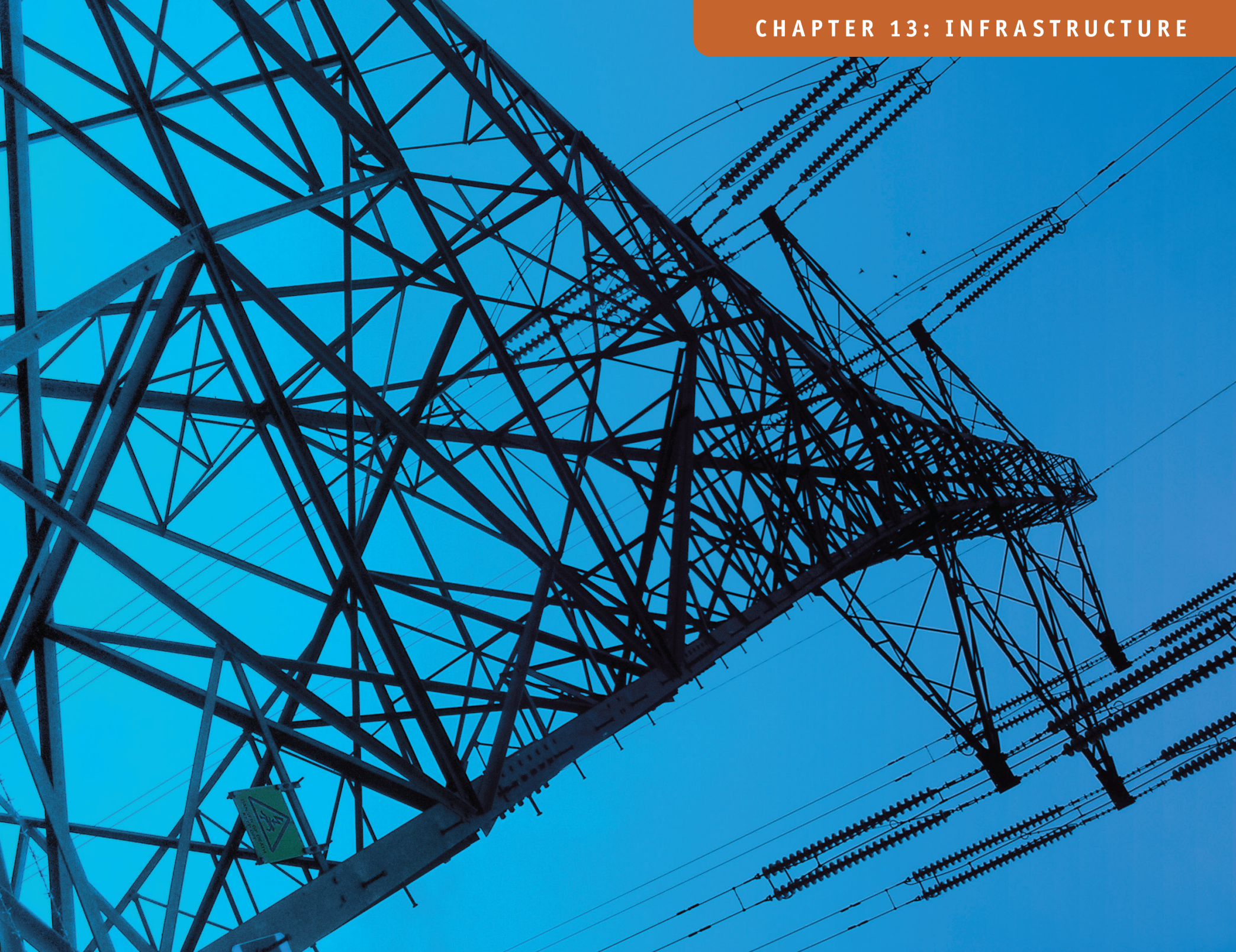
Chapter 13
Infrastructure Element



Infrastructure Element

Overview 1300

The Infrastructure Element provides policies and actions on the District's water, sanitary sewer, stormwater, solid waste management, energy, information and communications technology, and enhanced coordination among these sectors. Investments in these systems are essential to Washington, DC's future, specifically in meeting the demands of existing users, accommodating future change and development, and enhancing the District's resiliency and sustainability. These policies are complemented by those in the Land Use, Urban Design, Environmental Protection, Transportation, Community Services and Facilities, and other elements, all of which recognize the interplay between infrastructure and related topics. 1300.1

Since the 2006 update to the Comprehensive Plan, billions of dollars have been invested in the energy, water, digital, and solid waste systems that are intrinsic to the District's daily life and functions for its residents and visitors. Collectively, these investments have made the District a better place to live, work, and visit through the replacement of aging infrastructure, modernization of existing infrastructure, as well as environmental mitigations that are improving Washington, DC's natural environment. However, most of these investments were not directed toward expanding capacity because existing systems had spare capacity. With the level of forecasted growth in population and jobs, Washington, DC will need to think innovatively about how to build on the substantial infrastructure investments made in the last decade. 1300.2

To meet future demands effectively, the District should take a cross-system approach to infrastructure, identify ways to use existing infrastructure more innovatively, apply new and emerging technologies to make infrastructure more efficient, and expand capacity where needed. This approach should focus on improving quality of life. The District will also need to plan for a future where infrastructure is forced to contend with increased pressures from climate change. Infrastructure should be designed in a resilient way to withstand chronic stressors and system shocks. Safe, reliable, and available infrastructure provision must be considered through an equity lens to address and eliminate gaps for underserved communities and to meet the needs of low-income residents, vulnerable populations, and communities of color. 1300.3

Infrastructure is critical to the continued success and growth of Washington, DC; infrastructure capacity and effectiveness directly impact quality of life. Infrastructure systems provide vital services to residents, workers, and visitors; shape and enhance the public realm; underlie and contribute to health, wellness, safety, security, and quality of life; are fundamental to promoting economic growth; and form a backbone that allows the District to function as a home to hundreds of thousands

of persons and as the nation's capital. In these ways, infrastructure fundamentally contributes to Washington, DC's ability to fulfill the Comprehensive Plan's vision of an equitable, inclusive, and resilient District. 1300.4

The District's current infrastructure includes:

- More than 1,350 miles of drinking water pipelines and 1,800 miles of sewers;
- More than 2,200 miles of electrical cable;
- More than 2,300 miles of natural gas pipelines;
- Approximately 700 miles of fiber-optic cable owned by the District;
- More than 400 outdoor Wi-Fi access points;
- Thirteen communications towers strategically located across the District; and
- More than 70,200 street lights. 1300.5

The planning, management, and oversight of the District's energy, water and sewer, solid waste, and information and communications technology systems are distributed among several entities, including DC Water (formerly DC Water and Sewer Authority), the U.S. Army Corps of Engineers (USACE), the Potomac Electric Power Company (PEPCO), Washington Gas, the District's Department of Public Works (DPW), the District's Office of the Chief Technology Officer (OCTO), commercial telecommunications providers, and others. In addition, the General Services Administration (GSA) contracts with Washington Gas and PEPCO to supply federal agencies with natural gas and electricity, respectively, and many federal agencies, as well as some hospitals, educational institutions, and other nonprofit organizations that avail themselves of DC-Net. This element incorporates planning and policy guidance from the short- and long-term plans of these service providers. 1300.6

The critical infrastructure issues facing Washington, DC are addressed in this element. They include:

- Achieving and maintaining a state of good repair across all infrastructure systems;
- Improving water quality and public health by addressing the District's combined sewer, sanitary sewer, and wastewater systems;
- Responding to rapid changes in technology and equitably and accessibly distributing new digital technologies and services;
- Modernizing the aging water, gas, and electric distribution systems;
- Addressing infrastructure sufficiency for new development; and
- Enhancing the District's utility systems to increase resilience. 1300.7

Since 2006, when the Comprehensive Plan was last revised, Washington, DC has experienced rapid population and job growth, which has made the District one of the fastest growing large cities in the country. In 2018, the District's population grew to 700,000, a figure not seen since the 1970s. Washington, DC has grown by 121,000 people, or 20.8 percent, since the 2006 update of the Comprehensive Plan. This trend puts the District on track to bypass its previous peak population of 802,000 within the next decade. Washington, DC experienced the largest share of this growth (79,000 residents) in the six years since the 2010 decennial census. Even if projected growth takes longer to achieve, addressing long-term capacity needs and investing in infrastructure is critical to meet current and future needs. 1300.8

The overarching goal for infrastructure is to provide high-quality, robust, efficiently managed and maintained, and properly funded infrastructure to meet the needs of residents, workers, and visitors in an accessible and equitable way, as well as to support future change and growth.

Infrastructure Goal 1301

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Policies and Actions

IN-1 Drinking Water 1302

The water system serving the District consists of two primary components: the water supply and treatment system, and the water distribution system. 1302.1

DC Water was created by District law in 1996, with the approval of the United States Congress, as an independent authority of District government with a separate legal existence. As of 2016, DC Water distributes safe, treated drinking water to all residents, workers, and visitors in the District. 1302.2

Since 2006, there has been an evolution in the way water management is approached: while previously siloed as separate systems, potable water, wastewater, and stormwater are now managed together. This approach focuses on optimal outcomes, with all components considered together during the planning process. The whole water cycle, from capture, treatment, and reuse, is now integrated at both the local and District-wide scale. Thus, some of the policies and actions below may apply to drinking water infrastructure, as well as to wastewater and stormwater systems. 1302.3

The water supply and treatment system includes raw water sources, pipelines carrying this water to treatment plants, and the water treatment plants themselves. USACE operates and maintains these facilities and supplies treated water to several distributors. These distributors (which include DC

Water) deliver water to over one million users in Washington, DC and Northern Virginia. 1302.4

The Washington Aqueduct water system was commissioned by Congress and built by USACE in the 1850s to provide the nation's capital with a plentiful water source. It has been in continuous operation ever since and is the only public water supply in the United States where the federal government has a direct role in providing drinking water. 1302.5

The Washington Aqueduct system is composed of the Great Falls and Little Falls intakes on the Potomac River, the Dalecarlia and McMillan Reservoirs, the Georgetown Conduit and Reservoir, the Washington City Tunnel, and the East Shaft Pump Station. The sand filtration site located at the McMillan Reservoir and Water Treatment Plan was decommissioned in 1986 and is no longer part of the water treatment system. Figure 13.1 shows the Washington Aqueduct system. 1302.6

Figure 13.1:

Washington Aqueduct System 1302.7

(Source: Washington Aqueduct, 2018)

The Potomac River is the source of all water treated and delivered to customers by the Washington Aqueduct, a federally owned and operated water supply agency. To ensure that this supply meets the needs of the Washington Aqueduct's customers, the Low Flow Allocation Agreement (LFAA) was created in 1978. The agreement was signed by the federal government, Maryland, Virginia, and the District of Columbia. In addition to the Washington Aqueduct, the Washington Suburban Sanitary Commission and the Fairfax County Water Authority are the affected water providers. The agreement, through a formula for allocating Potomac River water, ensures that the downstream user, the Washington Aqueduct, has an appropriate allocation of available water. With the construction of the Jennings Randolph and Little Seneca reservoirs, the additional water available to be released has been sufficient to operate through major droughts in 1999 and 2002. While the provisions of the LFAA have not been triggered, every year its parties conduct a drought exercise to review the procedures that would be used in a more significant drought emergency. 1302.8

In 1982, the major water utilities and the Interstate Commission on the Potomac River Basin (ICPRB) signed the Water Supply Coordination Agreement (WSCA), which required the major water suppliers to coordinate their operations during drought emergencies. The agreement also required that a 20-year study of supply and demand be prepared and updated every five years. Furthermore, it included cost-sharing agreements for new facilities and subsequently included the Jennings Randolph and Little Seneca reservoirs that serve as a backup water supply during droughts. 1302.9

The most recent ICPRB study, called the 2015 Washington Metropolitan Area Water Supply Study, estimated annual demand to be 529 million gallons per day (mgd), a 12 percent increase from the 486 mgd previously estimated for 2015. The study also forecasted a growth in annual demand to 545 mgd in 2040. Although the study found that the system can meet the projected demand under normal conditions, severe drought conditions could trigger emergency water use, which would stress system reservoir volumes. 1302.10

The historic maximum production of drinking water by the Washington Aqueduct occurred in 1974 and was 284 mgd. After 1974, water demand decreased due to both declining population and increasing water conservation; however, while the District's population has been growing since 2000, water consumption has remained stable due to conservation measures. Water demand is now relatively stable. In 2017, the average daily production from the Washington Aqueduct was approximately 131 mgd, with a maximum day use of approximately 176 mgd. 1302.11

The Washington Aqueduct treats water from the Potomac River at the Dalecarlia and McMillan water treatment plants (WTPs). Both of these plants were designed for much larger populations and higher water use

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projections than have been realized. As a result, their treatment capacity exceeds present-day demands and peak requirements of customers. The Dalecarlia facility has a design capacity of 164 mgd and a maximum capacity of 264 mgd. The McMillan facility has a design capacity of 120 mgd and a maximum capacity of 180 mgd. DC Water's projected average water demand based on population in 2020 is 156.5 mgd. Both Dalecarlia and McMillan serve not only the needs of the District, but they also provide water to Arlington County and a portion of the Fairfax Water service area in Virginia. The total demand of all three water providers is easily met within the current operational capability of the Washington Aqueduct water treatment system. 1302.12

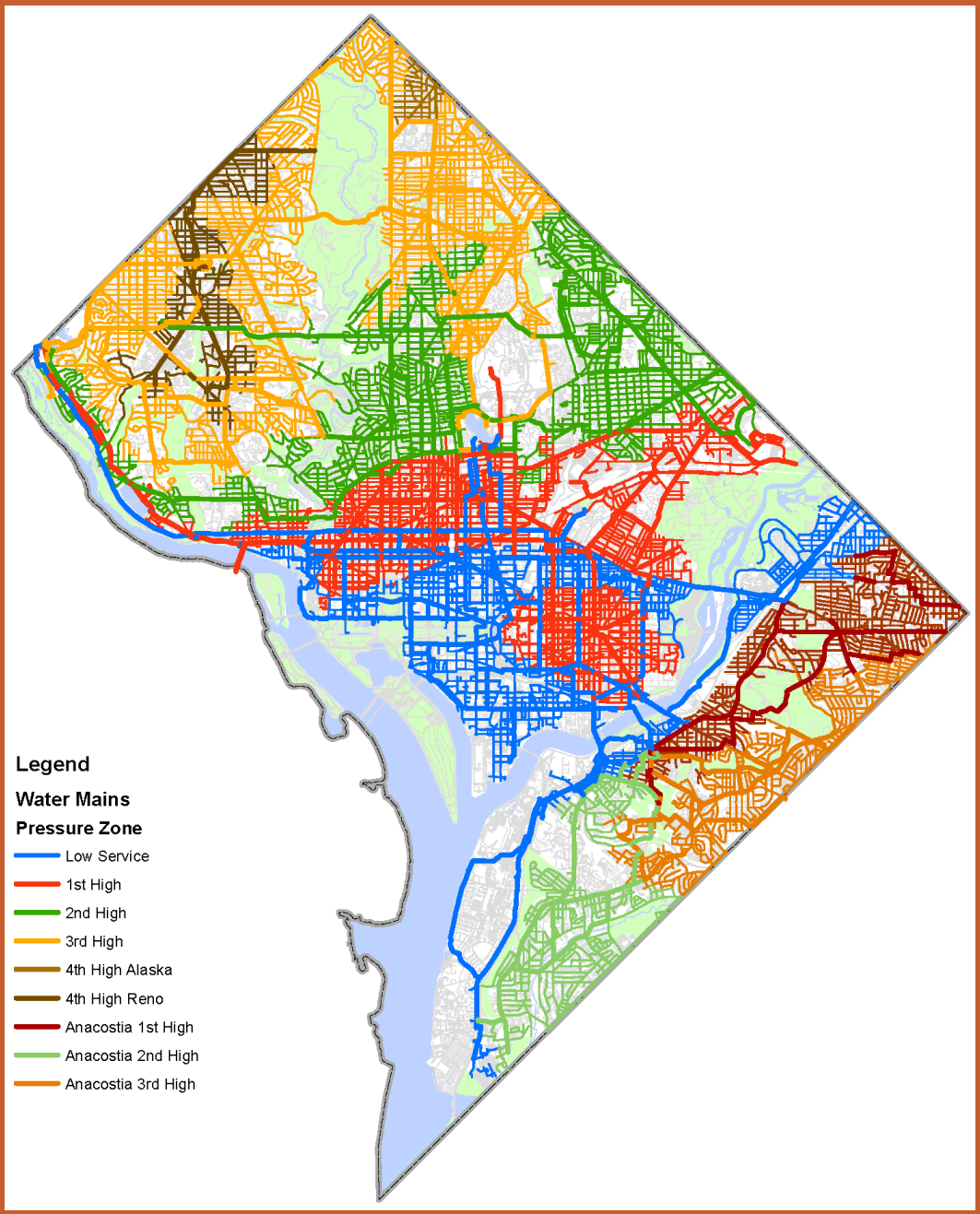
Potable water storage and pumping responsibilities are shared by DC Water and the Washington Aqueduct. DC Water operates four treated water pumping stations (Anacostia, Bryant Street, Fort Reno, and 16th and Alaska NW) and eight reservoirs and elevated tanks. The Washington Aqueduct operates the Dalecarlia Pump Station and three reservoirs: Foxhall, Van Ness, and Fort Reno. 1302.13

DC Water is the primary agency responsible for the District's treated water distribution system, which consists of pipes, elevated water storage tanks, valves, and public hydrants that deliver water to customers and meet other municipal needs such as fire suppression. The system is divided into nine water distribution zones (also known as service areas) based on differences in ground elevation. These areas are shown on Map 13.2. 1302.14

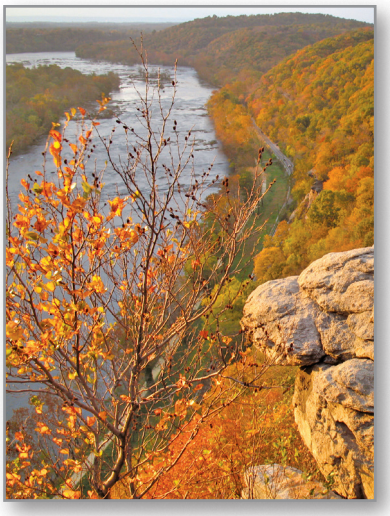
DC Water pumps an average of 95 mgd through the distribution system, which includes almost 1,350 miles of water mains ranging in size from four to 78 inches in diameter. This system also includes more than 36,000 valves and approximately 9,000 hydrants. The median age of the water mains is 79 years old, and some have been in service for more than a century. DC Water continually assesses the reliability and integrity of the water and sewer system pipes. To the extent that maintenance, corrosion, and break reports reveal problems, specific upgrades are factored into DC Water's 10-year Capital Improvement Program. 1302.15

Map 13.2:

DC Water Service Distribution Zones 1302.16



(Source: DC Water 2018)



The Interstate Commission on the Potomac River has concluded that water flow in the River and impoundments at upstream reservoirs will to be more than adequate to meet water needs through at least 2045.

IN-1.1 Ensuring an Adequate Future Water Supply 1303

While conservation efforts and other measures have been used as assumptions for the current 20-year drinking water demand forecast, which is significantly lower than demand was in 1995, important factors could affect future water availability. For example, the unpredictable effects of climate change, such as prolonged drought, could affect available water from the Potomac River, which is especially sensitive to changes in historic streamflow. One positive trend is the water conservation efforts of recent years. The 2015 ICPRB study found that the Washington, DC metropolitan area's efforts toward sustainable demand have been successful. While the area's population rose by approximately 18 percent from 1990 to 2015, its water demand has remained constant. The relatively consistent demand can be attributed to the falling per-household demand, which is forecasted to be reduced further by approximately 25 gallons per day between 2015 and 2040. The study also noted that supplier programs encouraging conservation were an important factor behind this trend. 1303.1

1303.2 The following policy states the District's commitment to plan for the long-term adequacy of its water supply. It is supplemented by policies in the Environmental Protection Element on water conservation. 1303.2

Policy IN-1.1.1: Adequate Water Supply

Provide a safe, adequate water supply, including in times of stress such as drought, to serve current and future District needs by working with other regional jurisdictions, USACE, and DC Water. 1303.3

IN-1.2 Modernizing Drinking Water Infrastructure 1304

In conjunction with DC Water, Washington, DC must consider the impacts of new development and ensure that water infrastructure will be able to meet future demand while maintaining water quality and reliability. Planned improvements to the water system involve normal maintenance to replace aging water distribution mains and small-diameter pipes, and upgrades to keep pace with population growth and new development. This may also include adding new water storage facilities, increasing the capacity of certain water mains, and upgrading pump stations. 1304.1

Some areas in Wards 7 and 8 have historically experienced low water pressure. To improve the pressure, DC Water built a new pumping station in 2008, and in 2018, completed the construction of a new two-million-gallon water storage tower and new transmission mains at St. Elizabeths. These elements collectively created a new water service zone (new pressure area) south of the Fort Stanton area. 1304.2

In 2013, DC Water adopted Blue Horizon 2020, a strategic plan aimed at realigning the way water and wastewater are managed in Washington, DC. The plan seeks to manage water, wastewater, and stormwater more holistically, recognizing that drinking water is a scarce commodity subject to a variety of threats and challenges. One of the goals of Blue Horizon 2020 is to optimally manage infrastructure. The plan sets the objective of replacing or rehabilitating one percent of linear water infrastructure annually. It calls for an increased focus on preventive maintenance, including development of a Comprehensive Asset Management Plan. It also seeks to use alternative technologies and innovation to create more sustainable, cost-effective operations. 1304.3

Policy IN-1.2.1: Managing Water Systems

Take an integrated approach to the planning of water, wastewater, and stormwater facilities and services. The merging of these systems will serve as the basis of a single water approach for both planning and management, which will balance the water environment and lead to better water services. 1304.4

Policy IN-1.2.2: Drinking Water Quality

Drinking water in Washington, DC shall be both clean and safe to residents, workers and visitors. 1304.5

Policy IN-1.2.3: Modernizing and Rehabilitating Water Infrastructure

Work proactively with DC Water to repair and replace aging infrastructure, and to upgrade the water distribution system to meet current and future demand. The District will support water system improvement programs that rehabilitate or replace undersized, defective, or deteriorating mains. The District will also support concurrent programs to ensure that lines are flushed in order to eliminate the potential for stagnant water to accumulate at the ends of water mains. 1304.6

Policy IN-1.2.4: Providing Adequate Water Pressure

Work proactively with DC Water to provide land for new storage tanks and other necessary operations so that adequate water supply and pressure can be provided to all areas of the District. The siting and design of water storage tanks and similar facilities should be consistent with the policies of the Urban Design and Environmental Protection elements, and should minimize visual impacts, with special consideration to views of ridges or hills. 1304.7

Action IN-1.2.A: Water System Maps

Support DC Water efforts to update water system maps to accurately show pipelines, valves, and hydrants, as well as the age, material, size, and lining of pipelines. 1304.8

Action IN-1.2.B: Small Diameter Water Main Rehabilitation Program

Continue the implementation of the Small Diameter Water Main Rehabilitation Program as identified in DC Water's Capital Improvement Plan (CIP). Work includes rehabilitating small-diameter (12-inch diameter and smaller) water mains to improve water pressure, system reliability, and flows in the system, as well as to maintain water quality. 1304.9

Action IN-1.2.C: Water Treatment Plant (WTP) Improvements

Continue the assessment of advanced water treatment processes that use ozonation, biologically active filters, ultraviolet light disinfection, and other innovative approaches to treat water. 1304.10

Action IN-1.2.D: Residential Lead Line Replacement Program

Require identification and replacement of all lead water mains and residential service pipes District-wide, focusing on households with children, low-income residents, and communities of color. Encourage completion of such efforts within a 10-year timeline. Support and expand opportunities to assist District homeowners in affordably replacing lead service lines, complementing DC Water's program. 1304.11

See the Environmental Protection Element for additional policies on drinking water quality and water conservation.

IN-2 Wastewater and Stormwater Systems 1305

This section of the element addresses wastewater and stormwater needs as well as DC Water's efforts to improve its system to meet current and future needs.

Although wastewater (sewage) and stormwater disposal needs are very different, they are addressed together in this section because of the physical links that currently exist between the two systems. 1305.1

Like many older American cities, a significant portion of Washington, DC is challenged with aging infrastructure issues, including maintenance. The existing sanitary sewer system dates as far back as 1810 and includes materials such as brick, vitrified clay, and cast iron. Current sewer construction materials typically consist of PVC, ductile iron, and concrete. This wide array of materials is distributed across an approximately 1,800-mile wastewater system, creating a complex set of maintenance considerations and needs. 1305.2

A significant portion of Washington, DC is served by a combined sewer system. Such systems, which use the same pipes to convey stormwater and wastewater were common in the 19th and early 20th centuries. Combined sewer systems are prevalent in the downtown area and in older portions of the District. Under normal conditions, the water from these systems is able to be treated; however, when stressed by significant storm events, the capacity of the system is overwhelmed, and combined sewer overflows (CSOs) occur. In some of these events, the combined sewer system cannot accommodate the increase in stormwater, causing a mixture of wastewater and stormwater to overflow into local waterways. There are presently 53 CSO outfalls listed in DC Water's National Pollutant Discharge Elimination System (NPDES) permit. The NPDES Permit Program, created in 1972, addresses water pollution by regulating its point sources and is administered by the U.S. Environmental Protection Agency (EPA). 1305.3

Like many older American cities, a significant portion of the District of Columbia is served by a combined sewer system. Such systems, which use the same pipes to convey stormwater and wastewater, were common in the 19th Century and are considered a relic of the past due to their damaging environmental effects.

DC Water's current CSO Abatement Program combines projects to maximize storage of stormwater and wastewater, and to minimize overflows to receiving waters. The program consists of inflatable dams, dynamically controlled weirs, outfall gates and other flow-regulating devices, sewer separations, and a swirl treatment facility. The Northeast Boundary Swirl Facility provides preliminary treatment, including disinfection and some solids removal for combined sewage overflows prior to discharge during wet weather. In addition, the DC Clean Rivers Project is a vast infrastructure program designed to capture and clean wastewater before it reaches the Potomac and Anacostia rivers, as well as Rock Creek. It is described later in this section. 1305.4

IN-2.1 Wastewater System 1306

DC Water is responsible for wastewater collection and transmission in the District, including operation and maintenance of the sanitary sewer system. DC Water operates 1,800 miles of sanitary and combined sewers, 160 flow meters, nine wastewater pumping stations, 16 stormwater pumping stations, 12 inflatable dams, and a swirl facility. With a total service area of approximately 725 square miles, DC Water also treats wastewater for approximately 1.6 million people in neighboring jurisdictions, including Montgomery and Prince George's counties in Maryland and Fairfax and Loudoun counties in Virginia. In addition, DC Water is responsible for the 50-mile-long Potomac Interceptor System, which provides conveyance of wastewater from areas in Virginia and Maryland to the Blue Plains Treatment Plant. 1306.1

According to Climate Ready DC, stormwater and sewer collection systems will likely need to manage more frequent and severe rain events and potential inundation from sea level rise and coastal storms. Washington, DC is working to ensure water infrastructure will be able to meet future demand by enhancing the efficiency and resilience of the system. 1306.2

Biosolids Management Program

The Walter F. Bailey Bioenergy Facility, which is now operational, significantly reduces DC Water's greenhouse gas (GHG) emissions. The innovative thermal hydrolysis process uses intense heat and pressure to treat wastewater solids, producing a much cleaner biosolid and on-site generation of up to one-third of Blue Plains' electricity needs, enough electricity to power 11,000 homes, and cutting DC Water's electricity bill at Blue Plains by one-third. The increased energy independence will reduce the financial burden on ratepayers while also helping to keep Washington, DC's rivers clean and reducing its carbon footprint. 1306.4a

DC Water processes up to 370 mgd of wastewater and separates approximately 400 tons of solids from that water daily. Before the biodigesters were built, DC Water produced 1,200 tons of solids a day that had to be trucked off Blue Plains at a cost to ratepayers of more than $17 million annually and more than two million trucking miles. This new thermal hydrolysis process has resulted in operational efficiencies in biosolids hauling and chemicals costs. 1306.4b

DC Water's Blue Plains WTP is located at the southernmost tip of Washington, DC, covering more than 150 acres partially fronting the Potomac River. Blue Plains is the largest advanced wastewater treatment facility in the world. It treats an annual average of 290 mgd and has a design capacity of 384 mgd, with a peak design capacity to treat more than one billion gallons per day. 1306.3

DC Water's CIP budget includes significant capital investment in several large projects, such as the Biosolids Management Program, DC Clean Rivers, and the Blue Plains Total Nitrogen Program. As of 2016, the 10-year CIP totals $3.75 billion, with a lifetime budget of $10.95 billion. 1306.4

Policy IN-2.1.1: Improving Wastewater Collection and Treatment

Provide for the safe and efficient collection and treatment of wastewater generated by the District's households and businesses. Ensure that new development does not exceed wastewater system capacity. 1306.5

Policy IN-2.1.2: Investing in Wastewater Treatment Facilities

The Blue Plains treatment plant should be maintained and upgraded as needed to meet capacity needs to accommodate growth in the District and to incorporate technological advances in wastewater treatment. Provide sustained capital investment in the District's sewer and stormwater collection system to maintain and sustain capacity. Construct the Clean Rivers Project to control combined sewer overflows and meet water quality standards. Continue to reduce overflows of untreated sewage and improve the quality of effluent discharged to surface waters. 1306.6

Policy IN-2.1.3: Unauthorized Storm Sewer Connections

Continue to take appropriate measures when illegal stormwater and sanitary sewer lines outside of the combined sanitary and stormwater system area are identified. These corrective measures include penalties and termination of service to abate unauthorized connections. 1306.7

Action IN-2.1.A: Wastewater Collection and Treatment Capital Improvement Programs

Continue to implement wastewater treatment improvements as identified in the DC Water CIP. Collection system projects include the replacement of undersized, aging, or deteriorated sewers; the installation of sewers to serve areas of new development or redevelopment; replacement and rehabilitation of pumping station force mains; and the Clean Rivers Project. Capital projects are required to rehabilitate, upgrade, or provide new facilities at Blue Plains to ensure that it can reliably meet its NPDES permit requirements now and in the future. 1306.8

Action IN-2.1.B: On-site Wastewater Treatment

Encourage the use of on-site water collection and reuse systems for any Planned Unit Development. On-site water systems collect stormwater and treat it so that it can be reused in a building or at the local, neighborhood scale for non-potable needs, including toilet flushing and cooling. 1306.9

IN-2.2 Stormwater Management 1307

The District's storm drainage system consists of approximately 1,800 miles of sanitary and combined sewers, 16 stormwater stations, 75,000 catch basins and manholes, and 22 flow-metering stations. DC Water also maintains more than 500 separate storm sewer discharges into local rivers and creeks. Since the early 1900s, separate stormwater and sanitary sewers have been constructed within the District. In the existing combined sewer area, pipes and infrastructure have been upgraded as new developments connect to the existing system. 1307.1

Planned and programmed stormwater improvements include the replacement of undersized or deteriorated storm sewers with new and larger diameter pipes, and the installation of storm sewers to serve areas of new development or redevelopment. Rehabilitation and replacement of pumping station force mains are also planned. Regional and intergovernmental cooperation will be needed to maximize the effectiveness of these upgrades (see the Chesapeake Bay Watershed Agreement text box). 1307.2

> *See the Environmental Protection Element for policies and actions related to low impact development, green roofs, and other ways to reduce stormwater run-off.*

Policy IN-2.2.1: Improving Stormwater Management

Ensure that stormwater is efficiently conveyed, backups are minimized or eliminated, and the quality of receiving waters is sustained. Stormwater management should be an interagency process, with clear lines of responsibility with regard to oversight, guidelines, and sources. 1307.3

Policy IN-2.2.2: Decrease Stormwater Runoff

Reduce stormwater runoff through a variety of approaches, such as rain gardens, bioswales, green roofs, trees, cisterns, and pervious pavement. By 2032, capture, retain, or reuse stormwater from at least 10 percent of Washington DC's land area. Focus on areas that flood regularly, have steep topography, or have known drainage capacity issues. 1307.4

Policy IN-2.2.3: Stormwater Retention Credits

Support ongoing District initiatives to reduce stormwater runoff, such as the Department of Energy and the Environment's (DOEE's) Stormwater Retention Credit Trading Program, which allows property owners to

Chesapeake Bay Watershed Agreement

On June 16, 2014, the Chesapeake Bay Watershed Agreement was signed. Signatories included representatives from the entire watershed. The agreement commits the Bay's headwater states to full partnership in the Bay Program. This is a historic agreement, as it facilitates coordination across the Bay's political boundaries. The agreement establishes goals and outcomes for the restoration of the Bay, its tributaries, and the lands that surround them. 1307.8a

generate and sell stormwater retention credits to earn revenue for projects that reduce stormwater runoff through installation of green infrastructure or removal of impervious surfaces. 1307.5

Action IN-2.2.A: Stormwater Capital Improvements

Continue the implementation of stormwater capital improvements as identified in DC Water's CIP. 1307.6

Action IN-2.2.B: Stormwater Management Responsibilities

In compliance with the Comprehensive Stormwater Management Enhancement Amendment Act of 2008, continue to refine an integrated process for managing stormwater that enhances interagency communication and formally assigns responsibility and funding to stormwater drainage management. This process should include:

- An appropriate funding mechanism to consistently maintain clean water standards and reduce surface runoff;
- Clear lines of responsibility with regard to which agency provides oversight, guidelines, and resources for the stormwater system and its management; and
- Assurance that stormwater improvements associated with new development are coordinated with the DC Water CIP. 1307.7

Action IN-2.2.C: Rainwater Reuse

Develop guidance on the installation, treatment, monitoring controls, and inspections for rainwater reuse for non-potable purposes. 1307.8

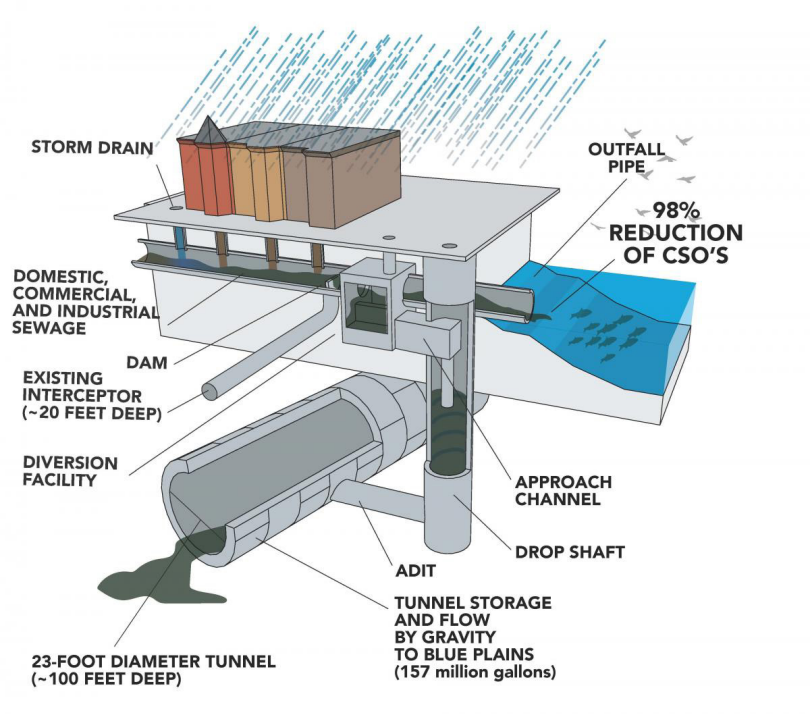
IN-2.3 Combined Sewer System 1308

As noted earlier, a portion of the District's sewer system includes combined wastewater and stormwater pipes. This area encompasses about 12,600 acres—or one-third of the District's land area (see Figure 13.4). A majority of this area was developed before 1900. 1308.1

The Clean Rivers Project is DC Water's ongoing program to reduce CSOs into the District's waterways, specifically the Anacostia and Potomac rivers and Rock Creek. The project is a large-scale infrastructure and support program designed to capture and clean wastewater during rainfalls before it reaches these water bodies. The project also aims to stop the chronic sewer overflows that have plagued Washington, DC since the early 1900s. The project is comprised of a system of deep tunnels, sewers, and diversion facilities that capture CSOs and deliver them to DC Water's Blue Plains advanced WTP, where the water is treated and cleaned before release to the District's rivers. Figure 13.3 illustrates the system. 1308.2

Figure 13.3:

DC Water's Clean River Tunnel System 1308.3



(Source: DC Water 2018)

The Clean Rivers Project encourages installation of green infrastructure, including green roofs, permeable pavements, and bioretention areas, such as tree boxes and bioswales to assist with reduction of CSOs to the Anacostia and Potomac rivers and Rock Creek. The Anacostia and Potomac rivers' tunnel systems include more than 18 miles of tunnels that are larger than Metrorail's tunnels and located more than 100 feet below the ground. With the current sewer system, practically every time it rains, untreated sewage and rainwater (combined sewage) is discharged into Washington, DC's rivers and creeks. The Clean Rivers Project will install diversion facilities at strategic locations to capture this untreated sewage and divert it to the 157-million-gallon tunnel system where it will be stored and subsequently conveyed to the Blue Plains advanced WTP for treatment. 1308.4

The DC Clean Rivers Project is estimated to reduce CSOs annually by up to 96 percent throughout the system and by up to 98 percent for the Anacostia River. In addition, the project will reduce the chance of flooding in the areas it serves from approximately 50 percent to 7 percent (equivalent to a 15-year storm) in any given year and reduce nitrogen discharged to the Chesapeake Bay by approximately one million pounds per year. 1308.5

Green Infrastructure and Local Employment

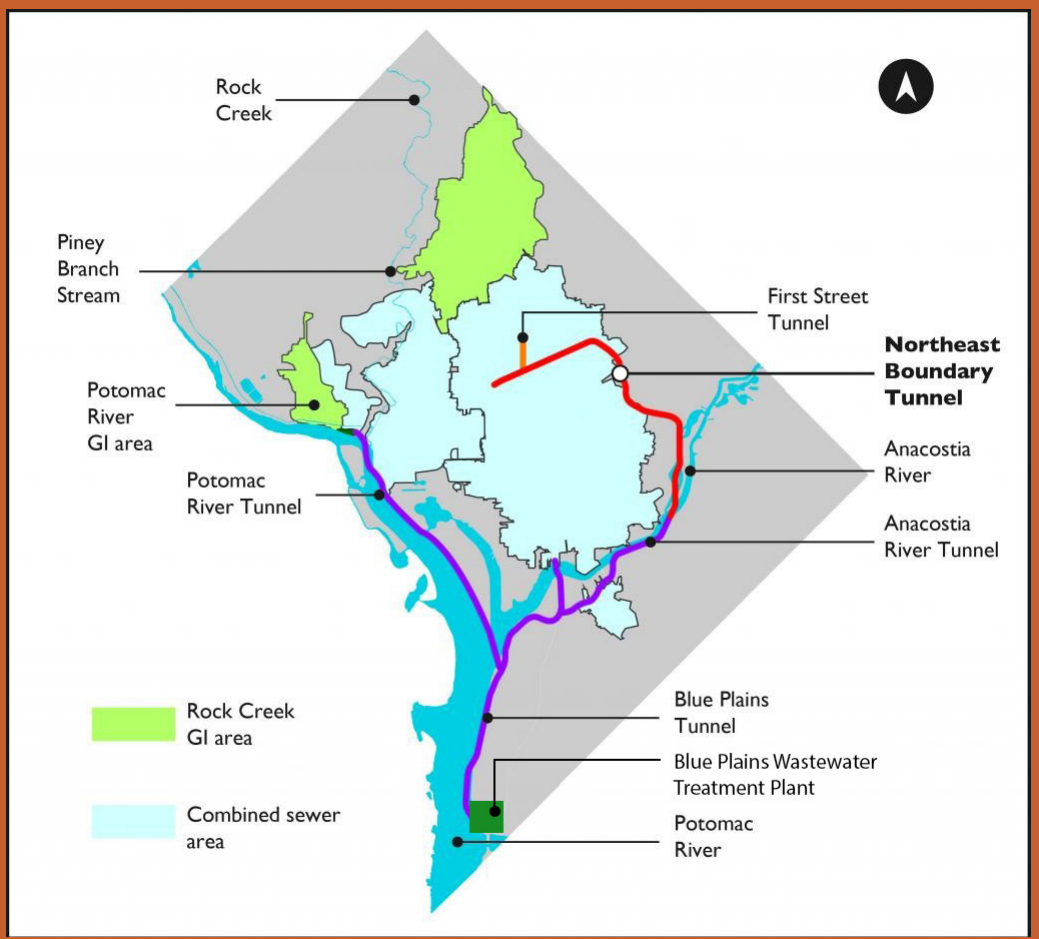
In addition to helping reduce CSOs, green infrastructure can also provide additional triple bottom-line (environmental, social, and economic) benefits to the District. An additional agreement between DC Water and District government will support local job creation through the implementation of green infrastructure. The agreement, signed in 2015, created the Infrastructure Academy, an ambitious local jobs program that includes training and certification opportunities for District residents interested in green infrastructure construction, inspection, and maintenance jobs. DC Water has established a goal to have 51 percent of new jobs created by this project filled by District residents. DC Water will also engage professional service firms and contractors based in Washington, DC to perform work associated with green infrastructure. 1308.5a

The DC Clean Rivers Project will greatly reduce CSO discharge, but even with the project's full implementation, CSO discharge will still occasionally occur. Additional provisions to improve water quality will also be needed. 1308.6

See the Environmental Protection Element for additional information on sewer overflow conditions, as well as the need to update the District's water quality standards.

Figure 13.4:

Combined Sewer System Area and Tunnel System *(updated to reflect new data)* 1308.7



(Source: DC Water 2018)

13

Policy IN-2.3.1: Reducing CSO Outfalls and Overflow Events

Reduce the number of CSO outfalls that drain into the region's rivers and reduce the number of CSO events by completing implementation of DC Water's Clean Rivers Project, which will reduce CSO outfall events by 98 percent to the Anacostia River and 96 percent system-wide when fully implemented. Encourage development of additional remediation efforts to address remaining CSO events to account for increased storm frequency and intensity from climate change and support fishable/swimmable water quality in the District's streams and rivers. 1308.8

Action IN-2.3.A: Rehabilitate Pumps

Rehabilitate and maintain pump stations to support the Clean Rivers Project and off-load stormwater in targeted combined sewer areas. 1308.9

Action IN-2.3.B: Federal Funding

Pursue federal funding to cover an equitable share of the Clean Rivers Project as the federal government was the original designer and builder of the system, is a major user of the combined sewer system, and is a significant beneficiary of the effort. 1308.10

IN-3 Solid Waste 1309

District-owned solid waste facilities transfer roughly 450,000 tons of solid waste per year, which is collected by both public and private solid waste collectors. Municipal solid waste consists of everyday items, such as product packaging, food waste, furniture and other household items, clothing, and larger bulk items, like household appliances. DPW solid waste management administration is responsible for waste collection services from all government entities and approximately 105,000 single-family homes and residential buildings with up to three living units. Private solid waste collectors handle solid waste from commercial establishments and multi-family residential buildings containing four or more units. The Department of General Services (DGS) is responsible for managing solid waste generated at District government facilities. Approximately 63 percent of the solid waste received by the two District-owned solid waste transfer stations is from commercial sources and multi-family residences, while 37 percent is generated from DPW-serviced residential uses and the government sector. 1309.1

DPW provides trash collection, recycling collection, leaf and yard waste collection, and dead animal removal in the District. At the Fort Totten transfer station, DPW manages residential drop-off of household hazardous and electronic waste as well as paper shredding services; DPW is also responsible for street and alley cleaning. The Solid Waste Education and Enforcement Team at DPW is responsible for education, technical assistance, outreach, and all sanitation regulations in the District. The DPW Office of

Recycling Rules

Residential and commercial recycling is required in the District. DPW residential recycling includes a pickup on the same day as trash pickup. Commercial recycling is required by law. Any premise not authorized to receive municipal trash and recycling collection services, or containing a unit used for non-residential purposes, is considered a business or commercial establishment. Under District law, all commercial properties are required to implement a recycling program. In January 2018, a new list of materials required to be recycled was published. For the first time, the same items will be required to be recycled in all commercial and residential properties across the District. 1309.3a

Waste Diversion is responsible for District-wide waste diversion policy and planning. 1309.2

The Mayor's Office of the Clean City is the central point of contact and champion for preventing and reducing litter and trash pollution in Washington, DC. The office collaborates with other District agencies to ensure cleanliness of Washington, DC, encouraging businesses, neighborhoods, and visitors to help reduce trash, pick up litter, sweep sidewalks, and discourage graffiti. It works to strengthen existing laws aimed at improving procedures and enhancing regulations to keep the District clean. 1309.3

See the Environmental Protection Element for information and policies on recycling, composting, and reducing the solid waste stream.

IN-3.1 Solid Waste Transfer Facilities 1310

An efficient solid waste transfer station system is essential to the District. There are currently four solid waste transfer facilities, two of which are privately owned and two of which are District-operated. The DPW-operated transfer stations are the Fort Totten Facility, located at 4900 John McCormack Drive NE, and the Benning Road Facility located at 3200 Benning Road NE. At each transfer station, waste is consolidated, sorted, and loaded onto long-haul trailers for transfer to landfills, energy facilities, recycling facilities, or compost facilities across the region. Of the municipal solid waste managed by District-owned transfer stations, approximately 60 percent is processed at the Fort Totten Transfer Station and the remaining 40 percent at the Benning Road Transfer Station. All municipal solid waste in Washington, DC is removed by truck because there are no active incinerators or landfills within Washington, DC. 1310.1

The Washington, DC does not currently operate a construction and demolition (C&D) debris transfer station, but it does permit disposal of a limited amount of C&D at the Fort Totten processing station. Large-scale commercial building debris disposal is handled privately. The majority of C&D is currently processed by several transfer stations in the surrounding areas of southern Maryland and northern Virginia. 1310.2

Policy IN-3.1.1: Solid Waste Collection

Provide safe, reliable, adequate solid waste collection from residences, business establishments, institutions, and other facilities. 1310.3

Policy IN-3.1.2: Reducing Community Impacts

Reduce the adverse effects of solid waste facilities, including noise, odors, and truck traffic, on District neighborhoods. 1310.4

Policy IN-3.1.3: Zero Waste

Work to achieve zero waste in the District by 2032 by diverting 80 percent or more of waste generated in Washington, DC. This diversion can be achieved through reuse, composting, and recycling. Encourage DPW implementation of a curbside food waste pickup diversion and composting program. 1310.5

Policy IN-3.1.4: Enhancing DPW Operations

Explore approaches for enhancing DPW operations to achieve outcomes such as cleaner, healthier, and more efficient DPW services and through innovative design solutions and related partnerships. Some of these approaches are contained in the West Virginia Avenue Public Works (DPW) 2016 Campus Master Plan. 1310.6

Action IN-3.1.A: Evaluate Transfer Station Needs

Evaluate the need for expansion of District-owned transfer stations to provide adequate space for proper handling of all types of separated waste, including refuse, recycling, organic waste, bulk waste, and hard-to-recycle items. 1310.7

Action IN-3.1.B: Waste Processing Facility Regulations

Encourage the private sector to provide more efficient, cleaner, and more environmentally friendly waste processing facilities for all types of solid waste. Collaborate across agencies, including, DPW, Department of Consumer and Regulatory Affairs, and DOEE to address this need. Work with Advisory Neighborhood Commissions (ANCs) and community organizations in drafting these regulations to ensure that neighborhood concerns are addressed. 1310.8

Action IN-3.1.C: Develop Zero Waste and Solid Waste Management Plans

Develop a holistic plan that includes all waste streams and related strategies to enable Washington, DC to reach its goal of 80 percent waste diversion. Strategies should include transfer station modernization needs, optimization of residential drop-off locations, and consideration of waste streams that include refuse, compostable materials, and recyclable materials, as well as hard-to-recycle items. 1310.9

See the Environmental Protection Element for additional policies and actions on waste management, recycling, and composting.

IN-4 Digital Infrastructure 1311

The provision of high-quality digital infrastructure—wireless networks, fiber optics, and broadband telecommunications—is important to residents and businesses and is vital to economic development. Such infrastructure is

What Is a Solid Waste Transfer Facility?

A solid waste transfer facility is a light industrial facility where trash collection trucks discharge their loads for transfer from small collection vehicles to larger, long-haul vehicles. Solid waste is reloaded onto these vehicles (e.g., trucks, trains, and barges) for shipment to a final disposal site. Transfer facilities are typically fully enclosed. Workers screen incoming waste on the receiving floor or in an earthen pit, recovering materials from the waste stream that can be recycled and separating out any inappropriate wastes (e.g., tires, large appliances, automobile batteries). Transfer facility operators usually unload, reload, and transport waste off the site in a matter of hours. 1310.6a

critical in the 21st century, particularly given the security and information needs of the nation's capital. 1311.1

Infrastructure solutions now include a wide variety of technologies, such as smart grids and utility systems, intelligent buildings, and mobility solutions, that contribute to greater accessibility to District services, more efficient and cost-effective management of District assets and resources, and a more resilient and sustainable ecosystem overall. 1311.2

Technology advances will continue to progress rapidly. Physical changes to infrastructure will be needed to integrate these new technologies, including enhanced wireless infrastructure and updated fiber to help accommodate the increased speed and volume needed for digital communications. The advancement of technology will also impact the way infrastructure is used in Washington, DC. Technology will create new ways for infrastructure systems to be integrated and to become more efficient. The District should start planning for potential related opportunities and the implications of these changes. 1311.3

OCTO is responsible for planning, maintaining, and expanding digital technology infrastructure and communications systems in the District, and for developing and enforcing related policies and standards. 1311.4

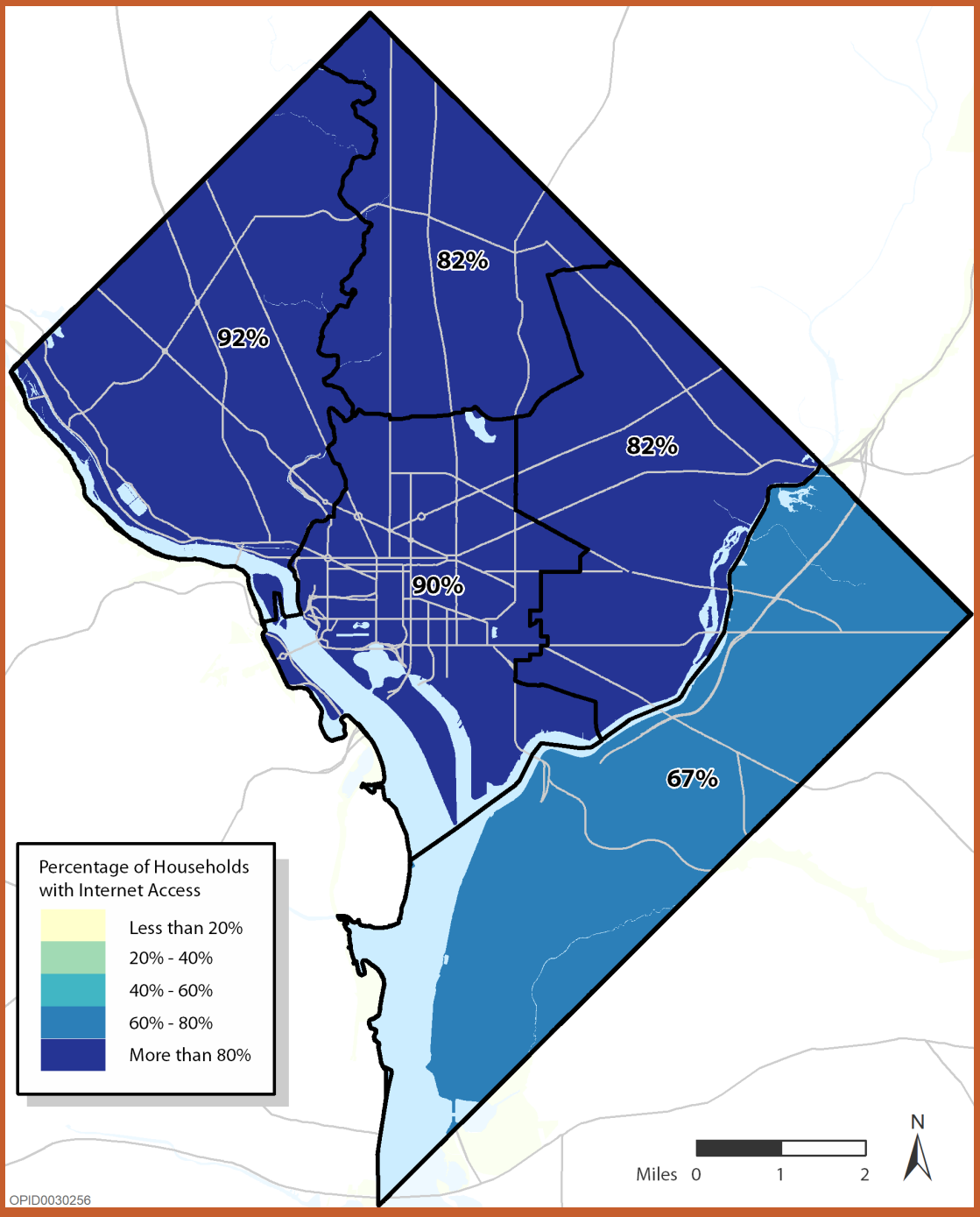
IN-4.1 Telecommunications Infrastructure 1312

Localities such as the District plan for and regulate telecommunications infrastructure in accordance with the 1996 Telecommunications Act, as well as other regulations and orders issued by the Federal Communications Commission (FCC). Washington, DC seeks to implement telecommunications policies that advance its initiatives to broaden technology infrastructure and wireless accessibility throughout the District, often in coordination with private industry and federal stakeholders. 1312.1

Digital access has become a need for most residents of the District. The digital divide is commonly understood to be the gap between people with useful access to digital and information technologies and those with little to no access at all. Bridging this divide will help contribute to long-term success, inclusion, and equity in the District. OCTO's Connect DC Program works to increase digital literacy, improve access to devices, and provide

Map 13.5:

Internet Access 1312.3



(Source: U.S. Census Bureau, 2016, 1-Year ACS Public Use Microdata)

Pennsylvania Avenue 2040 Initiative 1317.3

The District, in partnership with the Golden Triangle Business Improvement District, the National Capital Planning Commission, and private companies, launched the Pennsylvania Avenue 2040 (PA 2040) initiative to enhance visitors' experience on Pennsylvania Avenue by implementing smart city technologies. PA 2040 includes free broadband public Wi-Fi for the three-block corridor. Some of the initial technologies and applications tested in PA 2040 include moisture sensing in tree beds, smart waste management, and movement analytics. 1312.5a

The PA 2040 project is working to create a better experience for users of the west Pennsylvania Avenue NW corridor. The project has demonstrated effective interagency collaboration, and its working model will be applied to new projects. As the District's established test area for smart city applications, PA 2040 provides an environment to measure the impacts of smart city technology. 1312.5b

digital connectivity to underserved District residents. Map 13.5 shows internet access in the District, where the most underserved areas are in predominantly Black, lower-income communities in Wards 7 and 8. Digital access, along with the training to adopt and use technologies, is increasingly critical to access education, workplaces and other services and activities. 1312.2

OCTO's DC-Net Program provides managed voice, data, and video services to local, regional, and federal government agencies within the District over a District-owned, high-capacity, secure and redundant fiber-optic telecommunications platform. The security and reliability of DC-Net are paramount because District agencies are highly reliant on the carrier for voice communications, public safety applications, traffic management, parking management, financial data transactions, and security operations. This standards-based platform is the foundation for next-generation government and public safety communications throughout Washington, DC and will help to enable smart city solutions across the District. See IN-4.2 Leveraging New and Emerging Technology for additional information. 1312.4

Minimizing the digital divide through solutions such as expanding public wireless internet access, digital literacy programs, and access to job opportunities and technical internships that focus on digitally underserved neighborhoods are core goals for Washington, DC. 1312.5

Policy IN-4.1.1: Development of Communications Infrastructure

Washington, DC shall plan, coordinate, and oversee development and maintenance of communications infrastructure, including cable networks, fiber-optic networks, and wireless communications facilities to help support daily functions and goals related to equity and opportunity, economic development, transportation, public health and safety, security, resilience, and education. 1312.6

Policy IN-4.1.2: Digital Infrastructure Accessibility

Strategically expand the public wireless coverage that provides District residents, workers, and visitors access to highly reliable and secure internet-based services. 1312.7

Policy IN-4.1.3: Equitable Digital Access

Enhance access to digital services in the District to reduce the digital divide, strategically expanding public wireless coverage to serve underserved communities and providing such access at schools, libraries, and other District government facilities. 1312.8

Policy IN-4.1.4: Cyber Resiliency for Digital Infrastructure

Washington, DC's digital infrastructure should be adequately protected from both physical and digital threats by using best practices and enhancing operational capabilities. 1312.9

Action IN-4.1.A: Guidelines for Siting/Design of Facilities

Establish locational and design criteria for under- and above-ground telecommunication facilities, including conduit systems, small cells, antennas, towers, switching centers, and system maintenance facilities. In addition, establish provisions to put cables and wires underground wherever feasible. Consult with ANCs and community groups in the development of siting criteria. 1312.10

See the Environmental Protection Element for additional policies and actions on the siting of telecommunication towers and transmission facilities.

IN-4.2 Leveraging New and Emerging Technology 1313

Digital technology is enabling Washington, DC to enhance infrastructure systems and to create new ways to serve and support neighborhoods. The District's smart city approach leverages intelligent city infrastructure, connected devices, sensors, and data analytics to address challenges and improve the quality of life for residents, enhance economic growth and mobility, and improve operations and services. 1313.1

As digital technology advances, digital communications and information processing will become more important. The Internet of Things is the network comprised of physical devices, including computers, cellphones, vehicles, and any other device, that can connect to the internet and exchange data. This connectivity will allow new opportunities for infrastructure systems to be integrated, with electrical systems, water systems, and other infrastructure coordinating the operations. 1313.2

Testing applications of technology through pilot programs provides opportunities for the District to inform decision-making, develop new methods for integration, and create a flexible environment for investing in infrastructure. Urban prototyping allows the District to experiment with different pilots and technology applications, with the ability to learn and build on previous efforts. 1313.3

Infrastructure technologies are evolving and proliferating rapidly, and are expected to include notable changes, including the deployment of improved wireless connectivity, such as small cell/5G wireless. It is important that Washington, DC be responsive and flexible as new technologies emerge. 1313.4

Innovations in technology will create opportunities for the optimization of existing and future infrastructure. Smart city applications present promising opportunities, but also significant risks. While they can enhance infrastructure operations and address various needs, their adoption comes with risks that include the potential for rapid obsolescence, as well as a wide

range of data management and security and privacy issues that will need to be addressed at federal, regional, and local levels in the coming years. 1313.5

Policy IN-4.2.1: Technology Applications

Technology-based initiatives, including pilot projects, should be designed to be user centric, prioritizing end users, such as residents for public-facing solutions, or government employees for government-facing solutions. These efforts should focus on solutions that address challenges including financial, operational, and environmental sustainability and resiliency issues. District needs should be clearly identified and rigorously evaluated before technology initiatives are deployed. 1313.6

Policy IN-4.2.2: Encourage Interdisciplinary and Cross-Sector Collaboration

Foster an environment of collaboration, cooperation, and shared opportunity across disciplines (technology, District planning, and design) and sectors (public, private, philanthropic, and think tanks) so that a range of perspectives and stakeholders participate in the identification of potential use cases and appropriate digital solutions to address identified District needs and providing an efficient use of District infrastructure, investment, and resources in smart city efforts. 1313.7

Policy IN-4.2.3: Efficient Use of District Assets and Resources

Leverage District assets and resources to reduce overall cost and complexity as new technologies are identified, evaluated, and deployed, including smart city projects. 1313.8

Policy IN-4.2.4: Neighborhood Integration

Integrate the hardware that supports digital technology in ways that minimize environmental impacts and visual intrusions or negative impacts to public space through noise, lighting, clutter, or obstructions. 1313.9

Policy IN-4.2.5: Privacy and Security

Smart-city services and solutions should strike an appropriate balance between capability and privacy so that they have or use appropriate resilience and cybersecurity measures. In all applications that involve collection and storage of user data, the District shall anonymize data to protect the privacy of individual residents, workers and visitors to the extent possible. 1313.10

Policy IN-4.2.6: Data Privacy

The privacy of residents, workers, and visitors should be protected through careful management of data in both specific and aggregate forms. Washington, DC is committed to being open and transparent about the

"who, what, where, when, why, and how" of data collection, transmission, processing and use, but these factors should be balanced with data privacy and security considerations. The District should anonymize data collection to protect the privacy of individual residents, workers and visitors when possible. 1313.11

Action IN-4.2.A: Building on Pilot Project Lessons

Upon completion of pilot activities, such as PA 2040 and ParkDC, develop after-action reports that inform future work. 1313.12

IN-4.3 Ownership and Control of Infrastructure 1314

The strategic and monetary value of Washington, DC's infrastructure is likely to increase significantly. As an example, increased demand for denser, faster networks and access points for 5G and related technologies are anticipated to drive a significant increase in the value of utility and streetlight poles, as well as the District's fiber network. 1314.1

Washington, DC should recognize these factors across related planning efforts, using caution before providing access to infrastructure assets in either the near or long term as part of public-private partnerships. 1314.2

Policy IN-4.3.1: Coordinating District Communications Infrastructure

Ensure OCTO conducts the planning, coordination, oversight, and development of District-owned communications infrastructure, including fiber-optic networks and wireless communication. 1314.3

Policy IN-4.3.2: Asset Control in Public-Private Partnerships

Encourage District retention of ownership and/or control of assets as part of public-private partnerships. Assets may include data, public rights-of-way and publicly owned elements within a public right-of-way, including light poles, sidewalks, transit shelters, and other fixtures. 1314.4

Policy IN-4.3.3: Preparation for and Responsiveness to Change

Encourage flexibility in responding to, absorbing, and incorporating technology changes as they emerge, while at the same time preparing for technology implications over longer time horizons, including potential obsolescence. Current technology changes include 5G networks, autonomous vehicles, and drone and robot delivery services. Consideration should be given to both District needs and those of private providers. 1314.5

Policy IN-4.3.4: Data-Sharing Agreements

Establish appropriate data-sharing agreements with private sector entities and others who use District infrastructure. All such agreements shall

Smart Parking

In large cities, approximately 30 percent of traffic congestion is caused by drivers who circle District streets in search of parking. The District Department of Transportation has initiated ParkDC, a demand-based pricing pilot initiative to manage and regulate the District's curbside and parking assets. The program is designed to encourage parking turnover in high-demand areas to improve traffic congestion. It leverages intelligent sensors to measure parking usage and availability, then it shares this information with a mobile application to assist drivers with parking choices. The pilot is also using other sensor technologies to measure driver circling and identify whether this approach reduces traffic congestion. 1313.11a

anonymize and protect the personally identifiable information of District residents, workers and visitors. 1314.6

Policy IN-4.3.5: Equitable Access to Digital Services and New Technologies

Prioritize equity in the public and private implementation of new technologies. District government shall seek to provide equitable access to digital services and encourage the application of new technologies to enhance access to services for all residents, and especially residents in Wards 7 and 8 and underserved populations, households with children, older adults, and persons with disabilities. Recognize and address potential barriers to access, adopt, and use new technologies. 1314.7

IN-5 Energy Infrastructure 1315

While population growth may entail a significant increase in energy demand, demand will be offset by the incorporation of distributed energy resources (DERs). DERs increase the efficiency and effectiveness of energy generation, storage, distribution, and use. DERs will help Washington, DC achieve a clean energy future, avoid infrastructure investments, and improve resilience and the integration of clean energy resources to the grid, if properly considered in planning for Washington, DC's energy future. 1315.1

Local law requires that, by 2032, the District will source all of the energy it consumes from renewable sources and up to 200 megawatts from local solar generation. These efforts, paired with major energy efficiency initiatives, account for foreseeable significant changes in energy use and infrastructure needs. 1315.2

IN-5.1 Electric Infrastructure 1316

Electricity is delivered to District consumers by electric transmission and distribution facilities. Power plants generate high-voltage electricity, which is transported along transmission lines into the power grid to substations located throughout the District. From the substations, distribution lines deliver the electricity to transformers on the ground or mounted on utility poles. The transformers reduce the voltage so that it can be safely used by District consumers. Currently, PEPCO supplies 85 percent of the District's residential customers and 63 percent of its commercial customers; the remainder is provided by other suppliers. 1316.1

Since the decommissioning of PEPCO's oil-fired power plants at Benning Road and Buzzard Point, the majority of electricity supplied to District residents is generated by coal-fueled power plants in Maryland. Washington, DC receives this power from point-to-point or radial transmission lines

that terminate in the area they serve. With the decommissioning of the District's power plants, PEPCO is in the process of transforming the radial transmission system to a networked system, which would create redundancy and make the District more resilient. This networked system project, called the Capital Grid Project, will connect multiple supply lines to critical substations, creating alternative pathways for power to flow that will support faster restoration and reduce the potential impact of unforeseen shocks and stressors. 1316.2

The Capital Grid Project, will connect multiple supply lines to critical substations, creating alternative pathways for power to flow that will support faster restoration and reduce the potential impact of unforeseen shocks and stressors.

To maintain reliable power distribution in Washington, DC, PEPCO maintains a presence on various properties in the District for substations, fleet maintenance, and storage and service yards. PEPCO currently uses a 10-year planning horizon to estimate substation capacity. Its latest 10-year forecast determined that two new and four rebuilt substations will be needed to meet forecast load growth needs through 2030. These capital improvements are estimated at more than $943 million in investment. 1316.3

As part of PEPCO's Capital Grid Project, a new waterfront substation will provide additional capacity for the South Capitol Corridor, Buzzard Point, and the Southwest Waterfront areas. A new substation is planned for Mount Vernon Triangle that will serve north of Massachusetts Avenue (NoMa), Northwest One, and the Mt. Vernon Triangle. Four substations are being rebuilt as follows:

- Harrison substation, which serves Friendship Heights and Chevy Chase;
- Harvard substation, which serves Columbia Heights, Adams Morgan, and Mt. Pleasant;
- F Street substation, which serves the western downtown area; and
- Champlain substation, which is a sub-transmission substation and will provide new 69 kV and 34 kV supply to four substations. 1316.4

PEPCO is in the midst of a number of 4 kV to 13 kV conversion projects, updating aging overhead and underground infrastructure to current standards, which will allow for more growth and be able to accommodate more distributed energy resources. Conversions are taking place in Georgetown, Fort Totten, Southwest, Congress Heights, Columbia Heights, and Barney Circle. 1316.5

Beyond the 10-year horizon, PEPCO expects to construct substations when needed to relieve future overloads at stations that are approaching capacity and to respond to future growth. However, future needs should be

Neighborhood Energy Systems

Neighborhood-scale energy systems, also known as district energy, can be a cost-effective way of improving resilience and reducing GHG emissions and energy costs. These systems can include both micro-grids and combined heat-and-power systems. Micro-grids are small, neighborhood-scale networks of electricity users with a local source of energy; while they are attached to the larger grid, they can also function independently. A combined heat-and-power system generates electricity while simultaneously producing heating and/or cooling, which is distributed through a neighborhood-scale network by steam, hot water, or chilled water. The District's current neighborhood-scale energy facilities are operated by GSA, as well as several local universities. New systems are proposed for several major redevelopment sites by the District, DC Water, and private developers. 1316.8a

continually assessed and closely monitored to balance investments for the future that will be needed to serve District needs at that point in time. 1316.6

Investments should be balanced with the District's goal of reducing energy usage by 50 percent, as recommended in the Sustainable DC Plan. If this goal is met, significantly fewer upgrades in distribution infrastructure for electricity will be needed. To avoid making unnecessary improvements, Washington, DC should actively coordinate infrastructure improvements across relevant agencies and energy providers. 1316.7

Over the past several years, PEPCO has deployed an advanced metering infrastructure system and has been developing the smart grid in the District. Projects related to the smart grid include installation of smart meters, automated switching devices that isolate electrical faults and automatically restore customers by switching them to other area feeders, and underground monitoring devices that detect problems before they turn into major events. In addition to improving reliability, the smart grid also helps conserve energy through demand response and direct load control programs and supports the installation of distributed generation and conservation voltage reduction. PEPCO is leveraging the smart grid for potential projects, such as electric vehicle charging infrastructure, micro-grids, and battery installations. Collectively, these programs are anticipated to reduce overall energy consumption and demand, leading to deferral of some capital expenses. 1316.8

Individual development projects and redevelopment on large sites will require new feeder lines to serve additional customers. Construction of these lines will impact existing development and infrastructure in a variety of ways. Underground distribution systems, which are typically required in new development, will require construction of new conduits, cables, and subsurface or pad-mounted transformers. Dense commercial or multi-family residential developments will often require the extension of new mainline underground feeder groups, potentially resulting in digging up streets and sidewalks. Public utility easements may also be needed to provide buried distribution systems inside multi-building developments. 1316.9

An increasing supply of electricity for the District is generated by a mix of renewable resources. Renewable energy requirements and incentives have resulted in deployment of 40 megawatts (MW) of intermittent solar energy to the grid, and the amount of energy supplied by solar is expected to increase in the future. As an example, by 2030 it is anticipated that 300 MW of power will be generated by solar panels in Washington, DC alone. 1316.10

The DC Power Line Undergrounding (DC PLUG) Project was recommended by the Power Line Undergrounding Task Force to significantly improve power reliability in the District. Through the collaborative task force process, the District approved a multi-year, $500 million power line

undergrounding project to help prevent prolonged electric service outages during major weather events. This effort will result in the strategic undergrounding of the high-voltage feeder power lines that are responsible for the higher frequency outages in Wards 3, 4, 7, and 8. Secondary and service lines will remain above ground. 1316.11

Policy IN-5.1.1: Adequate Electricity

Ensure adequate electric supply to serve current and future District needs. This will require collaboration with PEPCO and other service providers on the location and scale of facilities to meet future development and neighborhood demand. 1316.12

Policy IN-5.1.2: Undergrounding Electric Distribution Lines

Continue to enhance the resilience and safety of electric distribution lines and reduce their visual impact through power line undergrounding. Seek equitable means to cover the high costs associated with undergrounding. Use the opportunity for undergrounding to bury other above-ground communication lines, such as telephone and fiber lines, wherever feasible. 1316.13

Policy IN-5.1.3: Modernizing the Electric Distribution System

Modernize the energy delivery system, increase sustainability, and make the system more reliable, efficient, and cost-effective. Balance these expanded capabilities with PEPCO's basic obligation to deliver safe, reliable, and affordable energy to the District. 1316.14

Policy IN-5.1.4: Develop Neighborhood-Scale Energy Systems

Promote the development of micro-grids, District heating and cooling, and other neighborhood-scale energy strategies. Encourage large projects to assess the feasibility of neighborhood-scale energy systems. 1316.15

Action IN-5.1.A: Aging Infrastructure

Implement improvement programs that can help enhance the resilience of the transmission and distribution of electrical power, such as through system reinforcement. This may involve upgrading the system by repairing or replacing aging infrastructure or expanding the original facilities. 1316.16

Action IN-5.1.B: Undergrounding Electric Distribution Lines

Continue implementing the DC PLUG initiative, which calls for placing electric distribution lines underground throughout the District. 1316.17

> *See the Environmental Protection Element for information about the District's Energy Emergency Plan and Comprehensive Energy Plan.*

IN-5.2 Natural Gas Infrastructure 1317

Consumption of natural gas has remained stable for the past 25 years, (+/- 30 trillion BTU), even as petroleum and coal consumption have decreased dramatically and as the population has grown. District consumers receive natural gas through transmission and distribution pipelines leading to compressor stations in and around the region. Regional Washington Gas compressor stations are located in the District; Loudon County, Virginia; and in Chillum, Maryland, with additional Transco Natural Gas Compressor Stations in Manassas, Virginia, and Columbia, Maryland. It is important to be ever vigilant about the need for natural gas safety, given the potential hazards associated with gas leaks. 1317.1

Policy IN-5.2.1: Natural Gas Safety

Promote consumer education on the benefits of regular monitoring of all above-ground and buried natural gas piping on the ratepayer's side of the meter to prevent corrosion, leaking, and other safety hazards. Work with Washington Gas to assess, monitor, and address leaks from the distribution system. In addition to safety concerns relating to flammability, these gas leaks contain methane, which is a potent heat-trapping GHG. 1317.2

IN-6 Infrastructure and Growth 1318

This section addresses the need to plan for, coordinate, fund, and implement capital improvements to address existing deficiencies, as well to address the impacts and cost of new development. 1318.1

IN-6.1 Infrastructure and New Development 1319

One of the basic purposes of the Comprehensive Plan is to improve the linkage and coordination between the District's development and capital improvement decisions. When well-coordinated, a state of good repair for existing infrastructure can be maintained and infrastructure sufficiency for Washington, DC's growth can be achieved. The District anticipates potential development and/or redevelopment of various large sites in the District, including at Buzzard Point, Hill East, the Florida Avenue Market, Walter Reed, the Armed Forces Retirement Home, St. Elizabeths, Poplar Point, McMillan, Union Station/Burnham Place, Brentwood, and Bladensburg Road at New York Avenue NE, and possibly at RFK Stadium. The goal for these efforts is to create vibrant new communities that are effectively integrated with surrounding neighborhoods, and that offer a high-quality experience for residents, workers, and visitors. Having infrastructure keep pace with growth will be critical in coming years, given that existing

infrastructure systems may require modernization or expansion to meet the needs of these new areas. 1319.1

The efficient and effective financing, maintenance, operation, replacement, and expansion of local infrastructure are important for a high quality of life in Washington, DC and to properly support growth and changing needs. 1319.2

The general trend in cities and counties across the country has been for the development community to bear a greater share of the cost of infrastructure expansion, rather than leaving this burden to local taxpayers and ratepayers (see text box entitled Green Century Bonds). This is already common practice in the District. 1319.3

Coordination between agencies and with the private sector is necessary to ensure that infrastructure capacity remains adequate. Coordination helps to ensure that infrastructure is modernized and developed to serve future growth needs appropriately. It also helps identify where addressing infrastructure needs together will create time and cost savings. 1319.4

Policy IN-6.1.1: Coordination of Infrastructure Improvements

Ensure infrastructure upgrades are carefully scheduled and coordinated with development and redevelopment plans to minimize traffic rerouting, pavement cuts for laying cable or placement of other infrastructure within the street right-of-way, street closings, disruptive subsurface excavation, and utility shut-offs. 1319.5

Policy IN-6.1.2: Location and Impacts of Infrastructure Improvements

Site and design infrastructure to provide safe, reliable service, address environmental impacts, and address impacts to adjacent communities, recognizing historic siting choices that negatively impacted low-income residents and communities of color. Identify strategies to minimize impacts to adjoining properties during construction and when the infrastructure is operational. 1319.6

Policy IN-6.1.3: Infrastructure Capacity for New Neighborhoods and Large Sites

Undertake planning to provide adequate infrastructure system capacity when master planning new neighborhoods and large sites. 1319.7

IN-6.2 Paying for Infrastructure 1320

In general, local governments and/or independent agencies or authorities (e.g., DC Water and PEPCO) are responsible for the maintenance and upkeep of infrastructure. There are a number of ways that local governments fund infrastructure improvements. The most common are long-term financing via bonds and pay-as-you go revenues collected via taxes or utility rates. In many cases, municipalities have foregone investment in infrastructure due to revenue constraints. The result is deferred maintenance and a long backlog of unfunded repairs—an unfortunate reality in cities across the country. 1320.1

Many local governments require infrastructure costs for new development to be borne by the developer through impact fees, special assessments, or other fees or taxes. Such fees are usually proportionate to the actual costs of building new water lines, sewer lines, and other utilities to serve the development site. While impact fees are an effective way to address the impacts of new development, they usually cannot be used to address deferred maintenance. Those costs must be financed through other means—generally through higher rates that cover the cost of bonds and capital projects that address deferred maintenance. 1320.2

Policy IN-6.2.1: Creative Financing

Promote creative financing tools to fund infrastructure development, maintenance, and replacement. These could include innovative taxing programs, user fees, new development charges, improvements through Planned Unit Developments, and other innovative cost recovery mechanisms. 1320.3

Policy IN-6.2.2: Developer Contributions

Require that private developers fund the necessary relocation or upgrading of existing utilities to address limitations with existing infrastructure on or adjacent to proposed development sites. For necessary upgrades to infrastructure, including water and wastewater, developers should contribute to the cost of extending utilities to the project site or upgrading existing utilities to the specifications necessary for their proposed project. 1320.4

Green Century Bonds

In July 2014, DC Water issued its inaugural green bond to finance a portion of the DC Clean Rivers Project. This historic $350 million issuance represented DC Water's inaugural green bond issue and the first certified green bond in the U.S. debt capital markets. It was also the first municipal century bond issued by a water/wastewater utility in the United States. The bond will be paid back over a 100-year period, to distribute the cost among those who benefit from the significant investment. The issuance achieved its green certification based upon the DC Clean Rivers Project's environmental benefits, which include improving water quality by remediating CSOs, promoting climate resilience through flood mitigation and improving quality of life through promotion of biodiversity and waterfront restoration. 1320.2a

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Policy IN-6.2.3: Infrastructure Maintenance

Support investments in infrastructure to reach and maintain a state of good repair across all systems. 1320.5

Action IN-6.2.A: Developer Reimbursement Agreements

Formulate consistent, equitable, and manageable developer reimbursement agreements for the incremental costs of utility upgrades, including water and sewer. The agreements should provide a means for the initial developer to be reimbursed by the District through payments by other developers who benefit from the initial developer's infrastructure improvements. 1320.6

Action IN-6.2.B: Community Infrastructure Investment

Explore methods to properly assess and meet infrastructure needs associated with incremental development. 1320.7

IN-6.3: Cross-Systems Integration 1321

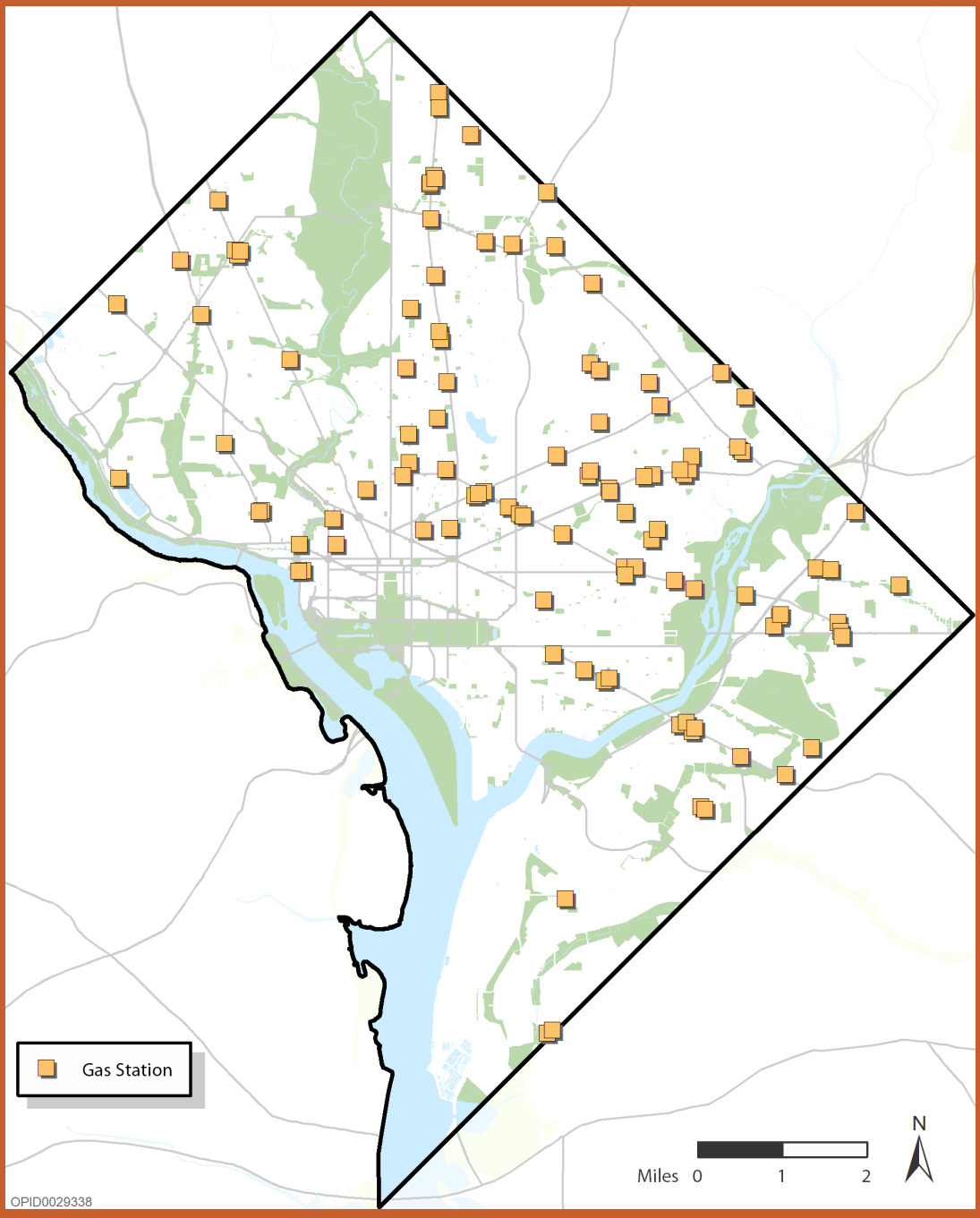
Future improvements to the District's infrastructure should be planned in a collaborative, integrated manner that can identify and maximize shared benefits, rather than be siloed by specific systems or agency. Examples of success, such as the DC Water Biosolids Management Program which converts byproducts of wastewater processing into energy to power the Blue Plains WTP, can become more commonplace in the District. Investments in infrastructure will require the collaboration of businesses, government, schools, community groups, and residents. Through this collaboration, and with the application of new technology, the best investments to infrastructure can be made. 1321.1

District government should also consider the importance of distributed networks, such as gas stations, in future planning efforts. The network created by standalone gas stations provides a significant energy supply to District residents, workers, and visitors. The locations of gas stations in Washington, DC are shown in Map 13.6. Future plans should consider the importance of such networks, especially in the context of emerging technologies and cross-system integrations. 1321.2

Future improvements to the District's infrastructure should be planned in a collaborative, integrated manner that can identify and maximize shared benefits, rather than be siloed by specific systems or agency.

Map 13.6:

Gas Station Locations in the District 1321.3



(Source: DC Office of Planning, 2018)

Policy IN-6.3.1: Infrastructure Collaboration

Encourage collaboration, cooperation, and shared opportunity across infrastructure projects, so that a range of perspectives and stakeholders participate in the identification of potential investments. Use technology to identify synergies, ensuring an efficient use of District infrastructure, investment, and resources. 1321.4

Policy IN-6.3.2: Coordination of Infrastructure Installation

Encourage enhanced coordination among relevant agencies and utilities when siting new or modernizing existing infrastructure, such as water lines and gas pipelines, telecommunications conduit, and streetscape improvements, in order to minimize duplicative efforts, such as digging, and to identify opportunities for cost and time savings. 1321.5

Action IN-6.3.A: Coordination of Infrastructure Upgrades

Continue to update a central repository for data and schedules for planned infrastructure upgrades to minimize the need for repeated street and sidewalk excavation. 1321.6

Action IN-6.3.B: Fueling Stations Shared Uses

Explore the potential for shared uses and reuses of fueling stations in the context of rapidly evolving and emerging technologies. This assessment should focus on possible cross-system uses for the facilities. 1321.7

IN-7: Infrastructure Resilience 1322

It is critical that infrastructure in Washington, DC be designed to withstand chronic stressors and system shocks. In recent years, the District has seen how hazardous events and climate change can stress and hurt infrastructure. For example, the destructive derecho storm of 2012 caused extensive damage to the electric grid and a prolonged power outage. Power was interrupted to more than 75,000 District residents and to public healthcare facilities for several days during a record-breaking heat wave. This event highlighted the severity and interrelated consequences of infrastructure failure, which negatively affected residents with medical needs and disproportionately harmed the lowest-income areas of the District. The storm resulted in 22 fatalities across the region and revealed the potential for cascading infrastructure impacts across critical systems that rely on electricity to operate, such as water and sewer, telecommunications, and transportation services, including transit and traffic signals. 1322.1

The District Preparedness System (DPS) forms the foundation of Washington, DC's efforts to integrate preparedness principles District-wide,

As the effects of climate change intensify and risks increase, it is critical for the District to plan for more frequent and severe impacts on infrastructure systems.

addressing protection, mitigation, response, and recovery capabilities and needs. Success of the DPS relies heavily on collaboration among District agencies with utilities across the region. By working together to identify and build the capabilities to address them, DPS stakeholders can continue to prepare for the most critical threats and hazards. DPS includes consideration of civic facilities (such as hospitals, fire and police stations, schools, libraries, and parks), as well as infrastructure. 1322.2

See the Community Services and Facilities Element for more information on DPS.

IN-7.1: Resilience and Critical Infrastructure 1323

Washington, DC faces major infrastructure challenges, a growing population, and increasing risks posed by natural hazards and climate change in addition to human-made hazards and incidents. As the effects of climate change intensify and risks increase, it is critical for the District to plan for more frequent and severe impacts on infrastructure systems. This need is emphasized in the Resilient DC Strategy, which lays out Washington, DC's approach to handling these challenges. 1323.1

This section addresses the protection and enhancement of critical infrastructure to address vulnerability to adverse effects of natural and human-made shocks, such as extreme weather events and security incidents, and to long-term stresses, such as sea level and temperature rise, which are driven by climate change. The District has adopted robust, multi-pronged strategies to address these issues. In addition to addressing sudden threats and hazards through DPS, Washington, DC is working to address chronic stressors, such as poverty, safety, and access to health care and healthy food, through a wide range of policies contained throughout the Comprehensive Plan, and these policies must be understood and implemented through an equity, particularly a racial equity, lens While Washington, DC recognizes that many, if not most, of the Comprehensive Plan policies are connected to resilience, policies that explicitly identify resilience are contained in specific subsections of this element to provide a logical framework: this section and the CSF-2.2 Healthy Communities and Resilience section in the Community Services and Facilities Element. 1323.2

Washington, DC is investing billions of dollars in resilient and adaptive infrastructure, including the DC PLUG Program, updates to the District's levee system, and the DC Clean Rivers Project. In addition to infrastructure hardening and other protective measures, infrastructure providers in Washington, DC should continue to focus their efforts on improving the robustness and reliability of critical systems to facilitate the continuous flow of goods, utility services, and information, particularly during times of crisis. 1323.3

This means developing adaptation plans that can include measures, such as relocation or retirement of existing infrastructure, and exploring the benefits of decentralized utility systems, which can offer greater system-wide reliability through redundancy. Adaptation plans should include consideration of projected impacts of climate change during the locational and design phases of infrastructure projects to ensure more deliberate review of proposed infrastructure investments in potentially hazardous locations and of the length of a given asset's useful life. 1323.4

Policy IN-7.1.1: District Preparedness

Prepare Washington, DC to prevent and protect against, mitigate, respond to, and recover from all hazards that threaten the District, including human-made and climate change hazards. Integrate preparedness goals into relevant efforts across relevant District agencies and utilities, including through coordination with DPS. Identify and integrate equity considerations into preparedness planning. 1323.5

Policy IN-7.1.2: Consider Vulnerabilities and Mitigations when Planning Critical Infrastructure

Support efforts by utilities to consider and evaluate vulnerability and mitigations for planning and protecting critical assets and systems from human-made and natural incidents and events, as well as chronic stressors, including sea level rise and heat emergencies. Identify and prioritize major vulnerabilities and hazards, such as flooding. Incorporate risk and hazard mitigation into operational and investment planning. Mitigations can include elevating natural gas lines and hardening water systems. 1323.6

Policy IN-7.1.3: Integration of Climate Adaptability

Promote integration of vulnerability assessments in resilience planning, including climate adaptability, into pertinent aspects of DPS using the best available data and in accordance with other District initiatives to adequately prepare for an evolving risk environment. 1323.7

Policy IN-7.1.4: Technology and Resilience

Explore the use and impact of new and emerging technologies on resilience vulnerability assessment and mitigation planning. 1323.8

Policy IN-7.1.5: Energy-Resilient Infrastructure

Encourage opportunities to make energy transmission and distribution systems more resilient. Opportunities include networking the transmission system, undergrounding power lines, and incorporating micro-grids where appropriate. 1323.9

Policy IN-7.1.6 Neighborhood-Scale Systems

Explore and consider neighborhood-scale systems as a measure that can help protect infrastructure from the impacts of climate change. Neighborhood-scale systems include micro-grids, district energy, and district stormwater management. 1323.10

Action IN-7.1.A: Micro-grid-Ready Construction

Explore tools to encourage new development projects to integrate micro-grid connectivity in their designs. Such incentives should be designed to expand decentralized power generation in the District, increasing the resilience of not only the energy distribution system but also those buildings or facilities that are dependent upon it. 1323.11

Action IN-7.1.B: Community Risk Assessments

Update the Community Risk Assessment (CRA) of DPS on a recurring basis to reflect changes in the risk profiles of relevant natural and human-made systems in Washington, DC. Incorporate relevant infrastructure information in the CRA process. 1323.12

Action IN-7.1.C: Protecting Critical Infrastructure

Protect critical facilities from a wide range of threats and hazards and develop fortified and redundant systems in order to deliver essential services at all times. 1323.13

Action IN-7.1.D: Training for Protecting Critical Infrastructure

Develop a training program for protecting public utilities for law enforcement and private sector personnel. 1323.14

Action IN-7.1.E: Vulnerability of Critical Infrastructure

Continue to support development of criteria and methodologies to assess the vulnerability of critical infrastructure to human-made and natural shocks, as well as chronic stressors. 1323.15

Action IN-7.1.F: Mitigating Vulnerability of Critical Infrastructure

Explore approaches and tools to address identified vulnerabilities of critical infrastructure. Regional, District-wide, and site-specific factors should be taken into account, as well as near-term and long-range risks. 1323.16

Action IN-7.1.G: Emerging Technologies and Critical Infrastructure

Review and evaluate the impacts of new and emerging technologies on the District's resilience and their potential for helping District government and utility operators to advance near-term and long-range infrastructure resilience objectives. 1323.17

For other policies and actions related to resilience and critical infrastructure, see the Community Services and Facilities Element.