.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts on wildlife resources because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures, attaching equipment to satellites launched for other purposes, and the use of portable devices that use satellite technology would not impact wildlife because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact wildlife resources, it is anticipated that this activity would have no impact on wildlife resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to wildlife resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation; effects to migratory patterns; indirect injury/mortality; reproductive effects; and invasive species effects. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to wildlife resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to wildlife resources. Land/vegetation clearing and

excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct injury/mortalities of wildlife that are not mobile enough to avoid construction activities (e.g. reptiles, small mammals, and young individuals), that utilize burrows (e.g., ground squirrels), or that are defending nest sites (such as ground-nesting birds). Disturbance, including noise, associated with the above activities involving heavy equipment or land clearing could result in habitat loss, effects to migration patterns, indirect injury/mortality, reproductive effects, and invasive species effects if BMPs and mitigation measures are not implemented.

  - New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public ROWs or private easements as well as the construction of access roads, POPs, huts, or facilitates to house outside plant equipment could result in potential impacts to wildlife resources. Impacts may vary depending on the number or individual poles installed and the extent of ground disturbance, but could include direct injury/mortality of individual species as described above; habitat loss, alteration, or fragmentation; effects to migratory patterns; indirect injury/mortality; and invasive species effects.
  - Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening could result in direct injury/mortality, habitat loss or alteration, effects to migratory patterns, indirect injury/mortality, and invasive species effects. Noise disturbance from heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in migratory effects and indirect injury/mortality.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water and construction of landings and/or facilities on the shores or the banks of waterbodies that accept the submarine cables could potentially impact wildlife (see Section 5.2.4, Water Resources, for a discussion of potential impacts to water resources). Potential effects could include direct injury/mortality, habitat loss, alteration, or fragmentation depending on the site location. If activities occurred during critical periods, effects to migratory patterns as well as reproductive effects and indirect injury/mortality could occur.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, such disturbance could result in direct injury/mortality of wildlife as described for other New Build activities. Habitat loss, alteration and fragmentation; effects to migration or migratory patterns, indirect injury/mortality, and invasive species effects could occur as a result of construction and resulting disturbance.
- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to wildlife resources. Land/vegetation clearing, excavation activities,

landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads could result in direct injury/mortality, habitat loss, alteration or fragmentation, and effects to migratory patterns. Security lighting and fencing could result in direct and indirect injury or mortality, effects to migratory patterns, as well as reproductive effects. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions.

- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to wildlife. However, if additional power units are needed, replacement towers, or structural hardening are required, impacts would be similar to new wireless construction. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions.
- Deployable Technologies: Implementation of deployable technologies including COWs, COLTs, and SOWs could result in direct injury/mortalities to wildlife on roadways. If external generators are used, noise disturbance could potentially impact migratory patterns of wildlife. RF hazards could result in indirect injury or mortality as well as reproductive effects depending on duration and magnitude of operations. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions.

  Deployment of drones, balloons, blimps, and piloted aircraft could potentially impact wildlife by direct or indirect injury/mortality from collision, entanglement, or ingestion and effects to migratory patterns and reproductive effects from disturbance and/or displacement due to noise. The magnitude of these effects depends on the timing and frequency of deployments. However, deployment activities are expected to be temporary and isolated, and likely affecting only a small number of wildlife.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers or poles; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to wildlife resources associated with deployment of this infrastructure are anticipated to be less than significant given the small-scale of likely individual FirstNet projects; however, some deployment activities could include direct injury/mortality, habitat loss, indirect injury/mortality, effects to migration, reproductive effects, and effects of invasive species depending on the project type, location, ecoregion, the species' phenology, and the nature and extent of the habitats affected. As stated above, these impacts would likely be limited to individual wildlife species and unlikely to cause population-level impacts. The specific deployment activity and where the deployment will take place will be determined based on location-specific conditions and the results of site-specific environmental reviews. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The wildlife that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

It is anticipated that there would be less than significant impacts to wildlife resources associated with routine inspections of the Preferred Alternative. Site maintenance would be infrequent, including mowing or limited application of herbicides, may result in less than significant effects to wildlife including direct injury/mortality to less mobile wildlife, or exposure to contaminants from accidental spills from maintenance equipment or release of pesticides.

During operations, direct injury/mortality of wildlife could occur from collisions and/or entanglements with transmission lines, towers, and aerial platforms.

Wildlife resources could still be affected by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support facilities. These features could also continue to disrupt movements of terrestrial wildlife, particularly during migrations between winter and summer ranges or in calving areas.

In addition, the presence of new access roads and transmission line ROWs may increase human use of the surrounding areas, which could increase disturbance to wildlife resulting in effects to migratory pathways, indirect injury/mortalities, reproductive effects, as well as the potential introduction and spread of invasive species as explained above. As stated above, these impacts would likely be limited to individual wildlife species and unlikely to cause population-level impacts, and therefore would likely than less than significant. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to further avoid or minimize potential impacts.

Alternatives Impact Assessment

The following section assesses potential impacts to wildlife resources associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration.

Therefore, potential impacts to wildlife resources as a result of implementation of this alternative could be as described below.

Deployment Impacts

As described above, implementation of deployable technologies could result in less than significant impacts from direct and indirect injury or mortality events, changes in migratory patterns, disturbance, or displacement. Greater frequency and duration of deployments could change the magnitude of impacts depending on species, life history, and region of the District. 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 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

Operational Impacts

As described above, operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be less than significant impacts because deployable activities are expected to be temporary and likely affecting only a small number of wildlife. The impacts can vary greatly among species and geographic region. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the nationwide, interoperable, public safety broadband network would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to wildlife resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 5.1.6.4, Terrestrial Wildlife.

5.2.6.5. Fisheries and Aquatic Habitats

Potential impacts to fisheries and aquatic habitats occurring in the District of Columbia and near offshore environment are discussed in this section.

Description of Environmental Concerns

Direct Injury/Mortality

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism from interactions associated with the Proposed Action. The most common direct injuries are entanglement, vessel strike, problems associated with accidental ingestion, and injuries incurred by sensitive animals from disturbance events. (USEPA, 2012d)

Based on the impact significance criteria presented in Table 5.2.6-1, less than significant impacts would be anticipated given the size and nature of the majority of proposed deployment activities. Although anthropogenic disturbances may be measurable but minimal for some FirstNet projects, individual behavior of fish species would be short-term and direct injury or mortality impacts at the population-level or sub-population effects would not likely be observed. BMPs and mitigation measures could help to avoid or minimize potential impacts to fisheries and aquatic invertebrate population survival.

Vegetation and Habitat Loss, Alteration, or Fragmentation

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

Depending on the location, construction of new infrastructure and long-term facility maintenance could result in the shoreline habitat alteration in localized areas; in some instances, the permanent loss of riparian vegetation could occur, which could lead to water quality impacts and in turn aquatic habitat alteration. Habitat loss is not likely to be widespread or affect populations of species as a whole; fish species would be expected to swim to a nearby location, depending on the nature of the deployment activity. Additionally, deployment activities with the potential for impacts sensitive aquatic habitats can 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, and BMPs and mitigation measures to protect water resources (see Section 5.2.4, Water Resources) could help to minimize or avoid potential impacts.

Effects to Migration or Migratory Patterns

Migration is the regular movement of animals from one region to another and back again. Migratory patterns vary by species and sometimes within the same species. For example, restrictions or alterations to waterways could alter migration patterns, limit fish passage, or affect foraging and spawning site access. Impacts are expected to be less than significant, and are anticipated to be localized and at a small-scale, and would vary depending on the species, time of year, and duration of deployment. BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Reproductive Effects

Reproductive effects are considered those that either directly or indirectly reduce an animal's ability to produce offspring or reduce the rates of growth, maturation, and survival of offspring, which can affect the overall population of individuals. Restrictions to spawning/breeding areas for fish and aquatic invertebrates and the alteration of water quality through sediment infiltration, obstruction of natural water flow, or loss of submerged vegetation resulting from the deployment of various types of infrastructure, are expected to be less than significant, though BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Invasive Species Effects

The potential to introduce invasive plants within construction zones can occur from vehicles and equipment being transported from one region to another, or when conducting revegetation of a site after deployment activities are complete. FirstNet deployment activities could result in short-term or temporary changes to specific project sites and these sites are expected to return to their natural state in a year or two. Invasive species are not expected to be introduced to project sites as part of the deployment activities from machinery or construction workers, therefore impacts are expected to be less than significant. BMPs and mitigation measures could help to avoid or minimize the potential for introducing invasive aquatic plant and animal species during implementation of the Proposed Action.

Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to fisheries and aquatic habitats and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions. The fisheries and aquatic habitats that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

<u>Activities Likely to Have No Impacts</u>

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are expected to have no impacts to fisheries and aquatic habitats under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance, including noise, associated with the installation of fiber optic cable in existing conduit would be limited to

entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that effects to wildlife would be temporary and would not result in any perceptible change.

- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts on fisheries and aquatic habitats because there would be no ground disturbance.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact fisheries and aquatic habitats because those activities would not require ground disturbance .
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact fisheries, it is anticipated that this activity would have no impact on the aquatic environment.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to fisheries and aquatic habitats as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation; effects to migratory patterns; indirect injury/mortality; reproductive effects; and invasive species effects. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to fisheries and aquatic habitats include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to fisheries and aquatic habitats. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities, particularly if they occur adjacent to water resources that support fish, could result in habitat loss, alteration and fragmentation; indirect injury/mortality; and invasive species effects if BMPs and mitigation measures are not implemented.
  - New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public ROWs or private easements as well as the construction of access roads, POPs, huts, or facilitates to house outside plant equipment could result in potential impacts to fisheries and aquatic habitats if activities occur near water resources that support fish. Impacts may vary depending on the number or individual poles installed or if access roads or stream crossings are needed, but could include habitat loss, alteration and fragmentation; indirect injury/mortality; and invasive species effects.

   - Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening, if conducted near water resources that support fish, could result in habitat loss, alteration and fragmentation; indirect injury/mortality; and invasive species effects.
   - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water and construction of landings and/or facilities on the shores or the banks of waterbodies that accept the submarine cables could result in direct injury/mortalities of fisheries and aquatic invertebrates that are not mobile enough to avoid construction activities (e.g. mussels), that utilize burrows (e.g., crayfish), or that are defending nest sites (some fish). Disturbance, including noise, associated with the above activities could result in habitat loss, effects to migration patterns, indirect injury/mortality, reproductive effects, and invasive species effects.
   - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, particularly near water resources that support fish, such disturbance could result in habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects.
- Wireless Projects
   - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to fisheries and aquatic habitats, if such actions were deployed near water resources. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads, particularly if they occur near waterbodies, could result in habitat loss or indirect injury/mortality, and invasive species effects, although highly unlikely. Refer to Section 2.4, Radio Frequency Emissions, for more information on RF emissions.
   - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to fisheries and aquatic habitats. However, if additional power units are needed, replacement towers, structural hardening, or physical security measures require ground disturbance, impacts would be similar to new wireless construction. For a discussion of RF emissions refer to Section 2.4, Radio Frequency Emissions.
   - Deployable Technologies: Implementation of deployable technologies including COWs, COLTs, or SOWs could result in habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects if new access roads or other ground disturbing activities are necessary that generate erosion, sedimentation, or water quality impacts. For a discussion of RF emissions refer to Section 2.4, Radio Frequency Emissions.

Deployment of drones, balloons, blimps, or piloted aircraft could potentially impact fisheries and aquatic habitat if deployment occurs within or adjacent to water resources. The magnitude of these effects depends on the timing and frequency of deployments, and could result in result in habitat loss, alteration, and fragmentation; indirect injury/mortality, and invasive species effects.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to fisheries and aquatic habitats associated with deployment of this infrastructure could include direct injury/mortality, habitat loss, indirect injury/mortality, effects to migration, reproductive effects, and effects of invasive species depending on the ecoregion, the species' phenology, and the nature and extent of the habitats affected. These impacts are anticipated to be less than significant due to the small-scale of deployment activities and the limited number of aquatic species expected to be impacted. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The fisheries and aquatic habitats that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

It is anticipated that there would be less than significant impacts to fisheries and aquatic habitats associated with routine inspections of the Preferred Alternative. Site maintenance, if conducted near water resources that support fish, including application of herbicides, may result in less than significant effects to fisheries and aquatic habitats including exposure to contaminants from accidental spills from maintenance equipment or release of pesticides.

Fisheries and aquatic habitat could still be affected by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support facilities. These features could also continue to disrupt movements of fish passage. In addition, the presence of new access roads and transmission line ROWs near water resources that support fish may increase human use of the surrounding areas, which could increase disturbance to fisheries and aquatic habitats resulting in effects to migratory pathways, indirect injury/mortalities, reproductive effects, as well as the potential introduction and spread of invasive species as explained above. Fisheries and aquatic habitat may also be impacted if increased access leads to an increase in the legal or illegal take of biota. However, impacts are expected to be less than significant due to the small-scale of expected activities with the potential to affect fisheries and aquatic habitat. As a result of the small-scale, only a limited number of individuals are anticipated to be impacted, furthermore, habitat impacts would also be minimal in scale. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to further 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.

<u>Deployment Impacts</u>

As explained above, implementation of deployable technologies could result in less than significant impacts from habitat loss, alteration, and fragmentation; indirect injury/mortality, and invasive species effects. Greater frequency and duration of deployments could change the magnitude of impacts depending on species, life history, and region of the District. However, impacts are expected to remain less than significant due to the limited nature of expected deployment activities. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

<u>Operational Impacts</u>

Operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be less than significant impacts to fisheries and aquatic habitats associated with routine operations and maintenance due to the limited nature of expected deployment activities. The impacts can vary greatly among species and geographic region. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the nationwide, interoperable, public safety broadband network would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to fisheries and aquatic habitats as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 5.1.6.5, Fisheries and Aquatic Habitats.

5.2.6.6. Threatened and Endangered Species and Species of Conservation Concern

This section describes potential impacts to threatened and endangered species (terrestrial mammals and invertebrates) in the District of Columbia associated with deployment and operation of the Proposed Action and Alternatives. There are no federally listed birds, fish, reptiles, amphibians, or plants in the District, and therefore, no potential impacts are anticipated. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on threatened and endangered species and their habitat were evaluated using the significance criteria presented in Table 5.2.6-2. The categories of impacts for threatened and endangered species and their habitats are defined as may affect, likely to adversely affect; may affect, not likely to adversely affect; and no effect. Characteristics of each effect type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes across the District, 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 5.2.6-2, 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 and invertebrates with known occurrence in the District of Columbia are described below. There are no federally listed birds, fish, reptiles, amphibians, or plants in the District of Columbia.

Table 5.2.6-2: Impact Significance Rating Criteria for Threatened and Endangered Species

Type of Effect	Effect Characteristic	Impact Level		
		May Affect, Likely to Adversely Affect	**May Affect, Not Likely to Adversely Affect**	**No Effect**
Injury/Mortality of a Listed Species	Magnitude or Intensity	As per the ESA, this impact threshold applies at the individual level so applies to any mortality of a listed species and any impact that has more than a negligible potential to result in unpermitted take of an individual of a listed species. Excludes permitted take.	Does not apply in the case of mortality (any mortality unless related to authorized take falls under likely to adversely affect category). Applies to a negligible injury that does not meet the threshold of take due to its low level of effect and/or ability to fully mitigate the effect. Includes permitted take.	No measurable effects on listed species.
	Geographic Extent	Any geographic extent of mortality or any extent of injury that could result in take of a listed species.	Any geographic extent that does not meet the threshold of take due to its low level of effect and/or ability to fully mitigate the effect. Typically applies to one or very few locations.	
	Duration or Frequency	Any duration or frequency that could result in take of a listed species.	Any duration or frequency that does not meet the threshold of take due to its low level of effect and/or ability to fully mitigate the effect. Typically applies to infrequent, temporary, and short-term effects.	
Reproductive Effects	Magnitude or Intensity	Any reduction in breeding success of a listed species.	Changes in breeding behavior (e.g., minor change in breeding timing or location) that are not expected to result in reduced reproductive success.	No measurable effects on listed species.
	Geographic Extent	Reduced breeding success of a listed species at any geographic extent.	Changes in breeding behavior at any geographic extent that are not expected to result in reduced reproductive success of listed species. Typically applies to one or very few locations.	
	Duration or Frequency	Any duration or frequency that could result in reduced breeding success of a listed species.	Infrequent, temporary, or short-term changes in breeding behavior that do not reduce breeding success of a listed species within a breeding season.	
Behavioral Changes	Magnitude or Intensity	Disruption of normal behavior patterns (e.g., breeding, feeding, or sheltering) that could result in take of a listed species.	Minor behavioral changes that would not result in take of a listed species.	No measurable effects on listed species.

Type of Effect	Effect Characteristic	Impact Level		
		May Affect, Likely to Adversely Affect	**May Affect, Not Likely to Adversely Affect**	**No Effect**
	Geographic Extent	Any geographic extent that could result in take of a listed species.	Changes in behavior at any geographic scale that are not expected to result in take of a listed species. Typically applies to one or very few locations.	
	Duration or Frequency	Any duration or frequency that could result in take of a listed species.	Infrequent, temporary, or short-term changes that are not expected to result in take of a listed species.	
Loss or Degradation of Designated Critical Habitat	Magnitude or Intensity	Effects to any of the essential features of designated critical habitat that would diminish the value of the habitat for the survival and recovery of the listed species for which the habitat was designated.	Effects to designated critical habitat that would not diminish the functions or values of the habitat for the species for which the habitat was designated.	No measurable effects on designated critical habitat.
	Geographic Extent	Effects to designated critical habitat at any geographic extent that would diminish the value of the habitat for listed species. Note that the likely to adversely affect threshold for geographic extent depends on the nature of the effect. Some effects could occur at a large scale but still not appreciably diminish the habitat function or value for a listed species. Other effects could occur at a very small geographic scale but have a large adverse effect on habitat value for a listed species.	Effects realized at any geographic extent that would not diminish the functions and values of the habitat for which the habitat was designated. Typically applies to one or few locations within a designated critical habitat.	
	Duration or Frequency	Any duration or frequency that could result in reduction in critical habitat function or value for a listed species.	Any duration or frequency that would not diminish the functions and values of the habitat for which the habitat was designated. Typically applies to Infrequent, temporary, or short-term changes.	

Terrestrial Mammals

Direct mortality or injury to the federally listed northern long-eared bat (*Myotis septentrionalis*) could occur if tree clearing activities occurred during the roosting season (i.e., approximately April-November) and bats were present. While projects would not likely directly affect winter hibernacula (e.g., caves), human disturbance in and around hibernacula when bats are present could lead to adverse effects to these species as well. Impacts would likely be isolated, individual events. When disturbed by noise or light, bats awaken resulting in a loss of body fat needed to help them survive in the spring. (USFWS, 2015g)

BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Invertebrates

Two federally listed amphipods occur in the District of Columbia, the Hay's Spring amphipod (*Stygobromus hayi*) and the Kenk's amphipod (*Stygobromus kenki*). Direct mortality or injury could occur to these species if land clearing or excavation activities associated with the Proposed Action occur in an area inhabited by one of these species. Changes in water quality from ground disturbing activities could cause stress resulting in lower productivity. Distribution of these species is limited to groundwater and springs associated with Rock Creek. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Reproductive Effects

Reproductive effects are considered those that either directly or indirectly reduce the breeding success of a listed species by altering its breeding timing or location, or reducing the rates of growth, maturation, and survival of offspring, which can affect the breeding success. Potential effects to federally listed terrestrial mammals and invertebrates with known occurrence in the District of Columbia are described below.

Terrestrial Mammals

Noise, light, and other human disturbances associated with the Proposed Action could adversely affect federally listed terrestrial mammals such as the northern long-eared bat (*Myotis septentrionalis*) within or in the vicinity of Proposed Action activities. Impacts would be directly related to the frequency, intensity, and duration of these activities. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts

Invertebrates

Changes in water quality from ground disturbing activities could cause stress resulting in lower productivity for the federally listed amphipods known to occur in the District of Columbia. In addition, introduction of invasive aquatic species could also indirectly affect aquatic invertebrates. Impacts associated with deployment activities are expected to result in less than significant changes to water quality. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

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 and invertebrates with known occurrence in the District of Columbia are described below.

Mammals

No behavioral effects to federally listed mammals are expected as a result of the Proposed Action. Bats have the capacity to divert from sound sources during foraging. Though, BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented, as necessary. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Invertebrates

Changes in water quality and quantity, habitat loss or alternation, and introduction of aquatic invasive species could impact food sources for federally listed mollusks resulting in lower productivity. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented, as necessary. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Loss or Degradation of Designated Critical Habitat

Effects to designated critical habitat and any of its essential features that could diminish the value of the habitat for the listed species or its survival and recovery would be considered an adverse effect and could be potentially significant. Depending on the species or habitat, the adverse effect threshold would vary for geographic extent. In some cases, large-scale impacts could occur that would not diminish the functions and values of the habitat, while in other cases small-scale changes could lead to potentially significant adverse effects. 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 and invertebrates with designated critical habitat in the District are described below.

Terrestrial Mammals

No designated critical habitat occurs for terrestrial mammals in the District of Columbia. 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.

Invertebrates

No designated critical habitat occurs for terrestrial or aquatic invertebrates in the District of Columbia. 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 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 threatened and endangered species and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions. The threatened and endangered species that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

Activities Likely to Have No Effect

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are expected to have no impacts to threatened and endangered species or their habitat under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance, including noise, associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Although threatened and endangered species and their habitat could be impacted, it is anticipated that effects to threatened and endangered species would be temporary, infrequent, and likely not conducted in locations designated as vital or critical for any period.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts on threatened and endangered species or their habitat because there would be no ground disturbance and very limited human activity.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact threatened and endangered because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact protected species, it is anticipated that this activity would have no impact on protected species.

Activities with the Potential to Affect Listed Species

Potential deployment-related effects to threatened and endangered species and their habitats as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality, reproductive effects, and behavioral changes. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential effects to threatened and endangered species include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to threatened and endangered species. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct injury/mortalities of threatened and endangered species that are not mobile enough to avoid construction activities (e.g. mollusks, small mammals, and young). Disturbance, including noise, associated with the above activities could result in direct injury/mortality, reproductive effects, or behavioral changes if BMPs and mitigation measures are not implemented.
  - New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public ROWs or private easements as well as the construction of access roads, POPs, huts, or facilitates to house outside plant equipment could result in potential impacts to threatened and endangered species and their habitat. Impacts may vary depending on the number or individual poles installed, but could include direct injury/mortality, reproductive effects, or behavioral changes.
  - Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening could result in direct injury/mortality, reproductive effects, or behavioral changes. Noise disturbance from heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in reproductive effects or behavior changes.

  - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water and construction of landings and/or facilities on the shores or the banks of waterbodies that accept the submarine cables could potentially impact threatened and endangered species and their habitat, particularly aquatic species (see Section 5.2.4, Water Resources, for a discussion of potential impacts to water resources). Effects could include direct injury/mortality, and if activities occurred during critical periods, reproductive effects and behavioral changes could occur.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts, there would be no impacts to threatened and endangered species or their habitats. If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, such disturbance could result in direct injury/mortality of threatened and endangered species as described for other New Build activities. Reproductive effects and behavioral changes could also occur as a result of construction and resulting disturbance.
- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to threatened and endangered species and their habitat. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads could result in direct injury/mortality, reproductive effects, or behavioral changes. Security lighting and fencing could result in direct injury/mortality, disruption of normal behavior patterns, as well as reproductive effects. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower; FirstNet activities would be infrequent, temporary, or short-term in nature and are unlikely to result in direct injury/mortality or behavioral changes to threatened and endangered species. However, if replacement towers or structural hardening are required, impacts could be similar to new wireless construction. Hazards related security/safety lighting and fencing may produce direct injury/mortality, reproductive effects, and behavioral changes. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Deployable Technologies: Implementation of land-based deployable technologies including COWs, COLTs, or SOWs could result in direct injury/mortalities to threatened and endangered species on roadways. If external generators are used, noise disturbance could potentially result in reproductive effects or behavioral changes to threatened and endangered species. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions.

Deployment of drones, balloons, piloted aircraft, or blimps could potentially impact threatened and endangered species by direct injury/mortality, reproductive effects, or behavioral changes. The magnitude of these effects depends on the timing and frequency of deployments.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to threatened and endangered species associated with deployment of this infrastructure could include direct injury/mortality, reproductive effects, and behavioral changes. These impacts may affect, but are not likely adversely affect protected species; BMPs and mitigation measures identified in Chapter 17 and as defined through consultation with the appropriate resource agency, could help to mitigate or reduce potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts to the federally listed bat and mollusks.

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 the federally listed bat and mollusks, as they would be conducted infrequently and in compliance with BMPs and mitigation measures developed through consultation with the appropriate resource agency.

During operations, direct injury/mortality of threatened and endangered species could occur from collisions and/or entanglements with transmission lines, towers, and aerial platforms. Listed species may be affected, but are not likely to be adversely affected. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to further avoid or minimize potential impacts.

Threatened and endangered species may be affected, but are not likely to be adversely affected, by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support facilities. These features could also continue to disrupt movements of some species, particularly during migrations between winter and summer ranges. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to further avoid or minimize potential impacts.

Alternatives Impact Assessment

The following section assesses potential impacts to threatened and endangered species associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to threatened and endangered species as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies may affect, but is not likely to adversely affect, threatened and endangered species through direct injury/mortality, reproductive effects, and behavioral changes. Greater frequency and duration of deployments could change the magnitude of impacts depending on species, life history, and region of the District. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Operational Impacts

As explained above, operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that activities may affect, but are not likely to adversely affect, threatened and endangered species and their habitats as a result of routine operations, management, and monitoring. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, 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 construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 5.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

5.2.7. Land Use, Recreation, and Airspace

5.2.7.1. Introduction

This section describes potential impacts to land use, recreation, and airspace resources in the District of Columbia associated with deployment and operation of the Proposed Action and Alternatives. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

5.2.7.2. 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 5.2.7-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

5.2.7.3. 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 ROW, 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.

Table 5.2.7-1: Impact Significance Rating Criteria for Land Use, Recreation, and Airspace

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less Than Significant with BMPs and Mitigation Measures Incorporated**	**Less Than Significant**	**No Impact**
Direct land use change	Magnitude or Intensity	Change in designated/permitted land use that conflicts with existing permitted uses, and/or would require a change in zoning. Conversion of prime or unique agricultural lands	Effect that is potentially significant, but with mitigation is less than significant	Minimal changes in existing land use, or change that is permitted by-right, through variance, or through special exception	No changes to existing development, land use, land use plans, or policies. No conversion of prime or unique agricultural lands
	Geographic Extent	Regional impacts observed throughout the state, territory, or District		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, territory, or District		Effects realized at one or multiple isolated locations	NA
	Duration or Frequency	Permanent: Land use altered indefinitely		Short-Term: Land use altered for as long as the entire construction phase or a portion of the operations phase	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less Than Significant with BMPs and Mitigation Measures Incorporated**	**Less Than Significant**	**No Impact**
Loss of access to public or private recreation land or activities	Magnitude or Intensity	Total loss of access to recreation land or activities	Effect that is potentially significant, but with mitigation is less than significant	Restricted access to recreation land or activities	No disruption or loss of access to recreational lands or activities
	Geographic Extent	Most or all recreational land/sites in a state, territory, or District; 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, or District	NA
	Duration or Frequency	Persists during the life of the project		Persists for as long as the entire construction phase or a portion of the operations phase	NA
Loss of enjoyment of public or private recreation land (due to visual, noise, or other impacts that make recreational activity less desirable)	Magnitude or Intensity	Total loss of enjoyment of recreational activities; substantial reduction in the factors that contribute to the value of the recreational resource, resulting in avoidance of activity at one or more sites	Effect that is potentially significant, but with mitigation is less than significant	Small reductions in visitation or duration of recreational activity	No loss of enjoyment of recreational activities or areas; no change to factors that contribute to the value of the resource
	Geographic Extent	Most or all recreational land/sites in a state, territory, or District; 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, or District	NA
	Duration or Frequency	Persists during or beyond the life of the project		Persists for as long as the entire construction phase or a portion of the operations phase	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less Than Significant with BMPs and Mitigation Measures Incorporated**	**Less Than Significant**	**No Impact**
Use of airspace	Magnitude or Intensity	Measurable, substantial change in flight patterns and/or use of airspace	Effect that is potentially significant, but with mitigation is less than significant	Alteration to airspace usage is minimal	No alterations in airspace usage or flight patterns
	Geographic Extent	Regional impacts observed throughout the state, territory, or District		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

Based on the impact significance criteria presented in Table 5.2.7-1, less than significant impacts would be anticipated given the size and nature of the majority of the proposed deployment activities. Direct land use changes would be minimized and isolated at specific locations and all required permits would be obtained; only short-term impacts during the construction phase would be expected.

Indirect Land Use Change

Changes in surrounding land use patterns and options for surrounding land uses could be influenced by the deployment, operation, and maintenance of facilities and the acquisition of rights-of-way or easement. The deployment, operation, and maintenance of structures, towers, roads, and other permanent features could conflict with surrounding land use patterns and options for surrounding land uses. The installation of poles, towers, structures, or other aboveground facilities or assets could have short- or long-term effects to surrounding land use patterns or options for surrounding land uses based on the characteristics of the structures or facilities, such as the location, type, or height. In addition, the acquisition of ROWs or easements and the construction of roads to access facilities and locations could influence changes in surrounding land uses. The effects from these actions would depend on the geographic location; compatibility with surrounding land uses; and characteristics of the ROW, easement, or access road. These characteristics, such as the length, width, and location could conflict with surrounding land use patterns or restrict options for surrounding land uses.

Based on the impact significance criteria presented in Table 5.2.7-1, less than significant impacts would be anticipated as any new land use would be small-scale and consistent with the surrounding land uses in the area; only short-term impacts during the construction phase would be expected.

Loss of Access to Public or Private Recreation Land or Activities

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 5.2.7-1, less than significant impacts would be anticipated as restricted access or a loss of access to recreation areas would not occur; only short-term impacts or small-scale limitations during the construction phase would be expected.

Loss of Enjoyment of Public or Private Recreation Land

The deployment of new towers, and the resulting built tower, could influence the enjoyment of public or private recreation land. Crews accessing the site during the deployment and maintenance of structures, towers, roads, and other permanent features could temporarily impact enjoyment of recreation land. The deployment of poles, towers, structures, or other aboveground facilities could affect the enjoyment of recreational land based on the characteristics of the structures or facilities, including permanent impacts to scenery, short-term noise impacts, and the presence of deployment or maintenance crews.

Based on the impact significance criteria presented in Table 5.2.7-1, less than significant impacts would be anticipated as only small reductions, if any, in recreational visits or durations would occur due to the relatively small-scale nature of likely FirstNet activities. Only short-term impacts during the construction phase would be expected.

Use of Airspace

Primary concerns to airspace include the following: if aspects of the Proposed Action would result in violation of FAA regulations; undermine the safety of civilian, military, or commercial aviation; or infringe on flight activity and flight corridors. Potential impacts could include air routes or flight paths, available flight altitudes, disruption of normal flight patterns, and restrictions to flight activities. Construction of new towers or alternations to existing towers could, but are not likely to, obstruct navigable airspace in the District of Columbia.

Based on impact significance criteria presented in Table 5.2.7-1, airspace impacts are not likely to change or alter flight patterns or airspace usage. Drones, balloons, and piloted aircraft would likely only be deployed in an emergency and for a short period, FirstNet would not impact airspace resources.

5.2.7.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure, and the specific deployment requirements, some activities would result in potential impacts to land use, recreation, and airspace resources and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to land use, recreation, and airspace resources under the conditions described below:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring alongside the road in utility corridors or within public road rights-of-way.
    - Land Use: See Activities Likely to Have Impacts below.
    - Recreation: See Activities Likely to Have Impacts below.
    - Airspace: No impacts to airspace would be anticipated since the activities would not affect flight patterns or cause obstructions that would require FAA and/or District review based on FAR 14 CFR, Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace* (See Section 5.1.7.5 Obstructions to Airspace Considerations).
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas.
    - Land Use: It is anticipated that there would be no impacts to land use since the activities that would be conducted would not directly or indirectly result in changes to existing and surrounding land uses.
    - Recreation: See Activities Likely to Have Impacts below.
    - Airspace: It is anticipated that there would be no impacts to airspace since the activities would not affect flight patterns or cause obstructions that would require FAA and/or District review based on FAR 14 CFR, Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace* (See Section 5.1.7.5 Obstructions to Airspace Considerations).
  - New Build – Aerial Fiber Optic Plant: Installing new poles and hanging cables on previously disturbed or new (undisturbed) ROWs or easements and the potential construction of access roads.
    - Land Use: See Activities Likely to Have Impacts below.
    - Recreation: See Activities Likely to Have Impacts below.
    - Airspace: Installation of new poles would not have an effect on airspace because utility poles are an average of 40 feet in height and do not intrude into useable airspace.
  - Collocation on Existing Aerial Fiber Optic Plant: Installation of new fiber on existing poles would be limited to previously disturbed areas.
    - Land Use: It is anticipated that there would be no impacts to land use since the activities that would be conducted would not directly or indirectly result in changes to existing and surrounding land uses.

    - Recreation: No impacts to recreation would be anticipated since the activities that would be conducted would not cause disruption or loss of access to recreational lands or activities or the enjoyment of those lands or activities.
    - Airspace: No impacts are anticipated to airspace from collocations.
- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber and installation of new equipment in existing huts.
    - Land Use: It is anticipated that there would be no impacts to land use since the activities would not directly or indirectly result in changes to existing and
    - surrounding land uses.
    - Recreation: Use of existing dark fiber would not impact recreation because it would not impede access to recreational resources.
    - Airspace: Lighting of dark fiber would have no impacts on airspace.
- New Build – Submarine Fiber Optic Plant: Installing cables in limited nearshore and inland bodies of water and the constructing landings and/or facilities on shores or the banks of waterbodies that accept the submarine cable.
    - Land Use: See Activities Likely to Have Impacts below.
    - Recreation: See Activities Likely to Have Impacts below.
    - Airspace: The installation of cables in or near bodies of water and construction of landings and/or facilities on shores or the banks of water bodies that accept the submarine cable would not impact flight patterns or cause obstructions that would require FAA and/or District review based on FAR 14 CFR, Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace* (See Section 5.1.7.5 Obstructions to Airspace Considerations).
- Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment would occur in existing boxes or huts. The section below addresses potential impacts to land use, recreation resources, and airspace if deployment of new boxes, huts, or access roads is required.
    - Land Use: See Activities Likely to Have Impacts below.
    - Recreation: See Activities Likely to Have Impacts below.
    - Airspace: No impacts to airspace would be anticipated since the activities would not affect flight patterns or cause obstructions that would require FAA and/or District review based on FAR 14 CFR, Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace* (See Section 5.1.7.5 Obstructions to Airspace Considerations).

- Wireless Projects
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, structure, or building.
    - Land Use: There would be no impacts to existing and surrounding land uses. The potential addition of power units, structural hardening, and physical security measures would not impact existing or surrounding land uses.
    - Recreation: See Activities Likely to Have Impacts below.
    - Airspace: See Activities Likely to Have Impacts below.
- Deployable Technologies
  - Deployable Technologies: These technologies would be used where permanent, fixed infrastructure cannot be deployed due to a variety of factors such as the need to supplement coverage or to avoid or mitigate permanent impacts to sensitive resources or receptors.
    - Land Use: It is anticipated that there would be no impacts to existing or surrounding land uses because these technologies would be temporarily located in areas compatible with other land uses.
    - Recreation: No impacts to recreation are anticipated, as deployable technologies would not affect the use or enjoyment of recreational lands.
    - Airspace: Use of land-based deployable technologies (COW, COLT, and SOW) is not expected to result in impacts to airspace, provided antenna masts do not exceed 200 feet above ground level or do not trigger any of the other FAA obstruction to airspace criteria listed in Section 5.1.7.5 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: It is anticipated that there would be no impacts to existing or surrounding land uses because these technologies would be temporarily located in areas compatible with other land uses.
    - Recreation: It is anticipated that there would be no impacts to recreational uses because these technologies would be temporarily deployed but would not restrict access to, or enjoyment of, recreational lands.
    - Airspace: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact airspace because those activities would not result in changes to flight patterns and airspace usage or result in obstructions to airspace.

- Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact to land use, it is anticipated that this activity would have no impact on land use.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to land use, recreation resources, or airspace as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including changes to existing and surrounding land uses. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to land use resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring alongside the road in utility corridors or within public road rights-of-way.
    - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations.
    - Recreation: It is anticipated that plowing, trenching, or directional boring may cause temporary, localized restrictions to recreational land or activities, which may persist during the deployment phase. It is reasonable to anticipate that small reductions in visitation to localized areas may occur during the deployment phase.
    - Airspace: No impacts are anticipated – see previous section.
  - New Build – Aerial Fiber Optic Plant: Installing new poles and hanging cables on previously disturbed or new (undisturbed) rights-of-way or easements and the potential construction of access roads.
    - Land Use: These activities could result in term potential impacts to land uses. Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New structures, poles, or access roads on previously undisturbed rights-of-way or easements could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new structures with existing and surrounding land uses.
    - Recreation: Deployment activities may cause temporary, localized restricted access to recreation land or activities, which may persist for the duration of the deployment phase. Small reductions to visitation during the deployment phase may be anticipated.
    - Airspace: No impacts are anticipated – see previous section.

  - New Build – Submarine Fiber Optic Plant: Installing cables in limited nearshore and inland bodies of water and the constructing landings and/or facilities on shores or the banks of waterbodies that accept the submarine cable.
    - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New landings and/or facilities on shore could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new facilities with existing and surrounding land uses.
    - Recreation: Deployment may temporarily restrict recreation on or within limited nearshore and inland bodies of water and the surrounding area during the deployment phase. Reductions in visitation may result during deployment.
    - Airspace: No impacts are anticipated – see previous section.
  - Installation of Optical Transmission or Centralized Transmission Equipment: Installation of equipment including construction of new boxes, huts, or access roads.
    - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New boxes, huts, or access roads could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new facilities with existing and surrounding land uses.
    - Recreation: Deployment of installation equipment and the construction of boxes, huts, or access roads may restrict access to recreation land or activities. Reductions in visitation during deployment may occur.
    - Airspace: No impacts are anticipated – see previous section.
- Wireless Projects
  - New Wireless Communication Towers: Installing new wireless towers, associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads.
    - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New wireless towers, associated structures, or access roads could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new facilities with existing and surrounding land uses.
    - Recreation: Deployment of new towers and associated structures could result in temporary, localized restricted access for recreation land or activities for the duration of the deployment phase. Reductions in visitation or duration of recreational activity may result from restricted access.

        - Airspace: Installation of new wireless towers could result in impacts to airspace if towers exceed 200 feet above ground level or meets the other criteria listed in Section 5.1.7.5 Obstructions to Airspace Considerations. An OE/AAA could be required for the FAA to determine if the proposed construction does affect navigable airways or flight patterns of an airport if the aerial fiber optic plant is built near one of Washington, D.C.'s regional airports.
    - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower.
        - Land Use: No impacts are anticipated – see previous section.
        - Recreation: Installation of antennas or microwaves to existing towers may cause temporary, localized restricted access to recreation lands or activities during installation, which may cause small reductions in visitation for the duration of installation.
        - Airspace: Collocation of mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, addition of power units, structural hardening, and physical security measures could result in impacts if located near airports or air navigation facilities.
- Deployable Technologies
    - Deployable Technologies: These technologies would be used where permanent, fixed infrastructure cannot be deployed due to a variety of factors such as the need to supplement coverage or to avoid or mitigate permanent impacts to sensitive resources or receptors.
        - Land Use: No impacts are anticipated – see previous section.
        - Recreation: No impacts are anticipated – see previous section.
        - Airspace: Implementation of deployable aerial communications architecture could result in temporary or intermittent impacts to airspace. Deployment of tethered systems (such as balloons or blimps) could pose an obstruction hazard if deployed above 200 feet and near District of Columbia airports (See obstruction criteria in Section 5.1.7.5 Obstructions to Airspace Considerations). Potential impacts to airspace (such as SUAs and MTRs) may be possible depending on the planned use of drones, piloted aircraft, untethered balloons, and blimps (e.g., frequency of deployment, altitudes, proximity to airports and airspaces classes/types, length of deployment, etc.). Coordination with the FAA would be required to determine the actual impact and the required certifications. It is expected that FirstNet would attempt to avoid changes to airspace and the flight profiles (boundaries, flight altitudes, operating hours, etc.).

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: The installation of permanent equipment on existing structures and the use of portable devices that use satellite technology.
    - Land Use: No impacts are anticipated – see previous section
    - Recreation: It is anticipated the installation of equipment on existing structures may cause temporary, localized restricted access to recreation lands or activities during installation, which may cause small reductions in visitation for the duration of installation.
    - Airspace: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology may impact airspace if equipment creates an obstruction.

In general, the abovementioned activities could potentially involve construction activities. Potential impacts to land uses associated with deployment could include temporary restrictions to existing and surrounding land uses in isolated locations. Potential impacts to recreation land and activities could include temporary, localized restricted access and reductions in visitation or duration of recreational activities. Potential impacts to airspace are expected to be less than significant due to the temporary and small-scale nature of deployment activities. Additionally FirstNet (or its network partners), would prepare an OE/AAA for any proposed tower that might affect navigable airways or flight patterns of an airport. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be no impacts to land use, recreation resources, or airspace associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for temporary, short-term inspections. If routine maintenance or inspection activities would conflict with existing or surrounding land uses, impact recreation resources, or conflict with airspace, impacts could result as explained above.

Operation of the Deployable Technologies options of the Preferred Alternative could result in the temporary presence of deployable vehicles and equipment (including airborne equipment), potentially for up to two years in some cases. The degree of change in the visual environment (see Section 5.2.8, Visual Resources)—and therefore the potential indirect impact on a landowner’s ability to use or sell of their land as desired—would be highly dependent on the specific deployment location and length of deployment. The use of deployable aerial communications architecture could temporarily add new air traffic or aerial navigation hazards. The magnitude of these effects would depend on the specific location of airborne resources along with the duration of their use. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to further avoid or minimize potential impacts.

5.2.7.5. Alternatives Impact Assessment

The following section assesses potential impacts to land use, recreation resources, and airspace associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to land use, recreation, and airspace resources as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to land use. While a single deployable technology may have imperceptible impact, multiple technologies operating in close proximity for longer periods could impact existing and surrounding land uses. There could be impacts to recreation activities during the deployment of technologies if such deployment were to occur within or near designated recreation areas. Enjoyment of activities dependent upon the visibility of wildlife or scenic vistas may be affected, however, impacts would be less than significant due to the temporary nature of likely deployment activities. If deployment triggers any obstruction criterion or result in changes to flight patterns and airspace restrictions, FirstNet (or its partners) would consult with the FAA to determine how to proceed. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to land use, recreation resources, or airspace associated with routine inspections of the Deployable Technologies Alternative, assuming that the same access roads used for deployment are also used for inspections. Operation of deployable technologies would result in land use, land ownership, airspace, and recreation (access and enjoyment) similar in type to those described for the Preferred

Alternative. The frequency and extent of those potential impacts would be greater than for the Proposed Action because under this Alternative, deployable technologies would be the only options available. As a result, this alternative would require a larger number of terrestrial and airborne deployable vehicles and a larger number of deployment locations in—all of which would potentially affect a larger number of properties and/or areas of airspace. Overall, these potential impacts would be less than significant due to the temporary nature of deployment activities. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to 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 land use, recreation resources, or airspace. Environmental conditions would therefore be the same as those described in Section 5.1.7, Land Use, Recreation, and Airspace.

5.2.8. Visual Resources

5.2.8.1. Introduction

This section describes potential impacts to visual resources in the District of Columbia associated with deployment and operation of the Proposed Action and Alternatives. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

5.2.8.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on visual resources were evaluated using the significance criteria presented in Table 5.2.8-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

Table 5.2.8-1: Impact Significance Rating Criteria for Visual Resources

Type of Effect	**Effect Characteristics**	**Impact Level**			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Adverse change in aesthetic character of scenic resources or viewsheds	Magnitude or Intensity	Fundamental and irreversibly negative change in aesthetic character	Effect that is potentially significant, but with mitigation is less than significant	Intermittently noticeable change in aesthetic character that is marginally negative	No visible effects
	Geographic Extent	Regional impacts observed throughout the state, territory, or District		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, or District		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

5.2.8.3. 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 the District, residents and visitors travel to the area to view its historic architecture, such as the White House and the U.S. Capitol building, and natural beauty of the Tidal Basin of the Potomac River. If lands considered visually significant or scenic were subject to vegetation loss or removal, short- or long-term effects to viewsheds or scenic resources could occur. Bare ground or interruption of a landscape due to vegetation removal could be considered an adverse change in the aesthetic character of scenic resources or viewsheds. New towers or structures constructed within scenic areas could disrupt the perceived aesthetic character or scenery of an area. If new towers were constructed to a height that required lighting, nighttime vistas could be affected in areas where the night skies do not have light disruptions or are within unpopulated areas.

Based on the impact significance criteria presented in Table 5.2.8-1, impacts to the aesthetic character of scenic resources or viewsheds would be considered potentially significant if landscapes were permanently removed or fragmented, or if damage to historic or cultural resources occurred. Given the small-scale of likely FirstNet activities, impacts are expected to be less than significant.

Nighttime lighting

If 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 5.2.8-1, lighting that illuminates the night sky on a regional basis, diminishes night sky viewing over long distances, and persists over the long-term would be considered potentially significant. Although likely FirstNet actions are expected to be small-scale, certain discrete locations may experience potentially significant impacts to night skies.

5.2.8.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to visual resources and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to visual resources under the conditions described below:

- Wired Projects
  - Collocation on Existing Aerial Fiber Optic Plant: While the addition of new aerial fiber optic plant to an existing aerial fiber optic transmission system would likely be visible, the change associated with this option is so small as to be essentially imperceptible. This option would involve no new nighttime lighting and pole replacement would be limited.
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to visual resources since the activities would be conducted at small entry and exit points and are not likely to produce perceptible changes, and would not require nighttime lighting.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts on visual resources because there would be no ground disturbance, would not require nighttime lighting, and would not produce any perceptible changes.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact visual resources since those activities would not require ground disturbance or vegetation removal.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact visual resources, it is anticipated that this activity would have no impact on visual resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to visual resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur as a result of ground disturbance, vegetation removal, or installation of permanent structures if development occurs in scenic areas. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to visual resources include the following:

- Wired Projects
    - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to visual resources. The degree of impact would depend on the timing, location, and type of project; installation of a hut or POP would be permanent, whereas ground-disturbing activities would be short-term. In most cases, development located next to existing roadways would not affect visual resources unless vegetation were removed or excavation occurred in scenic areas.
    - New Build – Aerial Fiber Optic Plant: Construction and installation of new or replacement poles and hanging cables could result in impacts to the aesthetic character of scenic resources or viewsheds depending on the location of the installation. In most cases, development in public rights-of-ways would not affect visual resources unless vegetation were removed or construction occurred in scenic areas. If new lighting were necessary, impacts to night skies could occur. Construction of new roadways could result in linear disruptions to the landscape, surface disturbance, and vegetation removal; all of which could impact the aesthetic character of scenic resources or viewsheds, depending on the location of the installation.
    - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water would not impact visual resources. However, impacts to the aesthetic character of scenic resources or viewsheds could potentially occur as result of the construction of landings and/or facilities on shores or the banks of waterbodies that accept the submarine cable.
    - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading, vegetation removal, or other ground disturbance to install small boxes or huts, or access roads, potential impacts to visual resources could occur but effects would be temporary and localized.
- Wireless Projects
    - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to visual resources. Land/vegetation clearing, excavation activities, landscape grading, and other surface disturbing activities during the installation of new wireless towers and associated structures or access roads could result in the degradation of the aesthetic character of scenic resources or viewsheds. Impacts may be experienced by viewers if new towers were located in or near a national park unit or other sensitive area.
    - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower and would not likely result in additional impacts to visual resources. However, if additional power units are needed, structural hardening, or physical security measures required ground disturbance or removal of vegetation, impacts to the aesthetic character of scenic resources or viewsheds could occur.

- Deployable Technologies: Implementation of deployable technologies could result in potential impacts to visual resources if long-term deployment occurs in scenic areas, or if the implementation requires minor construction of staging or landing areas, results in vegetation removal, areas of surface disturbance, or additional nighttime lightning.

In general, the abovementioned activities could potentially involve land/vegetation clearing, and potential scenic intrusion of towers, poles, roads, infrastructure, and other structures. Potential impacts to visual resources associated with deployment could include interruptions of landscapes, degradation of the aesthetic character of scenic resources or viewsheds, and overall changes in valued scenic resources, particularly for permanent fixtures such as towers or facilities. These impacts are expected to be less than significant due to the temporary and small-scale nature of deployment activities. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there would be no impacts to visual resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Nighttime lighting 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. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to further avoid or minimize potential impacts.

5.2.8.5. Alternatives Impact Assessment

The following section assesses potential impacts to visual resources associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration.

Therefore, potential impacts to infrastructure as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in potential impacts to visual resources if long-term deployment occurs in scenic areas. If staging or landing areas (depending on the type of technology) require surface disturbance or vegetation clearing, or if these areas were within scenic landscapes or required new nighttime lighting, impacts could occur to the aesthetic character of scenic resources or viewsheds. These impacts are expected to be less than significant as generally they would be limited to the deployment location and could often be screened or otherwise blocked from view. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to visual resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. The potential visual impacts—including aesthetic conditions and nighttime lighting—of the operation of deployable technologies would be less than significant. These potential impacts would be similar to the potential impacts described for the Deployable Technologies option of the Preferred Alternative, above, only likely with greater numbers of deployable units. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to further avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to visual resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 5.1.8, Visual Resources.

5.2.9. Socioeconomics

5.2.9.1. Introduction

This section describes potential impacts to socioeconomics in the District of Columbia associated with deployment and operation of the Proposed Action and Alternatives. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

5.2.9.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on socioeconomics were evaluated using the significance criteria presented in Table 5.2.9-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

5.2.9.3. 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
- 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.

Table 5.2.9-1: Impact Significance Rating Criteria for Socioeconomics

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Impacts to real estate (could be positive or negative)	Magnitude or Intensity	Changes in property values and/or rental fees, constituting a significant market shift	Effect that is potentially significant, but with mitigation is less than significant	Indiscernible impact to property values and/or rental fees	No impacts to real estate in the form of changes to property values or rental fees
	Geographic Extent	Regional impacts observed throughout the state, territory, or District		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, or District		Effects realized at one or multiple isolated cities/towns	NA
	Duration or Frequency	Persists during or beyond the life of the project		Persists for as long as the entire construction phase or a portion of the operations phase	NA
Impacts to employment	Magnitude or Intensity	High level of job creation at the state, territory, or District	Effect that is potentially significant, but with mitigation is less than significant	Low level of job creation at the state, territory, or District level	No job creation due to project activities at the state/territory level
	Geographic Extent	Regional impacts observed throughout the state, territory, or District		Effects realized at one or multiple isolated cities/towns	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Duration or Frequency	Persists during the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase	NA
Changes in population number or composition	Magnitude or Intensity	Substantial increases in population, or changes in population composition (age, race, gender)	Effect that is potentially significant, but with mitigation is less than significant	Minor increases in population or population composition	No changes in population or population composition
	Geographic Extent	Regional impacts observed throughout the state, territory, or District		Effects realized at one or multiple isolated locations	NA
	Duration or Frequency	Persists during the life of the project		Persists for as long as the entire construction phase or a portion of the operations phase	NA

NA = Not Applicable

Impacts to Real Estate

Deployment of the NPSBN has the potential to improve property values in areas that have reduced property values below typical market values due to below average public safety communication services. Improved services would 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, in the District of Columbia the median value of owner-occupied housing units in the 2009–2013 period was $470,500. Property value averages are both higher and lower in specific sub-areas of the District. Any property value effects of deployment of the NPSBN would occur at a localized level.

Some telecommunications infrastructure, such as wireless communications towers, may adversely affect property values, depending on infrastructure location and other characteristics. Researchers believe these negative impacts relate to perceptions of the aesthetics of towers, or fears over electromagnetic radiation. Economists and appraisers have studied this issue and use a statistical analysis methodology known as hedonic pricing, or hedonic modelling, to assess how different attributes of properties such as distance from a tower affect property value (Bond, Sims, & Dent, 2013). Essentially, analysts compare the value of multiple properties while statistically controlling for differences in property attributes, in order to isolate the effect of a specific attribute such as proximity of a communications tower.

A recent literature review examined such studies in the United States, Germany, and New Zealand (Bond, Sims, & Dent, 2013). These studies all focused on residential properties. One study identified a positive effect on price in one neighborhood due to the presence of a wireless communications tower. Most studies identified negative effects on price. Generally, these negative effects were small: an approximately two percent decrease in property price. In one case, the average reduction in price was 15 percent. In all cases, the effects declined rapidly with distance, with some cases showing no effect beyond 100 meters (328 feet) and one case showing effects up to about 300 meters (984 feet).

Based on review of the particulars of each study, the literature review authors hypothesize that many additional factors regarding communications towers, besides distance, may affect property value. These include the type, height, size, and appearance of communication towers; grouping of towers; the level of activity in the property market at the time properties are listed or sold; and the level of negative local media focus on potential health effects of communication towers at the time properties are listed or sold.

Economic Benefits or Adverse Impacts related to Changes in pending, Income, Industries, and Public Revenues

Developing the NPSBN may increase economic activity as governments and contractors make expenditures to deploy, operate, and maintain telecommunications and broadband infrastructure.

Funds for such expenditures would come primarily from federal, District, 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: up to $7 billion in cash funded by proceeds of incentive auctions authorized by the Act; network user or subscriber fees; and fees from covered leasing agreements that allow FirstNet to permit a secondary users to access network capacity on a secondary basis for non-public safety services only. The use of NPSBN capacity on a secondary basis for non-public safety services, including commercial services, by parties entering into a covered leasing agreement with FirstNet may also increase economic activity and generation of income for such party.

Direct spending of federal, state, and private sector funds to deploy and operate the NPSBN would likely represent new income to businesses that provide goods and services for the network, resulting in a positive impact. This direct impact would lead to indirect impacts (as directly impacted businesses purchase supporting goods and services) and induced impacts (as the employees of all affected businesses spend the wages they have earned). Because most FirstNet infrastructure investments would be dispersed across the nation, the business income and wages generated in any particular state or community would generally be small relative to the overall state or community economy, but measurable. Based on the significance criteria above, the business income and wage impacts would be considered positive and less than significant. It is also highly unlikely that these impacts would lead to significant market shifts or other significant changes to local/regional economic structure.

Spending and income generation related to developing the NPSBN would also result in changes to public revenues. Property taxes may change as property values increase or decrease due to the installation of new infrastructure. General and selective sales taxes may change (most likely increase), reflecting expenditures during system development and maintenance. Public utility tax revenues may change. These taxes are a subcategory of selective sales taxes that includes taxes on providers of land and mobile telephone, telegraph, cable, and internet services (U.S. Census Bureau, 2006). These service providers may obtain new taxable revenues from operation of components of the public safety broadband network. In such cases, public utility tax revenues may increase, but they could also remain the same or decrease if providers are granted tax breaks in return for operating portions of the network. Individual and corporate income taxes may change as FirstNet infrastructure development and operation creates new taxable income for involved companies and workers.

FirstNet's partner(s) may be given the right to use excess NPSBN capacity commercially. This would result in additional economic activity and generation of income. In turn, this could have revenue implications for federal and state governments, through taxes on sales and on corporate income generated by commercial use of the network.

First may have an additional, non-revenue benefit to the public sector. The network is likely to create operational cost savings and increased productivity for public safety personnel.

Impacts to Employment

Private companies and government organizations that receive income from deploying and operating the NPSBN would use portions of that income to hire the employees they need to provide their support to the network. This generation of new employment could be a minor, direct, beneficial impact of expenditures on FirstNet. Additional, indirect employment increases would occur as additional businesses hire workers to provide supporting goods and services. For instance, FirstNet contractors and their subcontractors and vendors would need engineers and information technology professionals, project managers, construction workers, manufacturing workers, maintenance workers, and other technical and administrative staff. Further employment gains would occur as businesses throughout the economy benefit from consumer spending by wage-earners in direct and indirectly affected businesses.

For the most part, employment gains in any particular state or community would generally be measurable, but small relative to the overall state or community economy. This is because FirstNet infrastructure investments would be dispersed across the nation. Based on the significance criteria above, the employment impacts would be considered positive and less than significant. However, even small employment games are beneficial, and would be especially welcomed in areas that have high unemployment. As discussed in Existing Environment, the average unemployment rate in 2014 in the District of Columbia (as shown by the unemployment rate map and selected economic indicators table) was 7.8 percent, somewhat higher than the national rate. Unemployment rates no doubt vary across sub-areas of the District.

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 5.2.9-1 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.

5.2.9.4. 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 2.1.3, 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 5.2.9-1.

Activities Likely to Have No Impacts

- Satellites and Other Technologies
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact socioeconomics, it is anticipated that this activity would have no impact on socioeconomic resources.

Activities with the Potential to Have Impacts

Potential impacts to socioeconomics for the Preferred Alternative would encompass a range of impacts that could result from deployment activities. The discussion below indicates which of the four types of socioeconomic impacts discussed above and listed again here apply to each type of deployment activity. For greater detail on the nature of these impacts, see the Description of Environmental Concerns section above.

- Impacts to Real Estate
- Changes to Spending, Income, Industries, and Public Revenues
- Impacts to Employment
- Changes in Population Number or Composition

Positive impacts on property values would generally not result from one or a few particular activities, but instead would result from the totality of the new NPSBN infrastructure and operational systems that enable improved public safety services to currently underserved areas. Similarly, any change to population numbers in a few locations as discussed above would result from large contract awards and contractor decisions about employee locations, not from specific deployment activities. Therefore, these types of impacts are not included in the activity-focused discussions below.

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Installation of fiber optic cable in existing conduit would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and District economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and Districtwide.
  - 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 District economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and Districtwide.
  - 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 District economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and Districtwide.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water, and associated onshore activities at existing or new facilities would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such

effects would be small in scale relative to the regional and District economy and of limited duration; their impacts would be less than significant.

    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and Districtwide.

- 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 District economy and of limited duration; their impacts would be less than significant.

    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and Districtwide.

- 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 District economy and of limited duration; their impacts would be less than significant.

    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and Districtwide.

- 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 District economy and of limited duration; their impacts would be less than significant.

    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and Districtwide.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures, such as generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads, or access roads would have the following types of socioeconomic impacts:
    - Impacts to Real Estate – As discussed above, communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013). Such impacts, if they occur, would be limited to a small area around each project and would generally be a small percentage reduction in property value; thus, the impacts would be less than significant.
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and District economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and Districtwide.
  - 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 District economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and Districtwide.
  - Deployable Technologies: COWs, COLTs, and SOWs and aerial deployable technologies require storage, staging, and (for aerial deployables) launch/landing areas. Development of such areas, or enlargement of existing areas to accommodate FirstNet equipment, would have the following types of socioeconomic impacts:
    - Impacts to Real Estate – It is possible that development or enlargement of storage, staging, and launch/landing areas could have adverse impacts on nearby property values. This is because such facilities may have adverse aesthetic aspects (e.g.,

large areas of pavement and large numbers of parked vehicles), equipment maintenance activities at such facilities may generate noise, and operational activities may generate traffic. Such factors could affect nearby property values. These impacts, if they occur, would occur within a limited distance of each site, and would be limited to a relatively small number of sites within the region and District. Therefore, these impacts would be less than significant.

    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and District economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and Districtwide.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the deployment of such devices and equipment would be similar to collocation of wireless equipment on existing wireless towers, structures, or buildings, and would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and District economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and Districtwide.

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 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

The discussion above characterized the impacts of each type of activity. The socioeconomic impacts of all activities considered together would also be less than significant. Even when considered together, the impacts would be very small relative to the total economic activity and property value of any region or the District. In addition, with the possible exception of property values, all deployment impacts would be limited to the construction phase.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of primarily of routine maintenance and inspection of fixed infrastructure. As with deployment activities, all operational activities would have socioeconomic impacts, because all represent economic activity. Public or private sector employees would conduct all operational activities, and therefore support employment and involve payment of wages. Even if these economic effects are a very small for each operational activity, and not significant across the entire District, 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 District economy; their impacts would be less than significant.
- Impacts to Employment – Public and private sector organizations responsible for operating the NPSBN would sustain existing employees and/or hire new employees to carry out operational activities. They would generate a less than significant number of jobs regionally and Districtwide.

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 District. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to further avoid or minimize potential impacts.

5.2.9.5. Alternatives Impact Assessment

The following section assesses potential impacts to socioeconomics associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to socioeconomics resulting from implementation of this alternative could be as described below.

Deployment Impacts

As explained above, all deployment activities represent economic activity and thus have socioeconomic impacts. These impacts would primarily be beneficial, such as generation of business income and employee wages, and creation or sustainment of jobs. The impacts would be small for each activity and therefore less than significant.

Deployable technologies such as COWs, COLTs, and SOWs, along with aerial deployable technologies, would require storage, staging, and launch/landing areas. Development or enlargement of these facilities could have adverse impacts on nearby property values. The potential for such impacts is higher under this alternative than the Preferred Alternative because it is likely that these facilities would be implemented in greater numbers and over a larger geographic extent. These potential impacts are anticipated to be less than significant as described above. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

Operation Impacts

All operational activities represent economic activity and thus have socioeconomic impacts. These impacts would primarily be beneficial, and because they are small individually, overall impacts would be less than significant.

The ongoing presence of facilities for housing and maintaining deployable technologies may have adverse aesthetic aspects (e.g., large areas of pavement and large numbers of parked vehicles) or other aspects (e.g., noise and traffic) that could negatively affect the value of surrounding properties. The potential for such impacts is higher under this alternative than the Preferred Alternative because it is likely that these facilities would be more numerous, present over a larger geographic extent, and used with greater frequency and duration. These impacts, if they occur, would be less than significant as they would be limited to a relatively small number of sites within the region and District. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to further avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed. Therefore, there would be no associated deployment or installation activities to deploy wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to socioeconomics from deployment and operation of the No Action Alternative. Socioeconomic conditions would therefore be the same as those described in Section 5.1.9, Socioeconomics.

5.2.10. Environmental Justice

5.2.10.1. Introduction

This section describes potential impacts to environmental justice in the District of Columbia associated with construction/deployment and operation of the Proposed Action and Alternatives. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

5.2.10.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on environmental justice were evaluated using the significance criteria presented in Table 5.2.10-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

5.2.10.3. Description of Environmental Concerns

Effects associated with other Resource Areas that have a Disproportionately High and Adverse Impact on Low-Income Populations and Minority Populations

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (Executive Office of the President, 1994), and guidance from CEQ, require federal agencies to evaluate potential human health and environmental effects on environmental justice populations. Specifically, “such effects may include ecological, cultural, human health, economic, or social impacts on minority communities, low-income communities, or Indian tribes when those impacts are interrelated to impacts on the natural or physical environment.” (Council on Environmental Quality, 1997) Thus, effects associated with other resource areas are of interest from an environmental justice perspective. This includes Human Health and Safety, Cultural Resources, Socioeconomics, Noise, Aesthetics and Visual Resources, and other resources.

Table 5.2.10-1: Impact Significance Rating Criteria for Environmental Justice

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Effects associated with other resource areas (e. g., human health and safety, cultural resources, socioeconomics) that have a disproportionately high and adverse impact on low-income populations and minority populations	Magnitude or Intensity	Direct and disproportionately high and adverse effects on environmental justice communities (as defined by EO 12898) that cannot be fully mitigated	Effect that is potentially significant, but with mitigation is less than significant	Direct effects on environmental justice communities (as defined by EO 12898) that are not disproportionately high and adverse, and therefore do not require mitigation	No direct effects on environmental justice communities, as defined by EO 12898
	Geographic Extent	Effects realized within counties at the Census Block Group level		Effects realized within counties at the Census Block Group level	Effects realized within counties at the Census Block Group level
	Duration or Frequency	Persists during the life of the project		Persists for as long as the entire construction phase or a portion of the operations phase	NA

NA = Not Applicable

Potential concerns noted in the impact analyses for these resources include dust, noise, traffic, and other adverse impacts of construction activities. New wireless communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013). (See Socioeconomics Environmental Consequences for additional discussion.) The presence and operation of large storage, staging, and launch/landing areas for deployable technologies could raise environmental justice concerns as described below. Indian tribes are considered environmental justice populations (Council on Environmental Quality, 1997); thus, impacts on tribal cultural resources (for instance, due to construction) could be a concern from an environmental justice perspective.

Impacts are considered environmental justice impacts only if they are *both* “adverse” and “disproportionately high” in their incidence on environmental justice populations relative to the general population (Council on Environmental Quality, 1997). The focus in environmental justice impact assessments is always, by definition, on adverse effects. However, telecommunications projects, such as those proposed by FirstNet, could have beneficial effects. These effects may include better provision of police, fire, and emergency medical services; improvements in property values; and the generation of jobs and income. These impacts are considered in the Socioeconomics Environmental Consequences (Section 5.2.9).

Construction impacts are localized, and property value impacts of wireless telecommunications projects rarely extend beyond 300 meters (984 feet) of a communications tower (Bond, Sims, & Dent, 2013). In addition, impacts related to deployment are of short duration. The potential for significant environmental justice impacts from the FirstNet deployment activities would be limited. Most, but not all, of the FirstNet operational activities have very limited potential for impacts as these activities are limited in scale and short in their duration.

Before FirstNet deploys projects, additional site-specific analyses to identify specific environmental justice populations and assess specific impacts on those populations may be necessary. Such analyses could tier-off the methodology and results of this PEIS. The areas shown in the environmental justice screening map of Affected Environment (Section 5.1.10) as having Moderate Potential or High Potential for environmental justice populations would particularly warrant further screening. As discussed in Section 5.1.10, the District of Columbia’s population has higher percentages of minorities than the region or the nation, and higher rates of poverty than the region or the nation. Most areas in the District of Columbia have High Potential or Moderate Potential for environmental justice populations. The High Potential areas mostly occur in the northeast, east, and southeast areas of the District, with scattered pockets of High Potential in the central and northwest portions of the District. Further analysis using the data developed for the screening analysis in Section 5.1.10 may be useful. In addition, USEPA’s EJSCREEN tool and USEPA’s lists of environmental justice grant and cooperative agreement recipients may help identify local environmental justice populations (USEPA, 2015f; USEPA, 2014g).

A site-specific analysis would also evaluate whether an actual environmental justice impact on those populations would be likely to occur. Analysts can use the evaluation presented below under “Activities with the Potential to Have Impacts” as a starting point. Analysts should bear in mind that any such activities that are problematic based on the adverse impact criterion of environmental justice may also have beneficial impacts on those same environmental justice communities.

5.2.10.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could deploy various types of facilities or infrastructure. Depending on the physical nature and location of FirstNet facilities or infrastructure and the specific action, some activities would result in potential impacts to environmental justice communities and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to environmental justice under the conditions described below:

- Wired Projects
    - Use of Existing Conduit – New Buried Fiber Optic Plant: Installation of fiber optic cable in existing conduit would be through existing hand holes, pulling vaults, junction boxes, huts, and POP structures. Activities at these small entry points would be limited and temporary and thus are not likely to produce perceptible changes affecting any surrounding communities. Therefore, they would not affect environmental justice communities.
    - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would be conducted electronically through existing infrastructure, and therefore would have no impacts on environmental justice. If physical access is required to light dark fiber, it would likely be through existing hand holes, pulling vaults, junction boxes, huts, and similar existing structures, with no resulting impacts on environmental justice communities.
- Satellites and Other Technologies
    - Satellite-Enabled Devices and Equipment: It is anticipated that the deployment of such devices and equipment would not involve new ground disturbance, impacts to environmental justice communities would not occur. Impacts associated with satellite-enabled devices requiring construction activities are addressed below.
    - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are

already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact environmental justice, it is anticipated that this activity would have no impact on environmental justice.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to environmental justice for the Preferred Alternative would encompass a range of impacts that could occur as a result of disturbance to communities from construction activities, such as noise, dust, and traffic. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to environmental justice communities include the following:

- Wired Projects
    - New Build – Buried Fiber Optic Plant: New fiber optic cable installation usually requires construction activities such as trenching, plowing (including vibratory plowing), or directional boring, as well as construction of hand holes, pulling vaults, junction boxes, huts, and POP structures. These activities could temporarily generate noise and dust, or disrupt traffic. If such impacts occur disproportionately to environmental justice communities, they would be considered environmental justice impacts.
    - New Build – Aerial Fiber Optic Plant: Pole/structure installation could temporarily generate noise and dust, or disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
    - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water would not impact environmental justice because there would be no ground disturbance or other impacts associated with this activity that would adversely impact communities. Associated onshore activities occurring at existing facilities such as staging of equipment and materials, or connection of cables, would be small in scale and temporary; thus, they would not impact environmental justice communities. Construction of new landings and/or facilities onshore or the banks of waterbodies that accept the submarine cable could temporarily generate noise and dust, or disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
    - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts, there would be no adverse impacts on surrounding communities, and thus no potential for environmental justice impacts. Installation of optical transmission equipment or centralized transmission equipment requiring construction of new utility poles, hand holes, pulling vaults, junction boxes, huts, and POP structures could temporarily generate noise and dust, or disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures, such as generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads, or access roads requires construction activities that could temporarily generate noise and dust, or disrupt traffic. New communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013). (See Socioeconomics Environmental Consequences for additional discussion.) If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would include mounting or installing equipment (such as antennas) on an existing facility. This activity would be small in scale, temporary, and highly unlikely to produce adverse human health or environmental impacts on the surrounding community. Thus, it would not impact environmental justice communities. If collocation requires construction for additional power units, structural hardening, and physical security measures, the construction activity could temporarily generate noise and dust and disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
  - Deployable Technologies: COWs, COLTs, and SOWs and aerial deployable technologies require storage, staging, and (for aerial deployables) launch and landing areas. To the extent such areas require new construction, noise and dust could be temporarily generated, and traffic could be disrupted. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.

In general, the impacts from the abovementioned activities would be short-term and could potentially involve objectionable dust, noise, traffic, or other localized impacts due to construction activities. In some cases, these effects and aesthetic effects could potentially impact property values, particularly from new towers. These impacts are expected to be less than significant, but are problematic from an environmental justice perspective if they occur disproportionately in environmental justice communities. Since environmental justice impacts occur at the site-specific level, analyses of individual proposed projects would help determine potential impacts to specific environmental justice communities. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of primarily of routine maintenance and inspection of fixed infrastructure. It is anticipated that such activities would not result in environmental justice impacts, as the intensity of these activities would be low (low potential for objectionable effects such as noise and dust) and their duration would be very short. Routine maintenance and inspection would not adversely affect property values, for the same reasons. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment activities that involve construction.

Impacts are expected to be less than significant. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to further avoid or minimize potential impacts.

5.2.10.5. Alternatives Impact Assessment

The following section assesses potential impacts to environmental justice associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and no new associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to environmental justice communities resulting from implementation of this alternative could be as described below.

Deployment Impacts

As explained above, deployable technologies such as COWs, COLTs, and SOWs, along with aerial deployable technologies, could require storage, staging, and launch/landing areas. To the extent such areas require new construction, noise and dust could be generated temporarily, and traffic could be disrupted. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts. Impacts are expected to be less than significant because they would be temporary in nature. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

Operation Impacts

The ongoing presence of facilities for housing and maintaining deployable technologies may have adverse aesthetic aspects (e.g., large areas of pavement and large numbers of parked vehicles) that could negatively affect the value of surrounding properties. In addition, equipment maintenance activities at such facilities may temporarily generate noise, and operational activities may generate traffic. These effects may be adverse in themselves, and may impact property values. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts. Impacts are expected to be less than significant as operations are expected to be temporary in nature. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to further avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed. Therefore, there would be no associated construction or installation activities to deploy wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to environmental justice as a result of deployment and operation of the No Action Alternative. Environmental conditions would therefore be the same as those described in Section 5.1.10 Environmental Justice.

5.2.11. Cultural Resources

5.2.11.1. Introduction

This section describes potential impacts to cultural resources in the District of Columbia associated with deployment and operation of the Proposed Action and Alternatives. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

5.2.11.2. 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 5.2.11-1. As described in Section 5.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

Table 5.2.11-1: Impact Significance Rating Criteria for Cultural Resources

Type of Effect	Effect Characteristics	Impact Level			
		Adverse Effect	**Mitigated Adverse Effect**[1]	**Effect, but Not Adverse**	**No Effect**
Physical damage to and/or destruction of historic properties[2]	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties	Adverse effect that has been procedurally mitigated through Section 106 process	Effects to a non-contributing portion of a single or many historic properties	No direct effects to historic properties
	Geographic Extent	Direct effects Area of Potential Effect (APE)		Direct effects APE	Direct effects APE
	Duration or Frequency	Permanent direct effects to a contributing portion of a single or many historic properties		Permanent direct effects to a non-contributing portion of a single or many historic properties	No direct effects to historic properties
Indirect effects to historic properties (i.e. visual, noise, vibration, atmospheric)	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties	Adverse effect that has been procedurally mitigated through Section 106 process	Effects to a contributing or non-contributing portion of a single or many historic properties	No indirect effects to historic properties
	Geographic Extent	Indirect effects APE		Indirect effects APE	Indirect effects APE
	Duration or Frequency	Long-term or permanent indirect effects to a single or many historic properties		Infrequent, temporary, or short- or long-term or permanent indirect effects to a single or many historic properties	No indirect effects to historic properties
Loss of character defining attributes of historic properties	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties	Adverse effect that has been procedurally mitigated through Section 106 process	Effects to a non-contributing portion of a single or many historic properties	No direct or indirect effects to historic properties
	Geographic Extent	Direct and/or indirect effects APE		Direct and/or indirect effects APE	Direct and/or indirect effects APE

Type of Effect	Effect Characteristics	Impact Level			
		Adverse Effect	Mitigated Adverse Effect[1]	Effect, but Not Adverse	No Effect
	Duration or Frequency	Long-term or permanent loss of character defining attributes of a single or many historic properties		Infrequent, temporary, or short-term changes to character defining attributes of a single or many historic properties	No direct or indirect effects to historic properties
Loss of access to historic properties	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties	Adverse effect that has been procedurally mitigated through Section 106 process	Effects to a non-contributing portion of a single or many historic properties	No segregation or loss of access to historic properties
	Geographic Extent	Any area surrounding historic properties that would cause segregation or loss of access to a single or many historic properties		Any area surrounding historic properties that could cause segregation or loss of access to a single or many historic properties	No segregation or loss of access to historic properties
	Duration or Frequency	Long-term or permanent segregation or loss of access to a single or many historic properties		Infrequent, temporary, or short-term changes in access to a single or many historic properties	No segregation or loss of access to historic properties

[1] Whereas mitigation measures for other resources discussed in this PEIS may be developed to achieve an impact that is "Less than Significant with Mitigation Incorporated," historic properties are considered to be "non-renewable resources," given their very nature. As such, any and all unavoidable adverse effects to historic properties, per Section 106 of the NHPA (as codified in 36 CFR Part 800.6), would require FirstNet to consult with the HPO/THPO and other consulting parties, including Indian tribes and Native Hawaiian Organizations, to develop appropriate mitigation.

[2] Per NHPA, a "historic property" is defined as any district, archaeological site, building, structure, or object that is either listed or eligible for listing in the NRHP. Cultural resources present within a project's APE are not historic properties if they do not meet the eligibility requirements for listing in the NRHP. Sites of religious and/or cultural significance refer to areas of concern to Indian tribes and other consulting parties that, in consultation with the respective party(ies), may or may not be eligible for listing in the NRHP. These sites may also be considered TCPs. Therefore, by definition, these significance criteria only apply to cultural resources that are historic properties, significant sites of religious and/or cultural significance, or TCPs. For the purposes of brevity, the term historic property is used here to refer to either historic properties, significant sites of religious and/or cultural significance, or TCPs.

5.2.11.3. 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 5.2.11-1, direct deployment impacts could be potentially significant if FirstNet's deployment locations were in areas with moderate to high probabilities for archaeological deposits, within historic districts, or at historic properties. To the extent practicable, FirstNet would attempt to minimize activities in areas with archaeological deposits or within historic districts. However, given that historic resources are present throughout the District of Columbia, some deployment activities may be in these same areas, in which case BMPs (see Chapter 17) would help avoid or minimize the potential impacts.

Indirect Effects to Historic Properties (i.e., visual, noise, vibration, atmospheric)

The potential for indirect effects to historic properties would be present during deployment of the proposed facilities/infrastructure and during trenching, grading, and/or foundation excavation activities. Indirect effects include the introduction of visual, noise, atmospheric, and/or vibration effects that diminish a property's historic integrity. The greatest likelihood of potentially significant impacts from indirect effects would be from the deployment of equipment in areas that would cause adverse visual effects to historic properties. To the extent practicable, FirstNet would attempt to minimize activities in areas within or adjacent to historic districts or properties.

Loss of Character Defining Attributes of Historic Properties

Deployment of FirstNet equipment has the potential to cause the loss of character defining attributes of historic properties; such attributes are the features of historic properties that define their NRHP eligibility. Examples of such impacts would be the loss of integrity of archaeological sites through ground disturbing activities, and direct impacts to historic buildings from equipment deployment that adversely alter historic architectural features. Significant impacts such as these can be avoided or minimized through BMPs (see Chapter 17).

Loss of Access to Historic Properties

The deployment of equipment requiring a secure area has the potential to cause the loss of access to historic properties. The highest potential for this type of significant impact would be from the deployment of equipment in secure areas that impact the access to sites of cultural importance to Native Americans. It is anticipated that FirstNet would identify potential impacts to such areas by conducting research on particular areas and through the NHPA consultation process, and would minimize deployment activities that would cause such loss of access.

5.2.11.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to cultural resources, while others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to cultural resources under the conditions described below:

- Wired Projects
    - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to cultural resources since the activities that would be conducted at these small entry and exit points are not likely to produce impacts.
    - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts on cultural resources. If required, and if done in existing huts with no ground disturbance, installation of new associated equipment would also have no impacts to cultural resources because there would be no ground disturbance and no perceptible visual changes.
- Satellites and Other Technologies
    - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact cultural resources because those activities would not require ground disturbance or create perceptible visual effects.
    - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact cultural resources, it is anticipated that this activity would have no impact on cultural resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to cultural resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur as a result of ground disturbance activities, including destruction of cultural or historic artifacts. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to cultural resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POP, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to cultural resources. Soil disturbance and heavy equipment use associated with plowing, trenching, or directional boring as well as land/vegetation clearing, excavation activities, and landscape grading associated with construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in the disturbance of archaeological sites, and the associated structures could have visual effects on historic properties.
  - New Build – Aerial Fiber Optic Plant: Ground disturbance during the installation of new utility poles and the use of heavy equipment during the installation of new utility poles and hanging of cables could result in the disturbance of archaeological sites, and the associated structures could have visual effects on historic buildings and structures within the District of Columbia.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water could impact cultural resources, as riverine areas of the District have the potential to contain both prehistoric and historic period archaeological sites associated with waterborne commerce. Impacts to cultural resources could also potentially occur as a result of the construction of landings and/or facilities on shores or the banks of waterbodies that accept the submarine cable, which could result in the disturbance of archaeological and historical sites, such as the canal walls and locks in Georgetown, and the associated network structures could have visual effects on historic properties.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance, there would be no impacts to cultural resources. If installation of transmission equipment required grading or other ground disturbance to install small boxes or huts, or access roads, there could potentially be impacts to cultural resources. Ground disturbance could impact archaeological sites, and the associated structures could have visual effects on historic properties.
  - Collocation on Existing Aerial Fiber Optic Plant: Soil excavation and excavated material placement during the replacement of poles and structural hardening could result in direct and indirect effects to cultural resources, although any effects to access would be short-term. Heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in direct and indirect effects to cultural resources.

- Wireless Projects
  - New Wireless Communication Towers: Deployment of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to historic properties. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the deployment of new wireless towers and associated structures or access roads, could result in the disturbance of archaeological sites. The deployment of new wireless communication towers and their associated structures could result in visual impacts to historic properties, especially in the District with its high concentration of historic public buildings and structures or the loss of access to historic properties.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower could result in impacts to historic properties. Ground disturbance activities could result in the disturbance of archaeological sites, and the deployment of collocated equipment could result in visual impacts or physical damage to historic properties, especially in urban areas, essentially including all of the District of Columbia.
  - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to cultural resources if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. In addition, impacts to historic properties could occur if the deployment is long-term, or if the deployment involves aerial technologies with the potential for visual or other indirect impacts.

In general, the abovementioned activities could potentially involve ground disturbance, construction of access roads and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to cultural resources associated with deployment could include physical damage to or destruction of historic properties, indirect impacts including visual effects, the loss of access to historic properties, or the loss of character-defining features of historic properties. These activities could affect, but not adversely affect, cultural resources as the potential adverse effects would be temporary and limited to the area near individual Proposed Action deployment site. Additionally, some equipment proposed to be installed on or near properties that are listed or eligible for listing on the NRHP could potentially be removed. Additionally as appropriate, FirstNet would engage in consultation as required under Section 106 of the NHPA. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major communications infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be no effect to cultural resources associated with routine inspections of the Preferred Alternative. If usage of heavy equipment as part of routine maintenance or inspections occurs off established access roads or corridors, or if the acceptable load of the surface is exceeded, ground disturbance impacts on archaeological sites could result as explained above. These potential impacts would be associated with ground disturbance or modifications of properties, however, due to the small-scale of expected activities, these actions could affect but would not likely adversely affect, cultural resources. In the event that maintenance and inspection activities occur off existing roads, FirstNet would engage in consultation as required under Section 106 of the NHPA. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to further avoid or minimize potential impacts.

5.2.11.5. Alternatives Impact Assessment

The following section assesses potential impacts to cultural resources associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to cultural resources as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in impacts to cultural resources if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in impacts to archaeological sites. These activities could affect, but not adversely affect, cultural resources due to the limited amount of expected ground disturbing activities and the short-term nature of deployment activities. However, in the event that land/vegetation clearing is required, FirstNet would engage in consultation as required under Section 106 of the NHPA. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the deployment impacts, it is anticipated that there would be effects, but no adverse effects to historic properties associated with implementation/running of the deployable technology. No adverse effects would be expected to either site access or viewsheds due to the temporary nature of expected activities. As with the Preferred Alternative, it is anticipated that there would be no effects to cultural resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off established access roads or corridors, impacts to archaeological sites could occur, however, in the event that this is required, FirstNet would engage in consultation as required under Section 106 of the NHPA. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to 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 cultural resources as a result of deployment and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 5.1.11, Cultural Resources.

5.2.12. Air Quality

5.2.12.1. Introduction

This section describes potential impacts to the District of Columbia's air quality from construction/deployment and operation of the Proposed Action and Alternatives. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

5.2.12.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on the District of Columbia's air quality were evaluated using the significance criteria presented in Table 5.2.12-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

Table 5.2.12-1: Impact Significance Rating Criteria for the District of Columbia

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Increased air emissions	Magnitude or Intensity	Pollutant concentrations would exceed one or more NAAQS in nonattainment and maintenance areas. Emissions in attainment areas would cause an area to be out of attainment for any NAAQS. Projects do not conform to the SIP covering nonattainment and maintenance areas.	Effect that is potentially significant, but with mitigation is less than significant	Negligible emissions would occur for any criteria pollutants within an attainment area but would not cause a NAAQS exceedance.	Action would not cause pollutant concentrations to exceed the NAAQS in nonattainment and maintenance areas. Emissions in attainment areas would not cause air quality to go out of attainment for any NAAQS. Projects are *de minimis* or conform to the SIP covering nonattainment and maintenance areas.
	Geographic Extent/Context	NA		NA	NA
	Duration or Frequency	Permanent or long-term		Short term	Temporary

NA = not applicable

5.2.12.3. 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 unknown timeframes (if power is lost to a site, for example). Impacts are likely to be less than significant due to the mobile nature of the sources and the temporary and short-term duration of deployment activities. Although unlikely, the emissions of criteria pollutants could impair the air quality of the region and potentially affect human health. Potential impacts to air quality from emissions may occur in areas where the current air quality exceeds, or has a history of exceeding, one or more NAAQS. The District of Columbia is in maintenance or nonattainment for one or more criteria pollutants, particularly, ozone is an issue (see Section 5.1.12, Air Quality, Table 5.1.12-3).

Based on the significance criteria presented in Table 5.2.12-1, 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 the District and NAAQS exceedances are not anticipated. Given that the District is designated as being in nonattainment or maintenance, 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.

5.2.12.4. Potential Impacts of the Preferred Alternative

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

Deployment and Operation Impacts

As described in Section 2.1.2, Proposed Action, implementing the Preferred Alternative could result in deploying various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to air quality and others would not. The potential impacts could range from no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure development scenarios described in Section 2.1.2, Proposed Action, the following are likely to have no impacts to air quality under the conditions described below:

- Wired Projects
  - *Use of Existing Conduit – New Buried Fiber Optic Plant:* Activities associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit. Gaining access to the conduit and installing the cable may result in minor disturbance at entry and exit points; however, this activity would be temporary and infrequent, and is not expected to produce any perceptible changes in air emissions.
  - *Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable:* Lighting up dark fiber would require no construction and have no short- or long-term emissions to air quality because it would create no new sources of emissions.
- Satellites and Other Technologies
  - *Satellite Enabled Devices and Equipment:* The duration of construction activities associated with installing permanent equipment on existing structures would most likely be short-term. It is anticipated that insignificant concentrations of criteria pollutants would be emitted during installment of this equipment from the use of machinery. Deployment and operation of satellite-enabled devices and portable equipment are expected to have minimal to no impact on ambient air quality concentrations.
  - *Deployment of Satellites:* FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact air quality resources, it is anticipated that this activity would have no impact on those resources.

Activities with the Potential to Impact Air Quality

Construction, deployment, and operation activities related to the Preferred Alternative could impact air quality by generating various quantities of criteria and air pollutant emissions. It is expected that such impacts would be less than significant due to the shorter duration and localized nature of the activities. The types of infrastructure development 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 or the banks of waterbodies that accept the 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. However, if additional power units are needed, structural hardening, and physical security measures required grading or excavation, then exhaust and fugitive dust from heavy equipment used for these activities could also result in increased air emissions.
   - *Deployable Technologies:* The type of deployable technology used would dictate the types of air pollutants generated. For example, mobile equipment deployed via heavy trucks could generate products of combustion from the internal combustion engines associated with the vehicles and onboard generators. These units may also generate fugitive dust depending on the type of road traveled during deployment (i.e., paved

versus unpaved roads). Aerial platforms (e.g., UASs or other aircraft) would generate pollutants during all phases of flight.

In general, the pollutants of concern from the abovementioned activities would be products of combustion from burning fossil fuels in internal combustion engines and fugitive dust from site preparation activities and vehicles traveling on unpaved road surfaces. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the construction impacts. These impacts are anticipated to be less than significant due to the limited nature of the deployment. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major communications infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be less than significant impacts to air quality associated with routine inspections of the Preferred Alternative due to the limited nature of the activity. If usage of heavy equipment as part of routine maintenance or inspections occurs off established access roads or corridors additional air quality impacts may occur, however, they would be less than significant as they would still be limited in nature. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to further avoid or minimize potential impacts.

5.2.12.5. Alternatives Impact Assessment

The following section assesses potential impacts to air quality associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific equipment associated with the Deployable Technologies Alternative could include heavy trucks with onboard generators, aerial vehicles (e.g., UASs or other aircraft), and ground support vehicles and other equipment for aerial deployment. The stand-alone Deployable Technologies Alternative differs from the Preferred Alterative in the number of mobile and aerial vehicles likely to deploy, the distances traveled from storage locations, and the duration of deployment. The potential impacts to air quality are as follows:

Deployment and Operation Impacts to Air Quality

Implementing deployable technologies could result in products of combustion from mobile equipment deployed via heavy trucks using internal combustion engines associated with the vehicles and onboard generators. While a single deployable vehicle may have an insignificant impact, multiple vehicles operating for longer periods, in close proximity, may have a greater cumulative impact, although this is expected to be less than significant based on the defined significance criteria, since activities would be temporary and short-term. These vehicles may also produce fugitive dust if traveling on unpaved roads. Some staging or landing areas (depending on the type of technology) may require excavation, site preparation, and paving. Heavy equipment used for these activities could emit products of combustion as a result of burning fossil fuels in internal combustion engines. The deployment and operation of aerial technology is anticipated to generate pollutants during all phases of flight, except for balloons. The products of combustion from ground support vehicles, as well as the duration of ground support operations and travel between storage and deployment locations would dictate the concentrations and associated impacts. Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be less than significant, given that these activities are of low-intensity and short duration.

No Action Alternative

Under the No Action Alternative, FirstNet would not deploy the NPSBN and there would be no impact to ambient air quality. By not deploying NPSBN, FirstNet would avoid generating emissions from construction, installation, or operation of wired, wireless, or deployable infrastructure or technologies; satellites; and other technologies.

5.2.13. Noise

5.2.13.1. Introduction

This section describes potential noise impacts from construction, deployment, and operation of the Proposed Action and Alternatives in the District of Columbia. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

5.2.13.2. Impact Assessment Methodology and Significance Criteria

The noise impacts of the Proposed Action were evaluated using the significance criteria presented in Table 5.2.13-1. As described in Section 5.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the

Table 5.2.13-1: Impact Significance Rating Criteria for Noise

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Increased noise levels	Magnitude or Intensity	Noise levels would exceed typical noise levels from construction equipment and generators. Noise levels at noise sensitive receptors (such as residences, hotels/motels/inns, hospitals, and recreational areas) would exceed 55 dBA or specific District 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

potential noise impacts to the District of Columbia addressed in this section are presented as a range of possible impacts.

5.2.13.3. Description of Environmental Concerns

Increased Noise Levels

The Proposed Action has the potential to generate noise during construction and operation of various equipment used for deployment. These noise levels could be above what is typically generated in a given area and may alter the ambient acoustical environment. If significant, the noise could cause impacts on residential areas, or other facilities that are sensitive to noise, such as churches, hospitals, or schools. The construction activities for deploying some of the various equipment evaluated under the Proposed Action could cause short-term impacts to nearby populations. However, it is likely that there would be less long-term effects from operational use of the proposed equipment (see Section 5.1.13, Noise).

Based on the significance criteria presented in Table 5.2.13-1, noise impacts would likely be less than significant given the size and nature of the majority of the proposed deployment activities. The majority of FirstNet's deployment activities would not be located in sensitive areas nor would a large number of noise sources be deployed/operated long-term in the same area. Noise levels from deployment activities are not expected to exceed typical noise levels for short-term/temporary construction equipment or generators.

To the extent practicable, FirstNet would attempt to mitigate or minimize noise effects during construction or operation. BMPs and mitigation measures would be followed to limit impacts on nearby noise-sensitive receptors. However, given that much of the concentration and setup of equipment would often occur in populated areas, FirstNet operations would not be able to completely avoid noise impacts due to construction and operations at various receptors.

5.2.13.4. 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, implementing the Preferred Alternative could result in deploying various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential noise impacts and while others would not.

In addition, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure development scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no noise impacts under the conditions described below:

- Wired Projects
  - *Use of Existing Conduit – New Buried Fiber Optic Plant:* Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Noise generated by equipment required to install fiber would be infrequent and of short duration, and is not expected to create perceptible impacts.
  - *Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable:* Lighting up dark fiber would require no construction or installation activities, and therefore would have no noise impacts.
- Satellites and Other Technologies
  - Satellite Enabled Devices and Equipment: The duration of construction activities associated with installing permanent equipment on existing structures would most likely be short-term. It is anticipated that insignificant levels of noise would be emitted during installment of this equipment. Noise caused by these construction and installation activities would be similar to other construction activities in the area, such as the installation of cell phone towers or other communication equipment. Deployment and operation of satellite-enabled devices and equipment are expected to have minimal to no impact on the noise environment.
  - *Deployment of Satellites:* FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact noise resources, it is anticipated that this activity would have no impact on those resources.

Activities with the Potential for Noise Impacts

Construction, deployment, and operation activities related to the Preferred Alternative could create noise impacts from either the construction or operation of the infrastructure. The types of infrastructure deployment scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to air quality include the following:

- Wired Projects
  - *New Build – Buried Fiber Optic Plant:* Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber as well as land/vegetation clearing, excavation activities, and landscape grading could result in high noise levels from the use of heavy equipment and machinery.

- *New Build – Aerial Fiber Optic Plant:* The use of heavy equipment during the installation of new poles and hanging cables, as well as constructing access roads, POP huts, or other associated facilities to house plant equipment would be short-term and could result in increased noise levels from the use of vehicles and machinery.
- *Collocation on Existing Aerial Fiber Optic Plant:* Excavation equipment used during potential pole replacement, and other heavy equipment used for structural hardening or reinforcement, could result in temporary increases in noise levels from the use of heavy equipment and machinery.
- *Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable:* Installation of new associated huts or equipment, if required, could result in short-term and temporarily higher noise levels if the activity required the use of heavy equipment for grading or other purposes.
- *New Build – Submarine Fiber Optic Plant:* The installation of cables in 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 shores or the banks of waterbodies that accept the submarine cable could result in short-term and temporarily increased noise levels to local residents and other noise sensitive receptors from heavy equipment used for grading, foundation excavation, or other ground disturbing activities.
- *Installation of Optical Transmission or Centralized Transmission Equipment:* Noise associated with the installation of optical transmission or centralized transmission equipment would be limited to the short-term, temporary use of vehicle and construction equipment. Long-term impacts are unlikely, as the noise emissions from optical networks are relatively low. Heavy equipment used to grade and construct access roads could generate increased levels of noise over baseline levels temporarily.

- Wireless Projects
  - *New Wireless Communication Towers:* Activities associated with installing new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in localized construction noise. Operating vehicles, other heavy equipment, and generators would be used on a short-term basis and could increase noise levels.
  - *Collocation on Existing Wireless Tower, Structure, or Building:* Vehicles and equipment used to mount or install equipment, or to grade or excavate additional land on sites for installation of equipment, such as antennas or microwave dishes on an existing tower, could impact the local noise environment temporarily.
  - *Deployable Technologies:* The type of deployable technology used would dictate the types of noise generated. For example, mobile equipment deployed via heavy trucks could generate noise from the internal combustion engines associated with the vehicles and onboard generators. Aerial platforms (e.g., UASs or other aircraft, except balloons) generate noise during all phases of flight, including takeoff, landing, and flight operations over necessary areas that could impact the local noise environment.

In general, noise from the abovementioned activities would be products of site preparation, installation, and construction activities, as well as additional construction vehicles traveling on nearby roads and localized generator use. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the construction impacts. These impacts are expected to be less than significant due to the temporary duration of deployment activities. Additionally, pre-existing noise levels achieved after some months (typically less than a year but could be a few hours for linear activities such as pole construction). Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

Operation Impacts

Operation activities associated with the Preferred Alternative would be less than significant and for routine maintenance and inspection of the facilities because of the temporary nature of the activities which would not create new permanent sources of noise. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that potential noise impacts would be similar to or less than those described for the deployment activities. If usage of vehicles or heavy equipment as part of routine maintenance or inspections or onsite generator use occurs, potential noise impacts could result as explained above. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to further avoid or minimize potential impacts.

5.2.13.5. Alternatives Impact Assessment

The following section assesses potential noise impacts associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific equipment associated with the Deployable Technologies Alternative would be heavy trucks with onboard generators, aerial vehicles (e.g., UASs or other aircraft), and ground support vehicles and equipment for aerial deployment. The stand-alone Deployable Technologies Alternative differs from the Preferred Alterative in the number of mobile and aerial vehicles likely to deploy, the distances traveled from storage locations and the duration of deployment. The potential noise impacts are as follows:

Deployment Impacts

Implementing deployable technologies could result in noise from mobile equipment deployed via heavy trucks, including not only onboard generators, but also the vehicles themselves. While a single deployable vehicle may have an insignificant impact, multiple vehicles operating for longer periods, in close proximity, may increase localized noise levels. Several vehicles traveling together could also create short-term noise impacts on residences or other noise-sensitive receptors as they pass by. The deployment of aerial technology is anticipated to generate noise during all phases of flight. Aerial technologies would have the highest level of noise impact if they are required to fly above residential areas, areas with a high concentration of noise-sensitive receptors (i.e., schools or churches), or over national parks or other areas where there is an expectation of quiet and serenity on their way to their final destinations. Residences near deployment areas for aerial technologies (i.e., airports or smaller airfields) could also be affected during takeoff and landing operations. Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be less than significant, given that these activities are of low-intensity and short duration. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

Operation Impacts

Operation activities associated with the Deployable Technologies Alternative would be similar to several of the deployment activities related to routine maintenance and inspection of the facilities. Operation of generators could also generate noise in the area. However, deployable technologies could be deployed to areas with few existing facilities, so noise impacts could be minimal in those areas. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that potential noise impacts would be the same as those described for the deployment activities. If usage of vehicles or heavy equipment as part of routine maintenance or inspections occurs, potential noise impacts could result as explained above.

Operational impacts from aerial technologies would include repeated flyovers by UAS vehicles while they are needed in the area. This could generate significant, short-term impacts on any residential areas or other noise-sensitive receptors under the flight path of these vehicles. However, once these operations cease, noise levels would quickly return to baseline levels. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to further avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, FirstNet would not deploy the NPSBN and there would be no impact to ambient noise. By not deploying NPSBN, FirstNet would avoid generating noise from construction, installation, or operation of wired, wireless, deployable infrastructure or satellites and other technologies.

5.2.14. Climate Change

5.2.14.1. Introduction

This section describes potential impacts to climate and climate change-vulnerable resources in the District of Columbia associated with deployment and operation of the Proposed Action and Alternatives. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

5.2.14.2. 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 5.2.14-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

CEQ requires the consideration of climate change from two perspectives. The first is the potential for impacts on climate change through GHG emissions resulting from the Proposed Action or Alternatives. The second is related to the implications and possible effects of climate change on the environmental consequences of the Proposed Action or Alternatives. This extends to the impacts of climate change on facilities and infrastructure that would be part of the Proposed Action or Alternatives (CEQ, 2014).

CEQ has established the significance criteria for GHG emissions at 25,000 MT CO_2e on an annual basis, with the requirement that if projected emissions exceed this threshold, a GHG emissions quantitative analysis is warranted (CEQ, 2014). Although 25,000 MT is a very small fraction (one 266,920th) of the total U.S. emissions of 6,673 MMT CO_2e in 2013 (USEPA, 2015o), the sum of additional emissions as a consequence of the deployment of FirstNet, combined with multiple new sources of CO_2 and other GHGs from other projects and human activities, could be significant.

CEQ guidance for the consideration of effects of climate change on the environmental consequences of the Proposed Action is more general. In addition to the consideration of climate change's effects on environmental consequences, it also includes the impact that climate change may have on the projects themselves (CEQ, 2014). Projects located in areas that are vulnerable to the effects of climate change (e.g., sea level rise) may be at risk. Analysis of these risks through the NEPA process can provide useful information to the project planning to ensure these projects are resilient to the impacts of climate change.

Table 5.2.14-1: Impact Significance Rating Criteria for Climate

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Contribution to climate change through GHG emissions	Magnitude or Intensity	Exceedance of 25,000 metric tons of CO_2e/year, and global level effects observed	Effect that is potentially significant, but with mitigation is less than significant	Only slight change observed	No increase in greenhouse gas emissions or related changes to the climate as a result of project activities
	Geographic Extent	Global impacts observed		Global impacts observed	NA
	Duration or Frequency	Long-term changes. Changes cannot be reversed in a short term		Changes occur on a longer time scale. Changes cannot be reversed in the short term	NA
Effect of climate change on FirstNet installations and infrastructure	Magnitude or Intensity	Climate change effects (such as sea level rise or temperature change) negatively impact FirstNet infrastructure	Effect that is potentially significant, but with mitigation is less than significant	Only slight change observed	No measurable impact of climate change on FirstNet installations or infrastructure
	Geographic Extent	Local and regional impacts observed		Local and regional impacts observed	NA
	Duration or Frequency	Long-term changes. Changes cannot be reversed in a short term		Changes occur on a longer time scale. Changes cannot be reversed in the short term	NA

NA – Not Applicable

5.2.14.3. Projected Future Climate

Climate model forecasts of future temperatures are highly dependent on emissions scenarios (low versus high), particularly in projections beyond 2050. By mid-century, the total number of days above 90 ºF is projected to increase in the majority of the Northeastern states especially the southern portion of the region. Under both low and high GHG emissions scenarios, the frequency, intensity, and duration of heat waves (sequential days with temperatures over 90 ºF) is also expected to increase, with the most intense heat waves occurring under higher emissions scenarios. Increases in temperature will also impact precipitation events, sea level rise, and ocean water acidity. (USGCRP, 2014a)

Air Temperature

Figure 5.2.14-1 and Figure 5.2.14-2 below illustrate the anticipated temperature changes for low and high GHG emission scenarios for the District of Columbia from a 1969 to1971 baseline.

Cfa – Figure 5.2.14-1 shows that by mid-century (2040 to 2059), temperatures in the District of Columbia under a low emission scenario will increase by approximately 4 °F, and by the end of the century (2080 to 2099) temperatures in the District of Columbia under a low emission scenario will increase by approximately 5 °F. (USGCRP, 2009)

Figure 5.2.14-2 shows that my mid-century (2040 to 2059) under a high emission scenario, temperatures will increase by approximately 5 °F in the District of Columbia. Under a high emissions scenario for the period (2080 to 2099) in the District of Columbia, temperatures will increase by approximately 9 °F. (USGCRP, 2009)

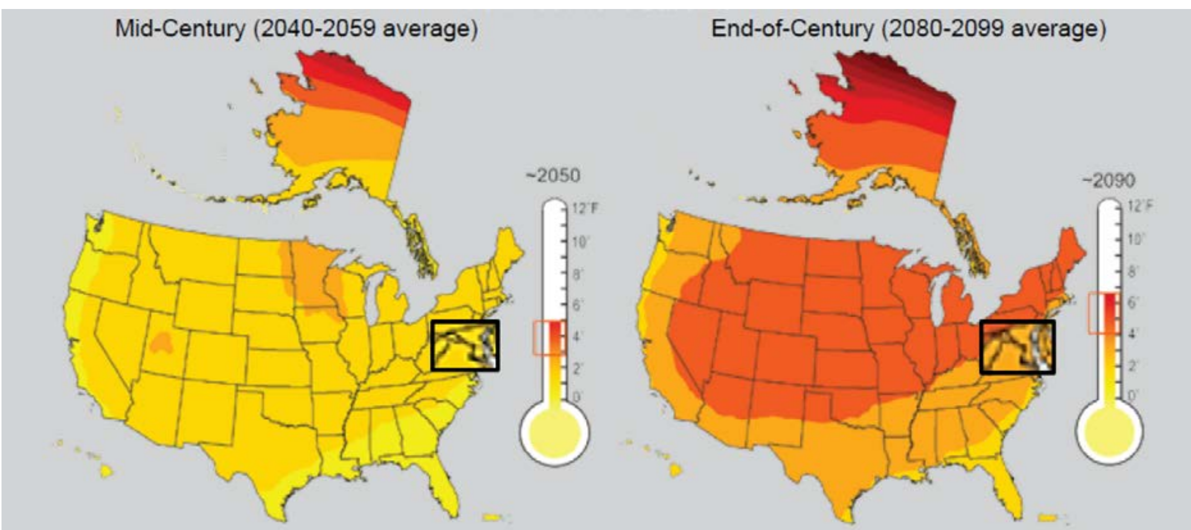


Figure 5.2.14-1: District of Columbia Low Emission Scenario Projected Temperature Change

Source: (USGCRP, 2009)

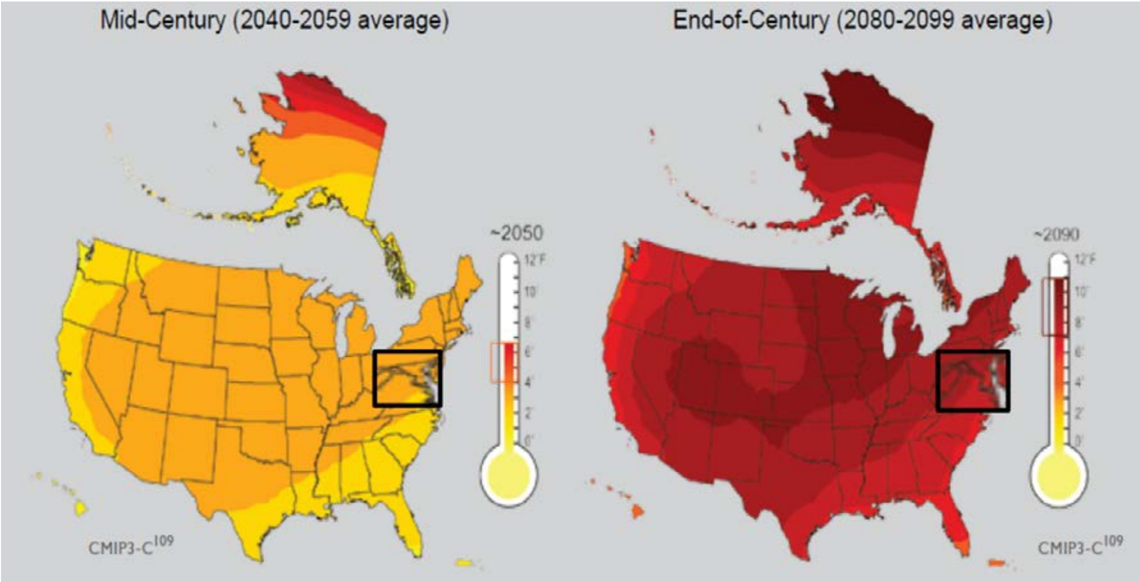


Figure 5.2.14-2: District of Columbia High Emission Scenario Projected Temperature Change

Source: (USGCRP, 2009)

Precipitation

By late in the century under a high emissions scenario, winters in the Northeast are projected to be much shorter with fewer cold days and more precipitation. Winter and spring precipitation is projected to increase, and the frequency of heavy downpours is projected to continue to increase as the century progresses. Seasonal drought risk is also projected to increase in summer and fall as higher temperatures lead to greater evaporation and earlier winter and spring snowmelt. (USGCRP, 2009)

Figure 5.2.14-3 and Figure 5.2.14-4 show predicted seasonal precipitation change for an approximate thirty-year period of 2071 to 2099 compared to a 1970 to 1999 approximate thirty-year baseline. Figure 5.2.14-3 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 5.2.14-4 shows a high emissions scenario, which assumes continued increases in emissions, with associated large increases in warming and major precipitation changes. Continued increases in emissions would lead to large reductions in spring precipitation in the Northeast. Note: white areas in the figures indicate that the changes are not projected to be larger than could be expected from natural variability. (USGCRP, 2014b).

Cfa – Under the low emissions scenario, in the 30-year period for 2071 to 2099, precipitation will increase by 10 percent in winter and spring in the District of Columbia. However, there are no expected increases in precipitation in fall other than fluctuations due to natural variability (USGCRP, 2014b).

Figure 5.2.14-4 shows that if emissions continue to increase, winter and spring precipitation could increase 20 percent over the period 2071 to 2099. In the spring, precipitation in this scenario is expected to increase up to 10 percent. Precipitation in fall under a high emissions scenario for this period could have no significant change or precipitation could potentially increase up to 10 percent (USGCRP, 2014b).

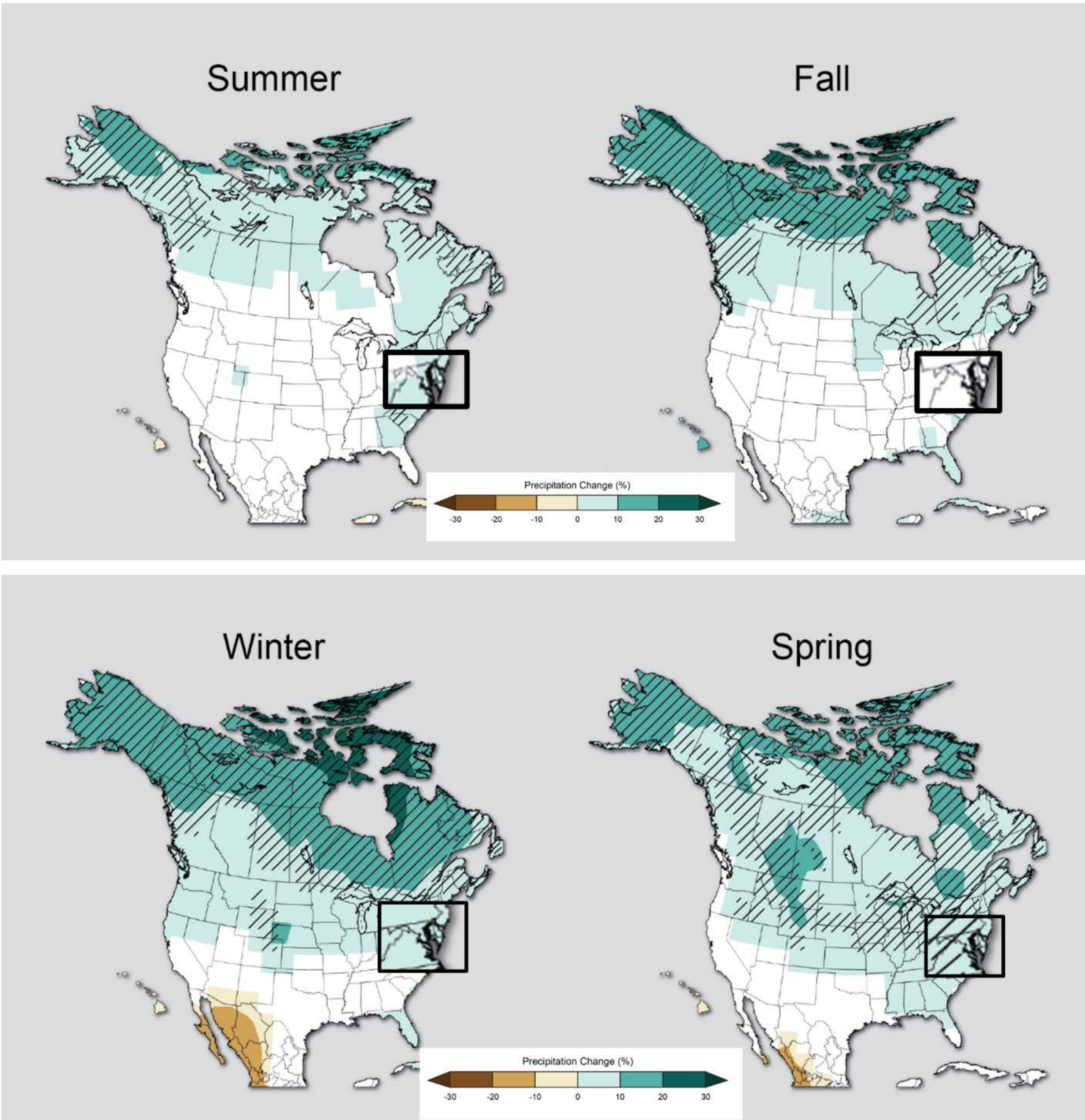


Figure 5.2.14-3: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a Low Emissions Scenario

Source: (USGCRP, 2014b)

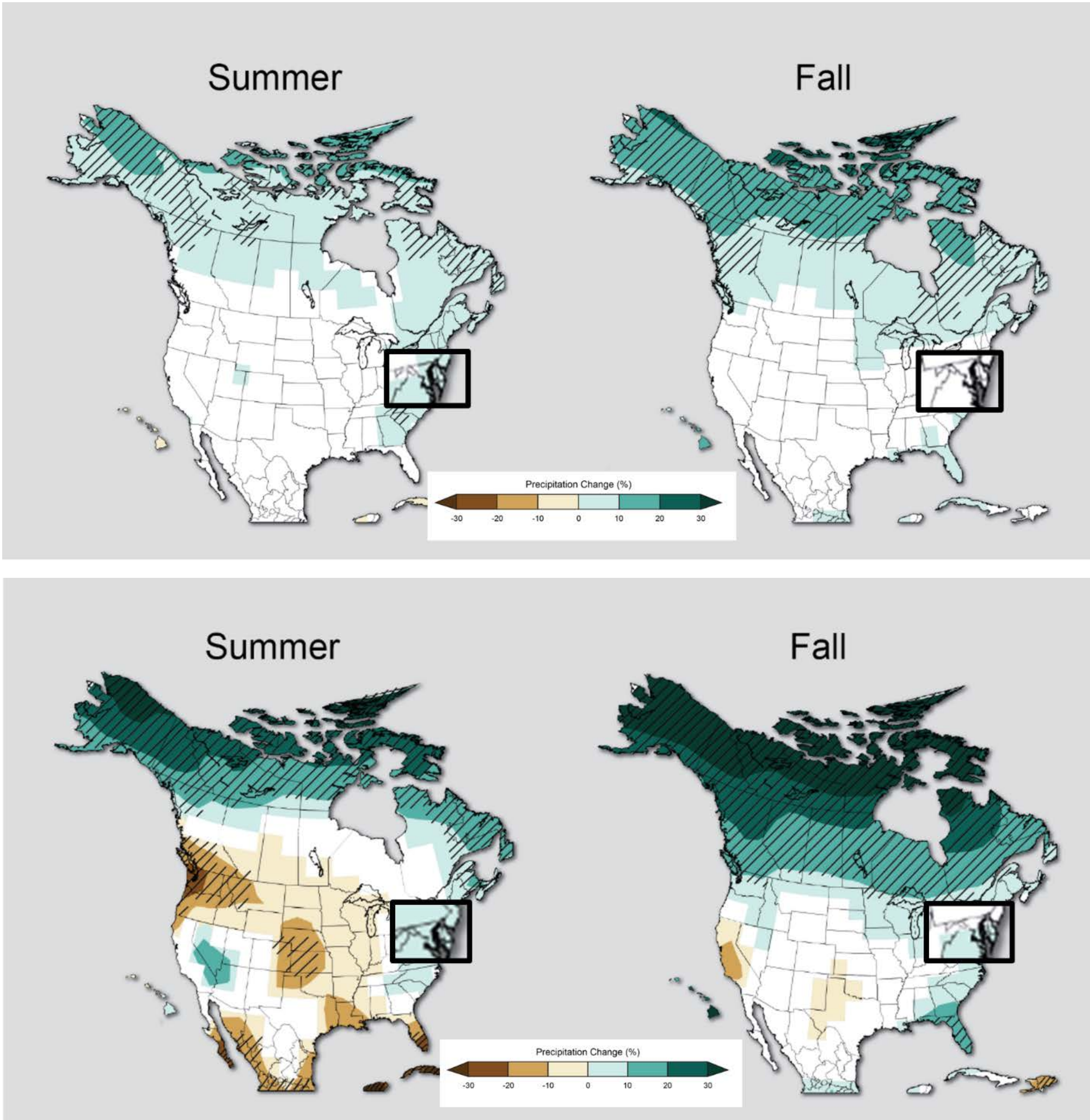


Figure 5.2.14-4: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a High Emissions Scenario

Source: (USGCRP, 2014b)

Sea Level

Several factors will continue to affect sea level rise in the future. Glacier melt adds water to the ocean, and increasing ocean temperatures result in thermal expansion. Worldwide, "glaciers have generally shrunk since the 1960s, and the rate at which glaciers are melting has accelerated over the last decade. The loss of ice from glaciers has contributed to the observed rise in sea level" (USEPA, 2012c). When water warms, it also expands, which contributes to sea level rise in the world's oceans. Studies show that the ocean has been storing more heat each year since the 1950s. The increased amount of heat in the ocean influences sea level and currents. (USEPA, 2012c)

The amount of sea level rise will vary in the future along different stretches of the U.S. coastline and under different absolute global sea level rise scenarios. Variation in sea level rise along different stretches of coast is mostly due to varying rates of land subsidence (also known as relative sea level rise). In the National Climate Assessment potential sea level rise scenarios were reported. These scenarios were developed based on varying degrees of ocean warming and ice sheet loss as estimated by organizations like IPCC (NOAA, 2012). Figure 5.2.14-5 and Figure 5.2.14-6 show feet of sea level above 1992 levels at different tide gauge stations. Figure 5.2.14-5 shows an 8-inch global sea level rise above 1992 levels by 2050 and Figure 5.2.14-6 shows a 1.24-foot global sea level rise above 1992 levels by 2050 (USGCRP, 2014c).

Cfa

The District of Columbia is bordered on three sides by Maryland and sits across the Potomac River from Virginia on its fourth side. The District of Columbia is also divided by the Anacostia River and Rock Creek River (City-Data, 2009). While the District is not located directly on the coast, the District is still affected by sea level rise. As shown in Figure 5.2.14-5, an 8-inch global average sea level rise above 1992 levels could result in a 0.7 to 1.3 foot sea level rise in 2050 along the coast of the states surrounding the District of Columbia. Figure 5.2.14-6 indicates that a 1.24-foot sea level rise above 1992 levels could result in a 1.3 to 2.0 foot sea level rise in 2050 along the coast of the states surrounding the District of Columbia. Sea level rise along this portion of the coast also will affect the Chesapeake Bay, which feeds into major rivers and streams in the District of Columbia.

“Sea level rise is projected to increase by 24 to 48 inches over the next century along the Chesapeake Bay as a result of the melting of polar ice caps combined with the thermal expansion of sea water. A commensurate rise in sea level will occur along the Potomac and Anacostia Rivers as well as Rock Creek over the next century, as all three waterways are tidal and respond to rises in sea levels. Between 1.74 to 2.55 square miles of District land, lies below 40 inches in elevation, land that is highly vulnerable to sea level rise and could potentially become inundated by the year 2100. A total of 3.42 square miles are below 140 miles in elevation, and this land will be more susceptible to episodic flooding and storm surges.” (DOEE, 2010).

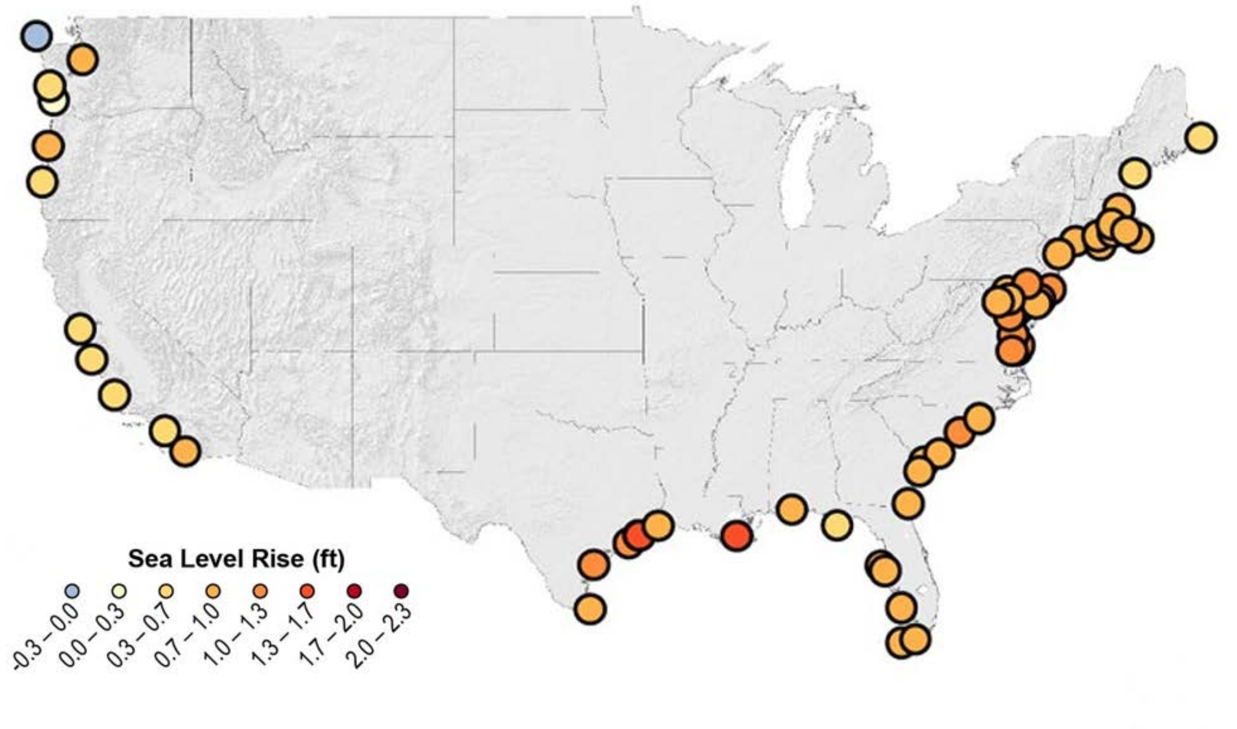
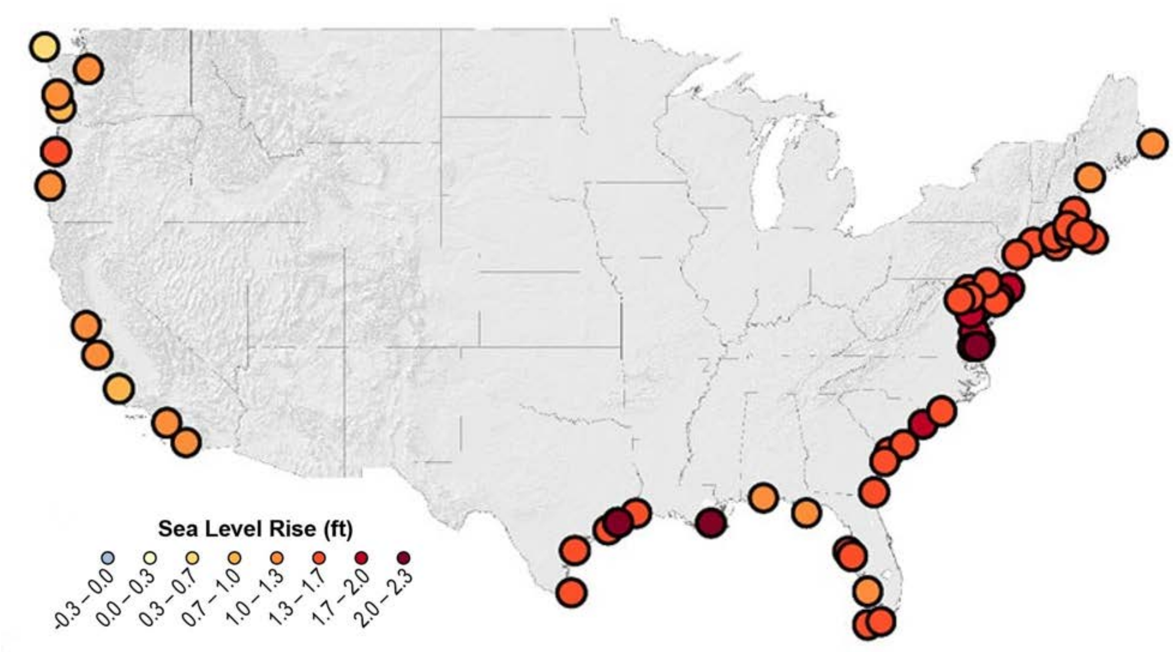


Figure 5.2.14-5: 8-Inch Sea Level Rise Above 1992 Levels by 2050



Source: (USGCRP, 2014c)

Figure 5.2.14-6: 1.24-Foot Sea Level Rise Above 1992 Levels by 2050

Severe Weather Events

It is difficult to forecast the impact of climate change on severe weather events such as thunderstorms and hurricanes. Trends in thunderstorms and hurricanes are subject to greater uncertainties than trends in temperature and associated variables directly related to temperature such as sea level rise. Climate scientists are studying the influences of climate change on severe storms such as hurricanes. Recent research has yielded insights into the connections between warming and factors that cause severe storms. For example, atmospheric instability and increases in wind speed with altitude link warming with tornadoes and thunderstorms. Additionally, research has found a link between warming and conditions favorable for severe thunderstorms. However, more research is required to make definitive links between severe weather events and climate change (USGCRP, 2014d).

United States coastal waters are expected to experience more intense hurricanes with related increases in wind, rain, and storm surges (but not necessarily an increase in the number of storms that make landfall). Changes in hurricane intensity are difficult to project because there are contradictory effects at work. Warmer oceans increase storm strength with higher winds and increased precipitation. However, changes in wind speed and direction with height are also projected to increase in some regions; this tends inhibit storm formation and growth. Current research suggests stronger, more rain-producing tropical storms and hurricanes are generally more likely, though such storms may form less frequently; ultimately, more research would provide greater certainty. (USGCRP, 2014d)

5.2.14.4. 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 5.2.14-1, climate change impacts as a result of GHG emissions could be significant and require a quantitative analysis if FirstNet's deployment of technology was responsible for increased emissions of 25,000 MT/year or more. The GHG emissions resulting from FirstNet activities fall into two categories: short-term and long-term. Short-term emissions could be associated with deployment activities (vehicles and other motorized construction equipment) and would have no long-term or permanent impact on GHG emissions or climate change. Long-term (both temporary and permanent) emission increases could result from operations, including the use of grid-provided electricity by FirstNet equipment such as transmitters and optical fiber, and from the temporary use of portable or onsite electric generators (a less efficient, more carbon-intensive source of electricity), during emergency situations when the electric grid was down, for example after a hurricane.

A single large cell tower would typically require 20-60kW of power to operate (Balshe, 2011). The CO_2 emissions associated with the operation of the tower would depend on whether it was supplied by a stand-alone power source, such as a generator, or from the grid, and whether it was operating at full power on a continuous basis. A standard 60kW 3-phase diesel generator consumes approximately 5.0 gallons of diesel per hour (Multiquip, 2015). Diesel fuel combustion emits 22.38 lbs of CO_2 per gallon (EIA, 2015g). A 60kW transmitter running on a generator would therefore be responsible for 1,221 kg of CO_2/day. Running continuously, the tower would cause the emission of 446 MT of CO_2 per year.

However, grid-provided electricity is less carbon-intensive, and would generate approximately 240 MT of CO_2 per year for the same equipment, depending on the region of the United States where the electricity was generated (USEPA, 2014b). Furthermore, the components of the system would not necessarily all be this large, running all the time, or at full power. Some may even run on low/no-emissions renewable energy. Therefore, this scenario is a “worst-case” for GHG emissions. If the system deployment resulted in the operation of more than 50 60 kW towers operating at maximum power in remote locations on diesel generators on a continuous basis, the 25,000 MT/year threshold may be exceeded and a quantitative analysis required. By comparison, optical fiber is considerably more energy efficient and consumes considerably less power than transmitters (Willem Vereecken, 2011), and would not impact GHG emissions in such a way as to require a quantitative analysis.

Impact of Climate Change on Project-Related Resource Effects

Climate change may impact project-related effects by magnifying or otherwise altering impacts in other resources areas. For example, in the District of Columbia, climate change projections indicate that the number of days with the heat index over 95 °F will increase from the current baseline of 29 per year, to 50 in the 2020s, and from 75 to 105 in the 2080s, depending on emissions scenario (low or high). In turn, these extended periods of extreme heat will negatively impact public health in the District (DOEE, 2015a). Sea level rise will also impact the District: relative sea level rise is projected to increase by 1.4 feet by 2050, and 3.4 feet by 2080. This, together with the expected increase in extreme rain events (USGCRP, 2014e), will increase nuisance flooding around the District, will negatively impact infrastructure such as roads, and impede access to various cultural and historic sites located in or near flooded areas (DOEE, 2015a).

Impact of Climate Change on FirstNet Installations and Infrastructure

Climate change impacts on FirstNet installations and infrastructure will vary from state to state, depending on the placement and vulnerability of the installations and infrastructure, and the impacts that climate change is anticipated to have in that particular location. Based on the impact significance criteria presented in Table 5.2.14-1, climate change effects on FirstNet installations and infrastructure would be significant if they negatively affected the operation of these facilities. Infrastructure located in areas within the District in low-lying areas would be vulnerable to chronic as well as acute flooding, which is projected to increase as sea level rises in the Chesapeake Bay and land subsidence continues (DOEE, 2015a). Increased periods of extreme heat (DOEE, 2015a) (USGCRP, 2014e) will increase the use of air conditioning and thereby place greater local and regional demands for electricity, while extreme heat may negatively impact grid operations. (DOE, 2015)

5.2.14.5. Potential Impacts of the Preferred Alternative

Greenhouse Gas Emissions

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

As described in Section 2.1.2, Proposed Action, implementation of the Preferred Alternative could result in the deployment and operation of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to GHG emissions, climate impacts in other resource areas, and FirstNet infrastructure and operations, and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure development scenarios described in Section 2.1.2, Proposed Action, the following are likely to have no impacts to climate change under the conditions described below:

- Wired Projects
    - *Use of Existing Conduit – New Buried Fiber Optic Plant:* There would be no short-term emissions associated with construction, as construction would not take place. The equipment required to blow or pull fiber through existing conduit would be used temporarily and infrequently, resulting in no perceptible generation of GHG emissions.
    - *Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable:* Lighting up dark fiber would require no construction and have no short- or long-term emissions. This would create no perceptible change in GHG emissions.
- Satellites and Other Technologies
    - *Distribution and Use of Satellite-Enabled Devices:* The installation of satellite-enabled equipment on existing structures, or the use of portable satellite-enabled devices would not create any perceptible changes in GHG emissions because they would not create any new emissions sources.
    - *Deployment of Satellites:* FirstNet does not anticipate launching satellites as part of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. Therefore, it is anticipated that there would be no GHG emissions or any climate change effects on the project because of these activities.

Potential to Have Impacts

The deployment and use of energy-consuming equipment as a result of the implementation of the Preferred Alternative would result in GHG emissions whose significance would vary depending on their power requirements, duration and intensity of use, and number. The types of infrastructure deployment scenarios that could be part of the Preferred Alternative and result in potential impacts to GHG emissions and climate change include the following:

- Wireless Projects
    - *New Build – Buried Fiber Optic Plant:* This activity would include plowing (including vibratory plowing), trenching, and directional boring, and could involve construction of POPs, huts, or other facilities to house outside plant equipment or hand holes to access fiber. These activities could generate GHG emissions.
    - *New Build Aerial Fiber Optic Plant:* These projects would require construction equipment for installing or replacing new poles and hanging cables as well as excavation and grading for new or modified ROWs or easements. It could also include construction of POPs, huts, or other facilities to house outside plant equipment. These activities could generate GHG emissions.
    - *Collocation on Existing Aerial Fiber Optic Plant:* These projects would require equipment for replacement of existing wiring and poles. GHG emissions associated with these projects would arise from use of machinery and vehicles to complete these activities. .
    - *New Build – Submarine Fiber Optic Plant:* The deployment of small workboats with engines similar to recreational vehicle engines may be required to transport and lay small wired cable. The emissions from these small sources would contribute to GHGs.
    - *Installation of Optical Transmission or Centralized Transmission Equipment:* The construction of small boxes or huts or other structures would require construction equipment, which could generate GHG emissions.
    - *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, since it would not occur. Minor, short-term, temporary GHG emissions may result from any associated equipment used for installation, such as cranes or other equipment. Long-term, permanent or temporary increases in GHG emissions would

result from the electricity requirements of the towers (both grid-provided and back up), and would depend on their size, number, and the frequency and duration of their use.

- Deployable Technologies
  - *COWs, COLTs, 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 (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 occuring as a result of soil disturbance and loss of vegetation are expected to be less than significant due to the limited and localized nature of deployment activities. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

Climate Change Impacts on FirstNet Infrastructure or Operations

Climate change effects on the Preferred Alternative could be potentially significant to less than significant with BMPs and mitigation measures incorporated because climate change may potentially impact FirstNet installations or infrastructure during periods of extreme heat, severe storms, and other weather events. Mitigation measures could minimize or reduce the severity or magnitude of a potential impact resulting to the project, including adaptation, which refers to anticipating adverse effects of climate change and taking appropriate action to prevent and minimize the damage climate change effects could cause.

5.2.14.6. Alternatives Impact Assessment

The following section assesses potential impacts to climate associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration.

Deployment Impacts

As explained above, implementation of deployable technologies could involve use of fossil-fuel-powered vehicles, powered generators, and/or aerial platforms. There could be some emissions and soil and vegetation loss as a result of excavation and grading for staging and/or landing areas depending on the type of technology. GHG emissions are expected to be less than significant based on the defined significance criteria, since activities would be temporary and short-term.

Operations Impacts

Implementing land-based deployable technologies (COW, COLT, SOW) could result in emissions from mobile equipment on heavy trucks using internal combustion engines associated with the vehicles and onboard generators. While a single deployable vehicle may have an insignificant impact, multiple vehicles operating for longer periods, in close proximity, may have a cumulative impact, although this impact is expected to be less than significant. Some staging or landing areas (depending on the type of technology) may require excavation, site preparation, and paving. Heavy equipment used for these activities could produce emissions as a result of burning fossil fuels in internal combustion engines. The deployment and operation of aerial technology is anticipated to generate pollutants during all phases of flight, except for balloons. These activities are expected to be less than significant due the limited duration of deployment activities.

Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be less than significant, given that these activities are of low-intensity and short duration.

Climate Change Impacts on FirstNet Deployable Infrastructure or Operations

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. These projects may also consist of deploying aerial vehicles including, but not limited to, drones, balloons, blimps, and piloted aircraft, which could involve fossil fuel combustion. Climate change effects have the most noticeable impacts over a long period. Climate change effects such as temperature, precipitation changes, and extreme weather during operations would be expected but could have little to no impact on the deployed technology due to the temporary nature of deployment. However, if these technologies are deployed continuously (at the required location) for an extended period, climate change effects on deployables could be similar to the Proposed Action, as explained above.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure, or satellites and other technologies. As a result, there would be no impacts to GHG emissions or climate as a result of deployment and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 5.1.14, Climate Change.

5.2.15. Human Health and Safety

5.2.15.1. Introduction

This section describes potential impacts to human health and safety in District of Columbia associated with deployment of the Proposed Action and Alternatives. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

5.2.15.2. 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 5.2.15-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

5.2.15.3. 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 5.2.15-1, 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

Table 5.2.15-1: Impact Significance Rating Criteria for Human Health and Safety

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Exposure to Worksite Occupational Hazards as a Result of Activities at Existing or New FirstNet Sites	Magnitude or Intensity	Exposure to concentrations of chemicals above occupational regulatory limits and time weighted averages. 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	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/District)		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the project.		Rare event	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Exposure to Hazardous Materials, Hazardous Waste, and Mine Lands as a Result of FirstNet Site Selection and Site-Specific Land Disturbance Activities	Magnitude or Intensity	Exposure to concentrations of chemicals above regulatory limits, or USEPA chemical screening levels protective of the 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. 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/District)		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the project.		Rare event	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Exposure to Hazardous Materials, Hazardous Waste, and Occupational Hazards as a Result of Natural And Manmade Disasters	Magnitude or Intensity	Exposure to concentrations of chemicals above regulatory limits, or USEPA chemical screening levels protective of the general public. Site contamination conditions could preclude development of sites for the proposed use. Physical and biologic hazards. Loss of medical, travel, and utility infrastructure.	Effect is potentially significant, but with mitigation is less than significant.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unsafe conditions. No loss of medical, travel, or utility infrastructure.	No exposure to chemicals, unsafe conditions, or other safety and exposure hazards.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory/District)		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

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, 2015b).

- Engineering controls,
- Work practice controls,
- Administrative controls, and
- Personal protective equipment (PPE).

Engineering controls are often physical barriers that prevent access to a worksite, areas of a worksite, or from idle and operating equipment. Physical barriers take many forms like perimeter fences, trench boxes, chain locks, bollards, storage containers (for storing equipment and chemicals), or signage and caution tape. Other forms of engineering controls could include machinery designed to manipulate the quality of the work environment, such as ventilation blowers. Whenever practical, engineering controls may result in the complete removal of the hazard from the work site, an example of which would be the transport and offsite disposal of hazardous waste or asbestos containing materials.

Work practice controls could be implemented as abiding by specific OSHA industry standards, such as the Confined Space Entry standard (29 CFR 1910.146) or thru the development of employer specific workplace rules and operational practices (OSHA, 2015b). To the extent practicable, FirstNet contractors would likely implement and abide by work practice controls through employee safety training and by developing site-specific health and safety plans (HASP). The HASPs would identify all potential hazardous materials and hazardous wastes, potential physical hazards, and applicable mitigation steps. Other components of a HASP identifying appropriate PPE for each task and the location of nearby medical facilities. Safety Data Sheets describing the physical and chemical properties of hazardous materials used during FirstNet deployment and maintenance activities, as well as the physical and health hazards, routes of exposure, and precautions for safe handling and use would be kept and maintained at all FirstNet project sites. In addition to HASPs and safety data sheets, SOPs would be developed and implemented by FirstNet partner(s) for critical and/or repetitive tasks that require attention to detail, specialized knowledge, or clear step-wise directions to prevent worker injury and to ensure proper execution.

Administrative controls are employer-initiated methods to reduce the potential for injury and physical fatigue (OSHA, 2015b). Administrative controls may take the form of limiting the number of hours an employee is allowed to work per day, requiring daily safety meetings before starting work, utilizing the buddy system for dangerous tasks and any other similar activity or process that is designed to identify and mitigate unnecessary exposure to hazards. When engineering controls, work practice controls, and administrative controls are not feasible or do not provide sufficient protection, employers must also provide appropriate PPE to their employees and ensure its proper use. PPE refers to the equipment worn by employees to minimize exposure to chemical and physical hazards. Examples of PPE include gloves, protective footwear, eye protection, protective hearing devices (earplugs, muffs), hard hats, fall protection, respirators, and full body suits. PPE is the last line of defense to prevent occupational injuries and exposure. (OSHA, 2015b)

DOES is not authorized by OSHA to administer the “state program” to oversee public and private sector workers. Therefore, DOES defers all regulatory authority and enforcement for occupational safety relating to FirstNet site work to the leadership and interpretation of OSHA.

Hazardous Materials, Hazardous Waste, and Mine Lands

The presence of environmental contamination and mine lands at FirstNet deployment sites has the potential to negatively impact health and safety of workers and the general public. Past or present contaminated media, such as soil and groundwater, may be present and become disturbed as a result of site activities. Mines may cause unstable surface and subsurface conditions because of underground shaft collapses or seismic shifting. Based on the impact significance criteria presented in Table 5.2.15-1, human health impacts could be significant if FirstNet deployment sites are near contaminated properties or abandoned mine lands. Prior to the start of any FirstNet deployment project, potential site locations should be screened for known environmental contamination and mining activities using federal resources such as the USEPA CIMC database and U.S. Department of Interior’s Abandoned Mine Lands inventory, through DOEE, or through an equivalent commercial resource, such as Environmental Data Resources, Incorporated.

By screening sites for environmental contamination, mining activities, and reported environmental liabilities, the presence of historic contamination and unsafe ground conditions could be evaluated and may influence the site selection process. In general, the lower the density of environmental contamination or mining activities, the more favorable the site will be for FirstNet deployment projects. If sites containing known environmental contamination (or mine lands) are selected for proposed FirstNet deployment activities it may be necessary to implement additional controls (e.g., engineering, work practice, administrative, and/or PPE) to ensure workers, and the general public, are not unnecessarily exposed to the associated hazards. Additionally, for any proposed FirstNet deployment site, it is possible undocumented environmental contamination is present.

During proposed FirstNet deployment activities, if any soil or groundwater is stained or emitting an unnatural odor, it may be an indication of environmental contamination. When such instances are encountered, it may be necessary to stop work until the anomaly is further assessed through record reviews or environmental sampling. Proposed FirstNet deployment would attempt to avoid known contaminated sites. However, in the event that FirstNet is unable to avoid a contaminated site, then site analysis and remediation would be required under RCRA, CERCLA, and applicable District laws in order to protect workers and the public from direct exposure or fugitive contamination.

Exposure assessments identify relevant site characteristics, temporal exposure parameters, and toxicity data to determine the likelihood of adverse health effects. More formally known as a human health risk assessment (HHRA), these studies provide mathematical justification for implementing controls at the site to protect human health. If the HHRA determines the potential for adverse health effects is too great DOEE 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 (e.g., 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

The impacts of natural and manmade disasters are likely to present unique health and safety hazards, as well as exacerbate pre-existing hazards, such as degrading occupational work conditions and disturbing existing environmental contamination. The unique hazards presented by natural and manmade disasters may include, fire, weather incidents (e.g., floods, tornadoes, hurricanes, etc.), earthquakes, vandalism, large- or small-scale chemical releases, utility disruption, community evacuations, or any other event that abruptly and drastically denudes the availability or quality of transportation infrastructure, utility infrastructure, medical infrastructure, and sanitation infrastructure. Additionally, such natural and manmade disasters could directly impact public safety communication infrastructure assets through damage or destruction.

Based on the impact significance criteria presented in Table 5.2.15-1, 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 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, seismic activities, and other newsworthy 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 contractors would develop disaster response plans that outline specific steps employees should take in the event of a natural or manmade disaster.

5.2.15.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to human health and safety and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant with mitigation, depending on the deployment scenario or site-specific activities.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to human health and safety under the conditions described below:

- Wired Projects
  - *Use of Existing Conduit – New Buried Fiber Optic Plant:* The pulling or blowing of fiber optic cable could be performed through existing conduit. Use of mechanical equipment would be limited to pulley systems and blowers. Some locations with no existing power supply may require the use of electrical generators. Hazardous materials needed for this work would include fiber optical cable lubricants, mechanical oil/grease, and fuel for electrical generators although these materials are expected to be used infrequently and in small quantities. These activities are not likely to result in serious injury or chemical exposure, or surface disturbances since work would be limited to existing entry and exit points, would be temporary, and intermittent. It is anticipated that there would be no impacts to human health and safety.
  - *Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable:* Lighting up of dark fiber could have no impacts to human health and safety because there would be no ground disturbance or heavy equipment used.
- Satellites and Other Technologies
  - *Deployment of Satellites:* FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact human health and safety resources, it is anticipated that this activity would have no impact on those resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to human health and safety as a result of implementation of the Preferred Alternative would encompass a range of impacts that occur as a result of ground disturbance activities, construction activities, equipment upgrade activities, management of hazardous materials and/or hazardous waste, and site selection. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to human health and safety include the following:

- Wired Projects
  - *New Build – Buried Fiber Optic Plant:* Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber would require the use of heavy equipment and hazardous materials. The additional noise and activity at the site would require workers to demonstrate a high level of situational awareness. Failure to follow OSHA and industry controls could result in injuries. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. Additionally, some of this work would likely be performed along road ROWs, increasing the potential for vehicle traffic to collide with site workers or equipment. If a proposed deployment activity involves the operation of heavy equipment, managing hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
  - *New Build – Aerial Fiber Optic Plant:* Installation of new poles and fiber optic lines could require excavation activities, working from heights, use of hazardous materials, and site locations in ROWs. Hazards associated with the site work include injury from heavy equipment, fall hazards, chemical hazards, and the potential for vehicle traffic to collide with site workers or equipment. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
  - *Collocation on Existing Aerial Fiber Optic Plant:* Installation of overhead fiber optic lines would require work from height. In some instances, new poles would be installed requiring excavation activities with heavy equipment. Hazards associated with the site work include injury from heavy equipment, fall hazards, chemical hazards, and the potential for vehicle traffic to collide with site workers or equipment. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.

- *New Build – Submarine Fiber Optic Plant:* The installation of cables in or near bodies of water may require workers to operate over aquatic environments, which presents opportunities for drowning. When working over water, exposure to sun, high or low temperatures, wind, and moisture could impact worker safety. Construction of landings and/or facilities on shores or the banks of waterbodies that accept the submarine cable would require site preparation, construction, and management of hazardous materials and hazardous waste. Excavation of soils or sediments at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
- *Installation of Optical Transmission or Centralized Transmission Equipment:* Installation of transmission equipment would require site preparation, construction activities, and management of hazardous materials and hazardous waste. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.

- Wireless Projects
  - *New Wireless Communication Towers:* Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads would require site preparation, construction activities, and management of hazardous materials and hazardous waste. Communication towers would be erected, requiring workers to perform their duties from heights sufficient to result in serious injury or death in the event of falling. Working from heights may also result in additional overhead hazards and falling objects. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions.
  - *Collocation on Existing Wireless Tower, Structure, or Building:* Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower. This would require workers to perform their duties from heights sufficient to result in serious injury or death in the event of falling not result in impacts to soils. Working from heights may also result in additional overhead hazards and falling objects. Excavation of soils at proposed sites known to contain environmental

contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions.

- Deployable Technologies
  - The use of deployable technologies could result in soil disturbance if land-based deployables are deployed on unpaved areas or if the implementation results in paving of previously unpaved surfaces. The use of heavy machinery presents the possibility for spills and soil and water contamination, and noise emissions could potentially impact human health; and vehicles and heavy equipment present the risk of workplace and road traffic accidents that could result in injury. Set-up of a cellular base station contained in a trailer with a large expandable antenna mast is not expected to result in impacts to human health and safety. However, due to the larger size of the deployable technology, site preparation or trailer stabilization may be required to ensure the self-contained unit is situated safely at the site. Additionally, the presence of a dedicated electrical generator would produce fumes and noise. The possibility of site work and the operation of a dedicated electrical generator have the potential for impacts to human health and safety. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions. Use of aerial vehicles would not involve telecommunication site work. Prior to deployment and when not in use, the aerial vehicles would likely require preventive maintenance. Workers responsible for these activities may handle hazardous materials, not limited to fuel, solvents, and adhesives.
- Satellites and Other Technologies
  - *Satellite-Enabled Devices and Equipment:* The use of portable devices that utilize satellite technology would not impact human health and safety because there is no construction activities or use of hazardous materials. The installation of permanent equipment on existing structures may require workers to operate from heights or in sensitive environments. As a result, the potential for falling, overhead hazards, and falling objects is greater and there is a potential to impact human health and safety.

In general, the abovementioned FirstNet activities could potentially involve site preparation work, construction activities, work in potentially harmful environments (road ROWs, work over water, and environmental contamination), management of hazardous materials and hazardous waste, and weather exposure. Potential impacts to human health and safety associated with deployment of the Proposed Project could include injury from site preparation and operating heavy equipment, construction activities, falling/overhead hazards/falling objects, exposure and release of hazardous chemicals and hazardous waste. It is anticipated that potential health impacts associated with human exposure to environmental hazardous materials in air, water, or soil, the risk of road traffic, workplace accidents and injuries, noise exposure, and risk of infectious disease transmission would be less than significant due to the small-scale of likely

FirstNet activities that would be temporary and of short duration. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there would be less than significant impacts to human health and safety associated with routine inspections of the Preferred Alternative, assuming that the inspections do not require climbing towers or confined space entry. In those instances, PPE or other mitigation measures could be necessary to adequately protect workers. If usage of heavy equipment were part of routine maintenance, the potential for impacts to human health and safety would also increase. It is anticipated that potential health impacts associated with human exposure to environmental hazardous materials in air, water, or soil, the risk of road traffic, workplace accidents and injuries, noise exposure, and risk of infectious disease transmission would be less than significant due to the small-scale of likely FirstNet activities that would be temporary and of short duration. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

5.2.15.5. Alternatives Impact Assessment

The following section assesses potential impacts to human health and safety associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable land-based infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to human health and safety as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to human health and safety. The largest of the land-based deployable technologies may require site preparation work or stabilization work to ensure the self-contained trailers are stable. Heavy equipment may be necessary to complete the site preparation work. However, in general, the deployable technologies are small mobile units that could be transported as needed. While in operation, the units are parked and operate off electrical generators or existing electrical power sources. Connecting deployable technology to a power supply may present increased electrocution risk during the process of connecting power. If the power source were an electrical generator, then there would also likely be a need to manage fuel onsite. These activities could result in less than significant impacts to human health and safety. It is anticipated that potential health impacts associated with human exposure to environmental hazardous materials in air, water, or soil, the risk of road traffic, workplace accidents and injuries, noise exposure, and risk of infectious disease transmission would be less than significant due to the small-scale of likely FirstNet activities that would be temporary and of short duration. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to human health and safety associated with routine inspections of the Preferred Alternative, assuming that the inspections do not require climbing towers or confined space entry. In those instances, PPE or other mitigation measures may be necessary to adequately protect workers. If usage of heavy equipment is part of routine maintenance, the potential for impacts to human health and safety would also increase. These impacts would be less than significant because of the small-scale of likely FirstNet activities; activities associated would routine maintenance, inspection, and deployment of deployable technologies would be temporary and often of limited duration. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to 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 human health and safety as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 5.1.15, Human Health and Safety.

ACRONYMS

Acronym	Definition
AARC	Average Annual Rate of Change
ACHP	Advisory Council on Historic Preservation
ACS	American Community Survey
AFB	Air Force Base
AGL	Above Ground Level
AIM	Aeronautical Information Manual
AIRFA	American Indian Religious Freedom Act
AML	Abandoned Mine Lands
APCO	Association of Public Safety Communications Officials
APE	Area of Potential Effect
AQCR	Air Quality Control Region
ARPA	Archaeological Resources Protection Act of 1979
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
BMP	Best Management Practice
BWI	Baltimore Washington International Airport (Thurgood Marshall Airport)
BYA	Billion Years Ago
CAA	Clean Air Act
CCD	Common Core of Data
CCMP	Comprehensive Conservation and Management Plan
CEQ	Council On Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFOI	Census of Fatal Occupational Injuries
CFR	Code of Federal Regulations
CGP	Construction General Permit
CH4	Methane
CIMC	Cleanups In My Community
CIO	Chief Information Officer
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COLT	Cell On Light Trucks
COW	Cell On Wheels
CRS	Community Rating System
CWA	Clean Water Act

Acronym	Definition
CWS	Community Water Systems
CZM	Coastal Zone Management
D.C.	District of Columbia
DEP	Department of Environmental Protection
DACA	Deployable Aerial Communications Architecture
DCA	Washington Reagan National Airport
DCMR	District of Columbia Municipal Regulations
DCOP	DC Office of Planning
DCPSC	D.C. Public Service Commission
DDOE	Department of the Environment
DDOT	District Department of Transportation
DOEE	Department of Energy and Environment
DOES	Department of Employment Services
DPW	Department of Public Works
DVRS	Digital Vehicular Repeater System
EDACS	Enhanced Digital Access System
EIA	Energy Information Agency
EMS	Emergency Medical Services
EO	Executive Order
EPCRA	Community Right To Know Act
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulations
FCC	Federal Communications Commission
FDMA	Frequency Division Multiplexing
FEMA	Federal Emergency Management Agency
FGDC	Federal Geographic Data Committee
FHWA	Federal Highway Administration
FLM	Federal Land Manager
FLPMA	Federal Land Policy and Management Act of 1976
FR	Federal Register
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
FSDO	Flight Standards District Offices
FSS	Flight Service Station
FWD	Fisheries and Wildlife Division
GAO	Government Accountability Office
GHG	Greenhouse Gas
GNIS	Geographic Names Information System
H_2S	Hydrogen Sulfide

Acronym	Definition
HAP	Hazardous Air Pollutant
HASP	Health and Safety Plans
HHRA	Human Health Risk Assessment
HPO	Historic Preservation Office
HSEMA	Homeland Security and Emergency Management Agency
IAD	Washington Dulles International Airport
IBA	Important Bird Area
IFR	Instrument Flight Rules
IPCC	Intergovernmental Panel On Climate Change
ISMP	Invasive Species Management Plan
ISWG	Invasive Species Working Group
IV&D	Integrated Voice and Data
IWIN	Integrated Wireless Network
LBS	Locations-Based Services
LCCS	Land Cover Classification System
LID	Low Impact Development
LMR	Land Mobile Radio
LRR	Land Resource Regions
LTE	Long Term Evolution
MARC	Maryland Area Regional Commuter
MBTA	Migratory Bird Treaty Act
MD	Maryland
MDI	Methylene Diphenyl Diisocyanate
MHI	Median Household Income
MLRA	Major Land Resource Areas
MOA	Memorandum of Agreement
MMPA	Marine Mammal Protection Act
MMT	Million Metric Tons
MSFCMA	Magnuson Stevens Fishery Conservation and Management Act
MSHA	Mine Safety and Health Administration
MSL	Mean Sea Level
MSW	Municipal Solid Waste
MT	Million Tons
MTN	Microwave Transmission Network
MWAA	Metropolitan Washington Airports Authority
MWCOG	Metropolitan Washington Council of Governments
MYA	Million Years Ago
N_2O	Nitrous Oxide
NA	Not Applicable
NAAQS	National Ambient Air Quality Standards

Acronym	Definition
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
NCA	National Climate Assessment
NEPA	National Environmental Policy Act
NERR	National Estuarine Research Reserve
NESCA	Nongame and Endangered Species Conservation Act
NFIP	National Flood Insurance Program
NHA	National Heritage Areas
NHL	National Historic Landmarks
NHPA	National Historic Preservation Act
NIH	National Institutes of Health
NIST	National Institute of Standards and Technology
NM	Nautical Miles
NNL	National Natural Landmark
NOAA	National Ocean and Atmospheric Administration
NOTAM	Disseminated Via Notices To Airmen
NOx	Nitrous oxide
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NPS	National Park Service
NPSBN	National Public Safety Broadband Network
NRC	National Response Center
NRCS	National Resources Conservation Service
NRHP	National Register of Historic Places
NSA	National Security Areas
NSR	New Source Review
NTIA	National Telecommunications and Information Administration
NTFI	National Task Force on Interoperability
NTNC	Non-Transient Non-Community
NWI	National Wetlands Inventory
NWR	National Wildlife Refuge
NWS	National Weather Service
OC	Optical Carrier
OCIO	Office of the Chief Information Officer
OE/AAA	Obstruction Evaluation and Airport Airspace Analysis
OSHA	Occupational Safety and Health Act
OTR	Ozone Transport Region
PAB	Palustrine Aquatic Bed

Acronym	Definition
PEIS	Programmatic Environmental Impact Statement
PEM	Palustrine Emergent Wetlands
PEPCO	Potomac Electric Power Company
PFO	Palustrine Forested Wetlands
PGA	Peak Ground Acceleration
PM	Particulate Matter
POP	Point of Presence
POR	Port of Richmond
PPE	Personal Protective Equipment
PSAP	Public Safety Answering Point
PSCR	Public Safety Communications Research
PSD	Prevention of Significant Deterioration
PSS	Scrub-Shrub Wetlands
PUB	Palustrine Unconsolidated Bottom
R&D	Research and Development
RACOM	Radio Communications
RCRA	Resource Conservation and Recovery Act
RF	Radio Frequency
ROW	Right-of-Way
RWBN	Regional Wireless Broadband Network
SAA	Sense and Avoid
SAIPE	Small Area Income and Poverty Estimates
SASP	State Aviation System Plan
SCC	State Corporation Commission
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
SIRS	Statewide Interdepartmental Radio System
SO_2	Sulfur Dioxide
SO_3	Sulfur Trioxide
SOC	Standard Occupational Classification
SONET	Synchronous Optical Network
SOP	Standard Operating Procedures
SOW	System On Wheels
SOx	Oxides of Sulfur
SPHQ	State Police Headquarters
SPL	Sound Pressure Level

Acronym	Definition
SRS	Statewide Radio System
STARS	Statewide Agencies Radio System
STATSGO2	State Soil Geographic Database
SUA	Special Use Airspace
SWDC	Special Waters of the District of Columbia
SWPPP	Storm Water Pollution Prevention Plan
THPO	Tribal Historic Preservation Office
TMDL	Total Maximum Daily Load
TPY	Tons per Year
TRI	Toxics Release Inventory
TSCA	Toxic Substances Control Act
TWA	Time Weighted Average
UA	Unmanned Aircraft
UAS	Unmanned Aircraft Systems
UCMP	University of California Museum of Paleontology
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
VA	Virginia
VCP	Voluntary Cleanup Program
VFR	Visual Flight Rules
VHF	Very High Frequency
VOC	Volatile Organic Compound
VPP	Voluntary Protection Program
VRE	Virginia Railway Express
WIP	Watershed Implementation Plan
WMATA	Washington Metropolitan Area Transit Authority
WMA	Wildlife Management Areas
WWI	World War I
WWII	World War II

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The citations in this Draft PEIS reflect the most recent information on the referenced site at the time the document was being written. If the site was updated after that point, the more recent information will be incorporated, as feasible, into the final document.

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