DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY

DC CLEAN RIVERS PROJECT
GREEN INFRASTRUCTURE PROGRAM

# GI PROGRAM PLAN

July 2016

# Distribution

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| To: | Director, Water Enforcement Division<br>Office of Regulatory Enforcement, US EPA<br><br>Chief, NPDES Branch (3WP31)<br>Water Protection Division, U.S. EPA Region III<br><br>Yvette Roundtree (3RC20)<br>Office of the Regional Counsel, US EPA, Region III |
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# Executive Summary

## ES.1 Introduction

The District of Columbia Water and Sewer Authority (DC Water) is implementing a Long Term Control Plan (LTCP), also referred to as the DC Clean Rivers Project (DCCR), to control combined sewer overflows (CSOs) to the District of Columbia's (District) waterways. DCCR is comprised of a variety of projects to control CSOs, including pumping station rehabilitations, green infrastructure (GI), and a system of underground storage/conveyance tunnels. DCCR is being implemented in accordance with a first amendment to the Consent Decree (Amended Consent Decree), entered on January 14, 2016, which amends and supersedes the 2005 Consent Decree (Consent Decree) and incorporates GI, in a hybrid green-gray solution to control CSOs while improving the quality of life in the District.

GI uses plants, trees and other measures to mimic natural processes to control stormwater, resulting in cleaned, cooled and slowed stormwater runoff. These systems promote stormwater detention and infiltration into the soil and include techniques such as pervious pavements, bioretention (rain gardens), rain barrels and downspout disconnections, and other technologies. By integrating natural processes into the urban environment, GI provides not only stormwater management, but also may support additional benefits such as local job creation, improved air quality, a cooler city, greener public and private spaces, added wildlife habitat, increased property values, and greenhouse gas mitigation.

This summary covers the basis of analysis for GI design, including Municipal Separate Storm Sewer System (MS4) data analyses, preliminary sewershed characteristic analyses, details of the recommended GI Program Plan, including identification and design of the GI control measures and projects, with approximate locations and costs, preservation and maintenance plans for the constructed GI projects, and public outreach for engagement in both sewersheds.

The purpose of this document is to demonstrate compliance with the Amended Consent Decree requirement as stated in the Amended Consent Decree's Appendix F, Section I (Page 1), which states: "Within 12 months after the Effective Date of the [Amended] Consent Decree, DC Water shall submit to EPA for approval pursuant to Section X (EPA Approval of Plans and Submissions) of this [Amended] Consent Decree a Green Infrastructure Program Plan (the "GI Program Plan")."

## ES.2 Basis for Analysis

DCCR provides a synopsis of the review of existing data and information that was used as the basis for analyses to investigate GI control measures in the Rock Creek and Potomac River sewersheds to achieve the Amended Consent Decree requirements. The analysis evaluated various properties within each sewershed for GI implementation, including sites located on publicly-owned property within the right-of-way (ROW) as well as other publicly-owned properties (public schools, recreation centers, etc.), opportunities on private property, and the complete separation of partially-separated areas within the sewersheds. This Section also includes the investigation of potential GI technologies for these properties through applicable and relevant standards and programs at the local and national levels and a summary of existing data that could influence design, including geotechnical and

environmental data for both sewersheds. That analysis was used to select appropriate GI control measures according to the space available within each sewershed. With the selection of GI technologies, the Section also discusses DCCR's methods for accounting for the stormwater managed within proposed GI control measures and the additional volume control potential from future retrofits under the District's stormwater management regulations (21 DCMR Chapter 5).

### ES.2.1. Rock Creek and Potomac River Sewershed Analyses

Preliminary GI implementation analyses of the Rock Creek and Potomac River sewersheds formed the basis of siting and design for the first projects in both sewersheds. Building off of the analysis summarized in Section 2, the analysis describes the identified potential GI technologies that could be used within the available properties in the sewersheds. The analysis was used to approximate the number and distribution of GI control measures across the two sewersheds to achieve the Amended Consent Decree requirements. Consideration is also given to partially separated areas within both sewersheds.

## ES.3 Recommended GI Program Plan

Following the Amended Consent Decree, eight (8) GI projects are outlined within the public ROW. Five (5) of these are in the Rock Creek sewershed (CSO 049) and three (3) are in the Potomac River Sewershed (CSOs 027, 028 and 029). Section 4.2 details the Rock Creek GI projects, and each of these projects is shown in Figure ES-1 below, and also Figure 4-1. GI control measures for the first project will include bioretention and permeable pavement. The following four projects may also include subsurface storage and targeted sewer separation. Per the Amended Consent Decree, the first Rock Creek GI project must be awarded by March 30, 2017, and the last project must be placed into operation by March 23, 2030.

Throughout the course of the GI projects implemented in the Rock Creek and Potomac River sewersheds, an adaptive management approach will be utilized such that efficiencies in implementation and lessons learned can be incorporated into subsequent projects, with the overall goal of reducing long-term program costs over time. Based on this approach, the GI Program Plan summarized herein will be adapted over time as needed to account for the experience gained through each project.

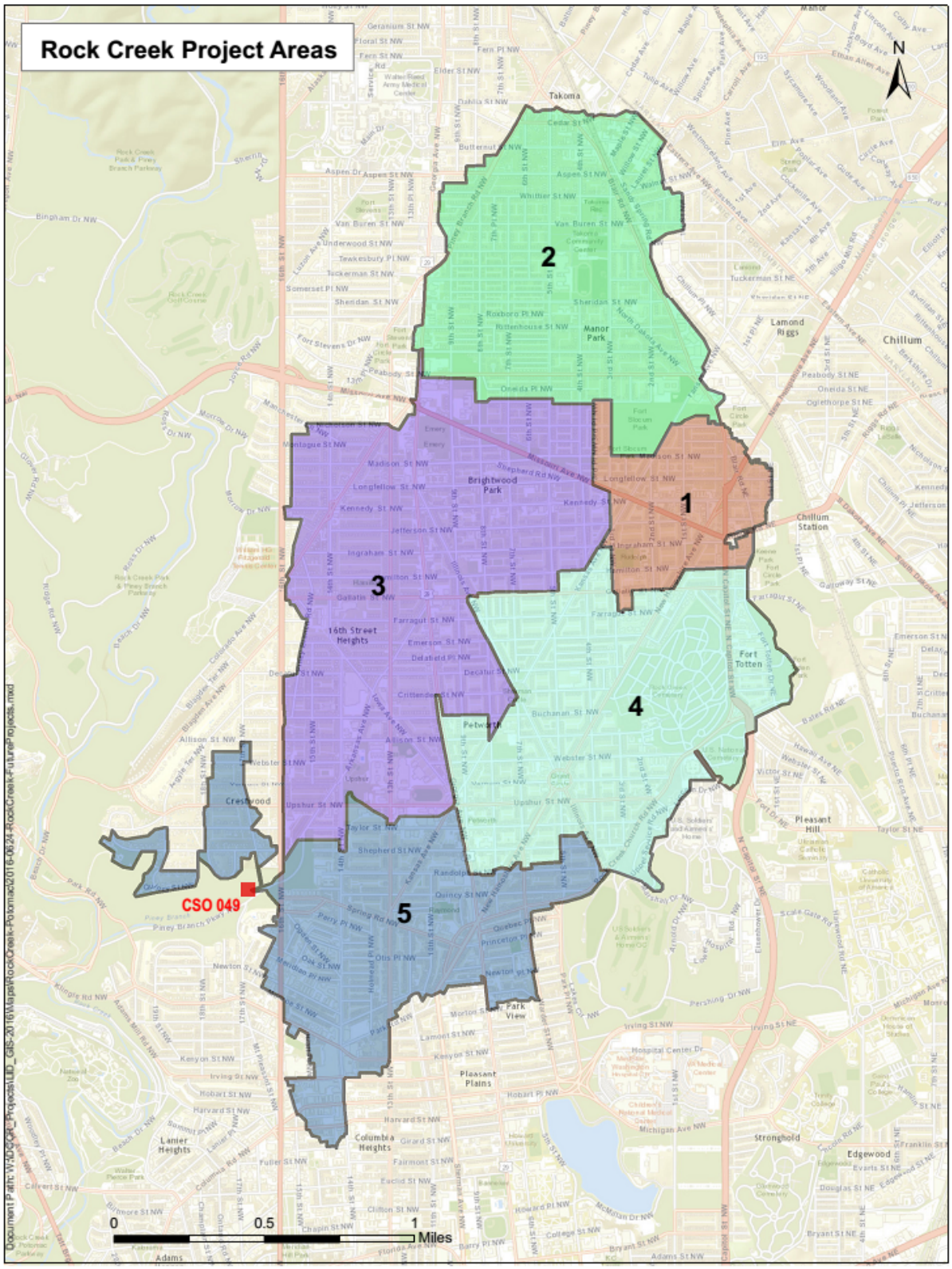


**Figure ES-1. Approximate Rock Creek GI Overall Project Locations**

Section 4.3 details the Potomac River GI projects, and project bounds for each of these three projects is shown in Figures ES-2, ES-3, and ES-4 below. These are also shown as Figures 4-3, 4-4, and 4-5. The first project GI control measures will include bioretention, permeable pavement, and targeted sewer separation. It is anticipated that the second project will consist primarily of targeted sewer separation with a limited amount of bioretention. The last project is anticipated to be a combination of all four GI control measure types. Per the Amended Consent Decree, the first Potomac River GI project must be awarded by June 23, 2017, and the last project must be placed into operation by June 23, 2027.

A parallel downspout disconnection program precedes the GI ROW installation, which may reduce the total volume capture required by the ROW GI control measures. Similarly, future retrofits under the District's stormwater management regulations (21 DCMR Chapter 5) may also offset the volume capture required.

In Section 4.4, permitting roles and responsibilities for the GI projects are detailed.

Section 4.5 covers pre- and post-construction monitoring and modeling. Each project site is to be monitored 12 months prior to construction and 12 months following construction completion. This is to evaluate the effectiveness of the GI control measures installed. Monitoring is currently underway for the first GI projects in both sewersheds at the upper and lower extents of each project. Concurrently groundwater elevations are being monitored and rainfall data is also being collected.

In Section 4.6, the private property implementation program, a majority of which is anticipated to be residential downspout disconnections, is discussed at length. The potential impact of downspout disconnections is large, but supplemental to the 8 GI projects. The final Section, 4.7, lays out a Public Notification System for the Rock Creek sewershed, using the same light system as proposed for the Anacostia River, with installations at three public access points ranging from the CSO 049 outfall to the mouth of Rock Creek.

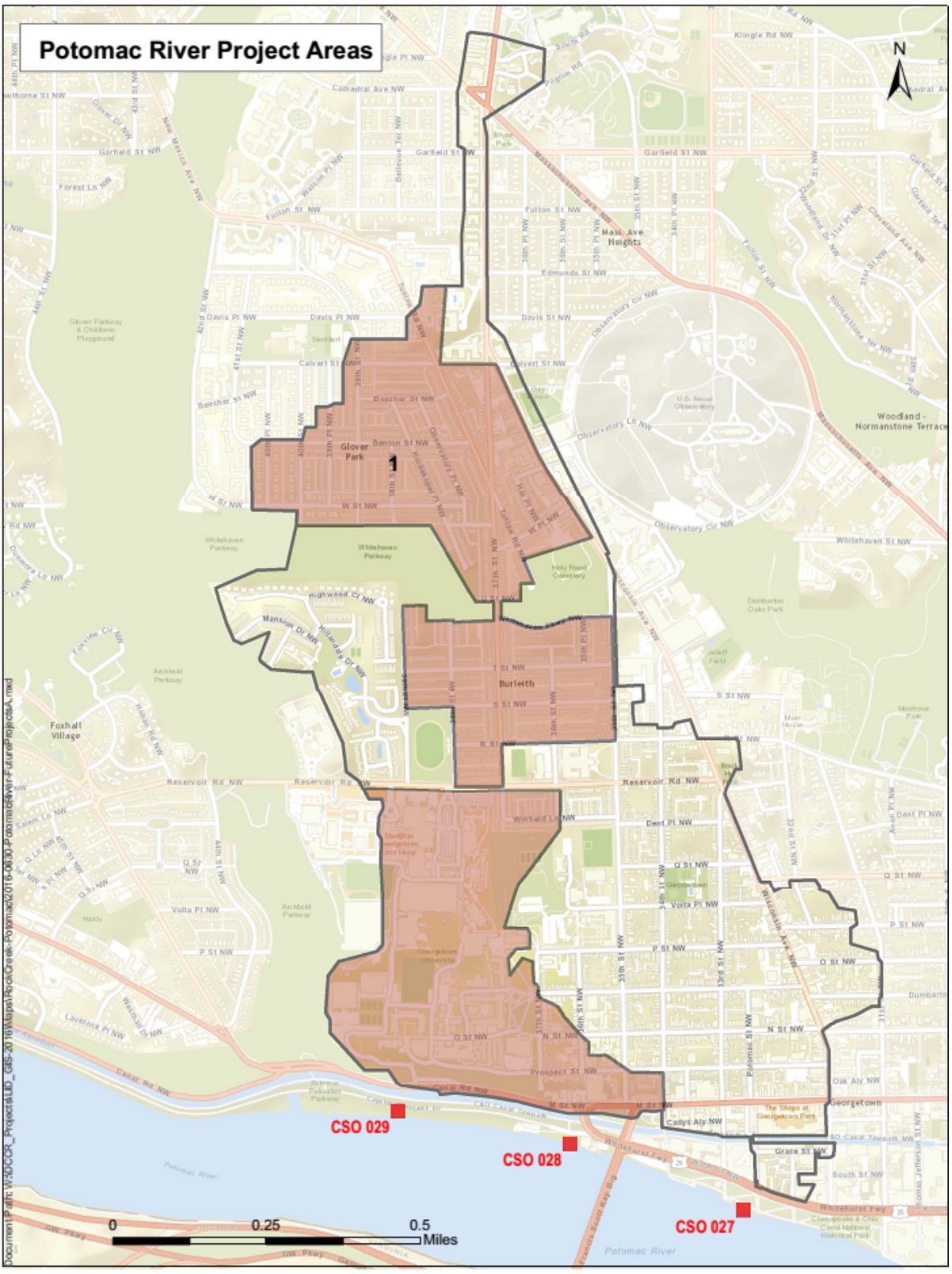


**Figure ES-2. Approximate Potomac River GI Project No. 1 Location**

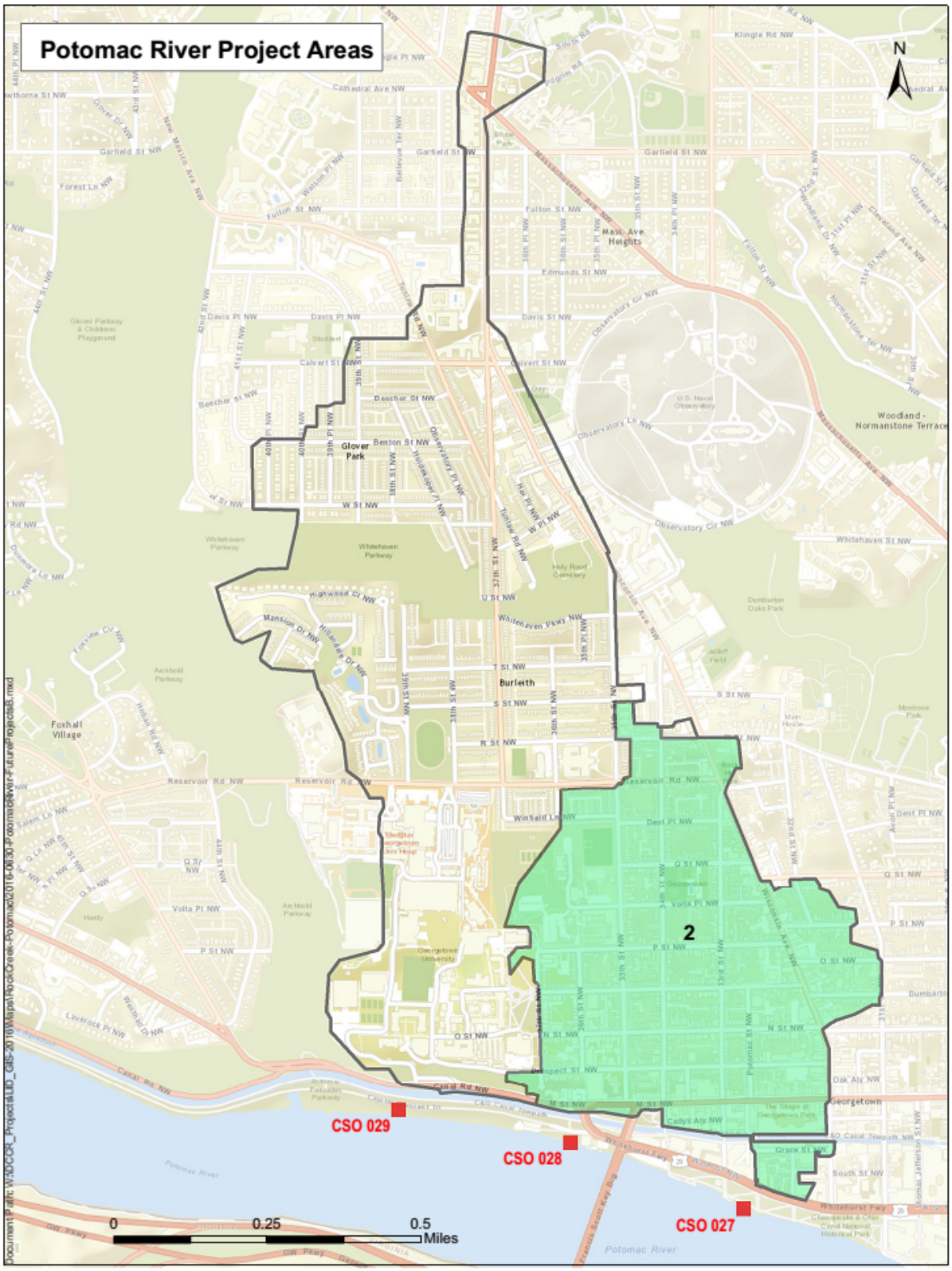


**Figure ES-3. Approximate Potomac River GI Project No. 2 Location**

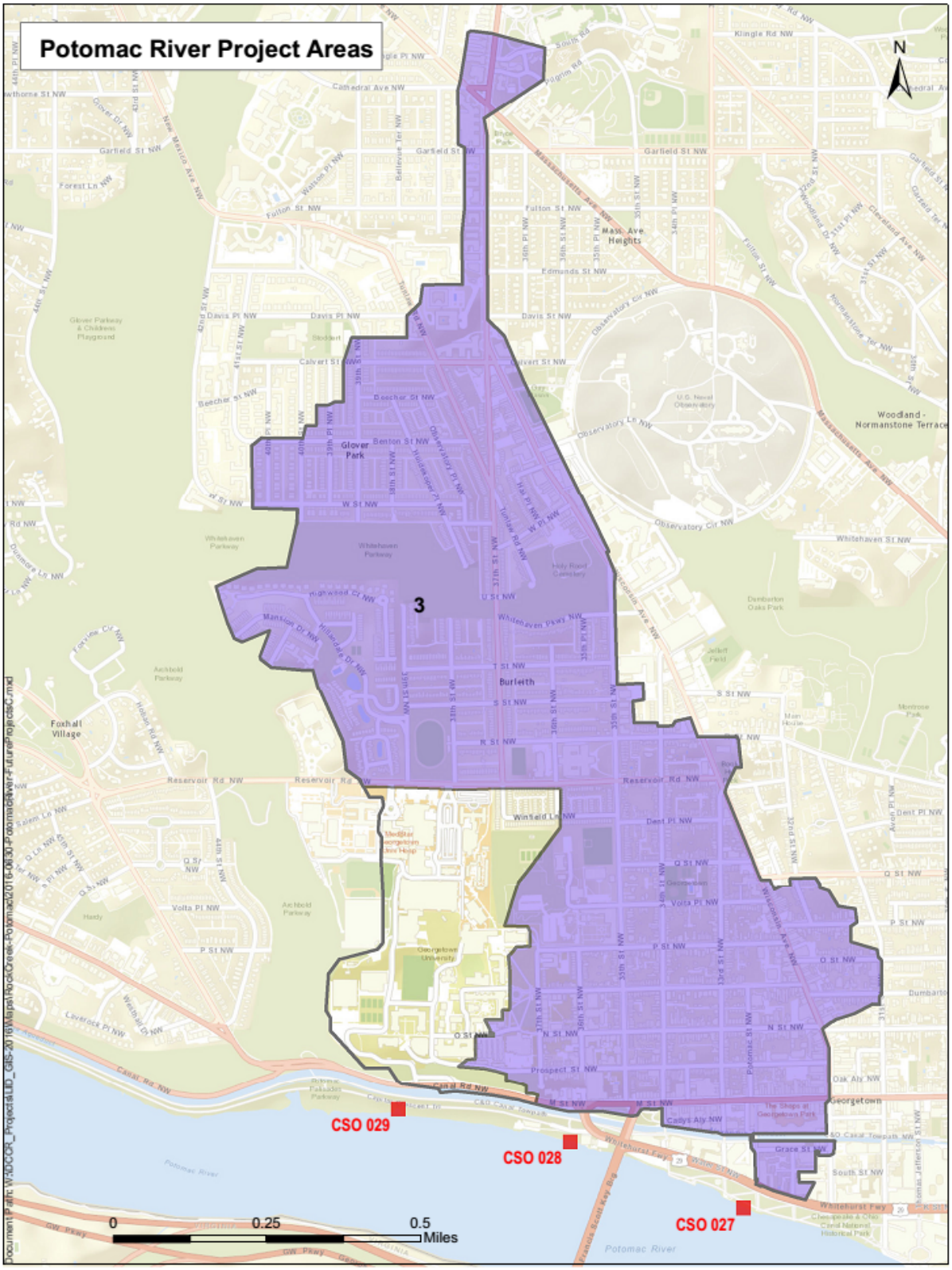


**Figure ES-4. Approximate Potomac River GI Project No. 3 Location**

### ES.3.1. Maintenance and Preservation Plan

Green infrastructure implementation on both public and private properties requires maintenance and preservation. Maintenance is DC Water's responsibility and will vary depending on the type of GI control measure as well as location. Preservation, however, is best addressed by a multi-faceted approach, depending on the type of impact, and whether it is the result of planned work or accidental damage. The preservation plan outlined includes coordination with all other users of public property in the vicinity to anticipate, monitor, and, if need be, rehabilitate or replace GI control measures that are adversely impacted.

### ES.3.2. Public Outreach and Engagement

DCCR has assembled a public outreach and engagement plan, including strategies, tactics, talking points, stakeholder identification, coordination with existing GI initiatives, communication vehicles and materials, and outreach phasing for each project and on both public and private properties. DC Water will continue to develop a calendar of public and private events with which to participate, present GI information and facilitate educational activities. DC Water will continue to develop relationships with stakeholders to disseminate educational materials related to the DC Water GI Program Plan and its GI projects, and a call to action as needed for these. Throughout the chain of GI projects, DC Water will continue to develop partnerships with residents, stakeholders and community-based organizations. At each GI project area, multiple public outreach meetings will be conducted and promoted via various media streams beforehand. All investigations will be preceded by public notifications, as will construction work and project progress. Downspout disconnection outreach will be rolled-out ahead of the GI projects, with active participation strongly encouraged via multiple media paths. Factsheets and other informational materials will be produced as needed.

# 1 Introduction

## 1.1 Purpose

The District of Columbia Water and Sewer Authority (DC Water) is implementing a Long Term Control Plan (LTCP), referred to as the DC Clean Rivers Project (DCCR), to control combined sewer overflows (CSOs) to the District of Columbia's (District) waterways. DCCR is comprised of a variety of projects to control CSOs, including pumping station rehabilitation, green infrastructure (GI), and a system of underground storage/conveyance tunnels. DCCR is being implemented in accordance with the first amendment to the Consent Decree (Amended Consent Decree), entered with the District courts on January 14, 2016, which amends and supersedes the 2005 Consent Decree (Consent Decree). The Amended Consent Decree requirements are outlined in Section 1.2. The Amended Consent Decree is provided in Appendix A.

The purpose of this document is to demonstrate compliance with the Amended Consent Decree requirement as stated in the Amended Consent Decree's Appendix F, Section I (Page 1), which states: "Within 12 months after the Effective Date of the [Amended] Consent Decree, DC Water shall submit to EPA for approval pursuant to Section X (EPA Approval of Plans and Submissions) of this [Amended] Consent Decree a Green Infrastructure Program Plan (the "GI Program Plan")."

This GI Program Plan includes the required information regarding GI control measures (including the analysis completed to determine the types of GI control measures), preservation and maintenance of constructed GI control measures, and GI public outreach, as required by Appendix F of the Amended Consent Decree.

## 1.2 Amended Consent Decree Requirements

The Amended Consent Decree specifies the necessary requirements for projects that DCCR must implement in all three sewersheds (Anacostia River, Potomac River, and Rock Creek) and deadlines for the implementation of these projects. Figure 1-1 shows the Amended Consent Decree. The requirements and deadlines of the Amended Consent Decree specific to GI implementation in the Rock Creek and Potomac River sewersheds are described in the following subsections.

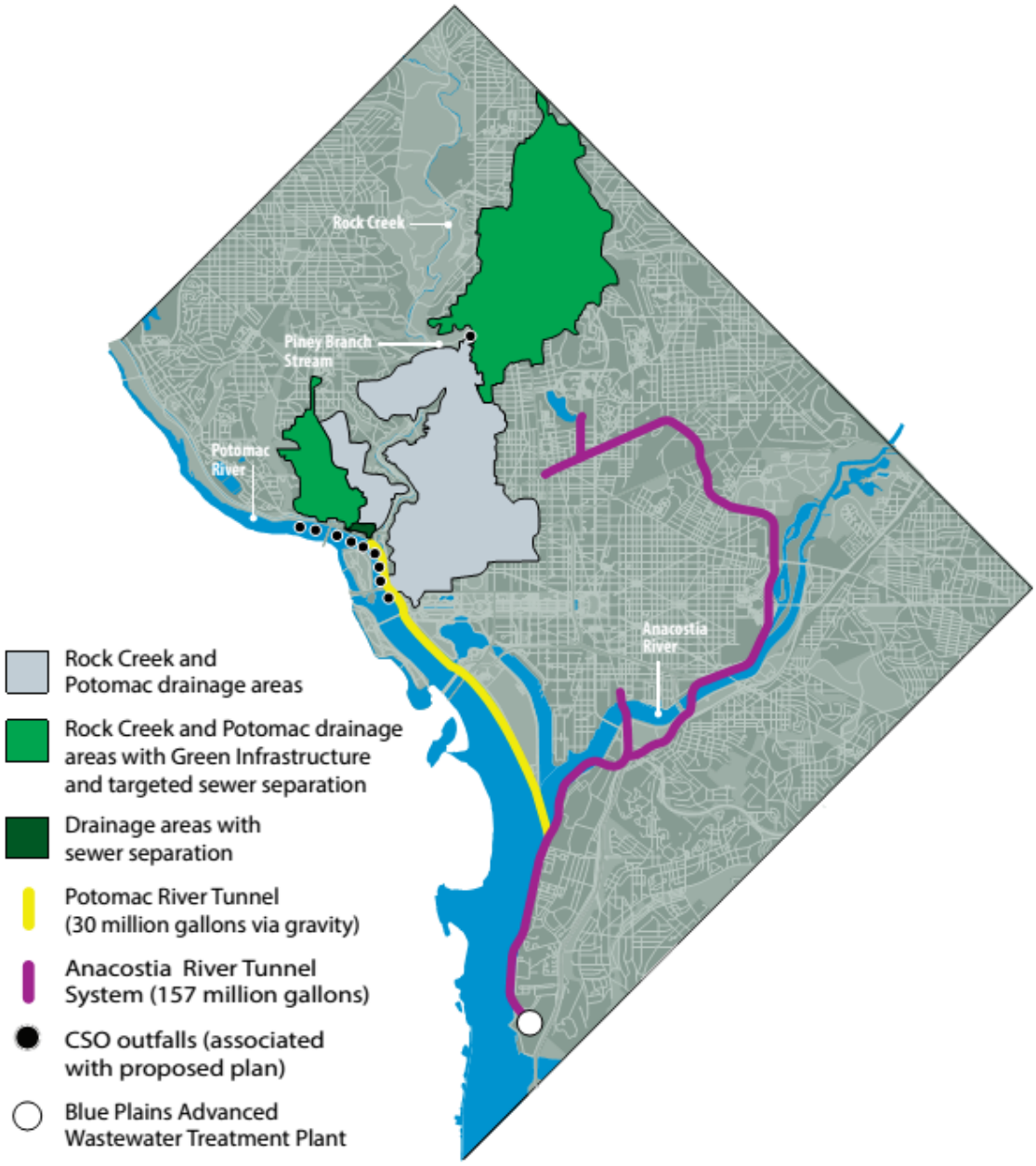


**Figure 1-1. Amended Consent Decree Requirements**
Source: DC Water (2016)

### 1.2.1 Rock Creek Sewershed GI Projects

The Amended Consent Decree requires that GI will be constructed in the Piney Branch drainage area within the Rock Creek sewershed to manage the volume of runoff produced by 1.2" of rain falling on 365 impervious acres (30% of the total impervious acres) in the sewershed. Table 1-1 lists the five Rock Creek sewershed projects required to achieve the 365 impervious acres and each project's associated schedule that are part of the Amended Consent Decree.

**Table 1-1. Rock Creek Sewershed Projects in Amended Consent Decree**

| Project No: | Impervious Acres to Control to 1.2" Retention Standard | Date to Award Contract for Construction | Date to Place in Operation |
|---|---|---|---|
| 1 | 20 | March 30, 2017 | March 30, 2019 |
| 2 | 75 | January 23, 2022 | January 23, 2024 |
| 3 | 90 | March 23, 2025 | March 23, 2027 |
| 4 | 90 | September 30, 2027 | September 30, 2029 |
| 5 | 90 | March 23, 2028 | March 23, 2030 |

Source: Amended Consent Decree (2016), Appendix F.

### 1.2.2 Potomac River Sewershed GI Projects

The Amended Consent Decree requires that GI will be constructed in the drainage areas for CSOs 027, 028, and 029 within the Potomac River sewershed to manage the volume of runoff produced by 1.2" of rain falling on 133 impervious acres in the sewershed. The number of impervious acres is equivalent to 30% of total impervious acres in the CSOs 027 and 028 sewersheds, and 60% of total impervious acres in the CSO 029 sewershed. Table 1-2 lists the three Potomac River sewershed projects required to achieve the 133 impervious acres and each project's associated schedule that are part of the Amended Consent Decree.

**Table 1-2. Potomac River Sewershed Projects in Amended Consent Decree**

| Project No: | Impervious Acres to Control to 1.2" Retention Standard | Date to Award Contract for Construction | Date to Place in Operation |
|---|---|---|---|
| 1 | 44 | June 23, 2017 | June 23, 2019 |
| 2 | 46 | June 23, 2022 | June 23, 2024 |
| 3 | 43 | June 23, 2025 | June 23, 2027 |

Source: Amended Consent Decree (2016), Appendix F.

## 1.3 Report Organization

The GI Program Plan is organized into six sections, including this Section 1, the Introduction. Below are descriptions of the remaining Sections:

- Section 2 provides a synopsis of the review of existing data and information that was used as the basis for analyses to investigate GI control measures in the Rock Creek and Potomac River sewersheds to achieve the Amended Consent Decree requirements. The analysis evaluated various properties within each sewershed for GI implementation, including sites located on publicly-owned property within the right-of-way (ROW) as well as other publicly-owned properties (public schools, recreation centers, etc.), opportunities on private property, and the complete separation of partially-separated areas within the sewersheds. This Section also includes the investigation of potential GI technologies for these properties through applicable and relevant standards and programs at the local and national levels and a summary of existing data that could influence design, including geotechnical and environmental data for both sewersheds. That analysis was used to select appropriate GI control measures according to the space available within each sewershed. With the selection of GI technologies, the Section also discusses DCCR's methods for accounting for the stormwater managed within proposed GI control measures and the additional volume control potential from future retrofits under the District's stormwater management regulations (21 DCMR Chapter 5).

- Section 3 details the GI implementation analyses of the Rock Creek and Potomac River sewersheds that formed the basis of siting and design for the first projects in both sewersheds. Building off of the analysis summarized in Section 2, the analysis describes the identified potential GI technologies that could be used within the available properties in the sewersheds. The analysis was used to approximate the number and distribution of GI control measures across the two areas to achieve the Amended Consent Decree requirements. Consideration is also given to partially separated areas within both sewersheds.

- Section 4 describes the GI Program Plan for the Rock Creek and Potomac River sewersheds. Proposed project locations and GI control measures on public and private

property are identified and described, along with a more detailed schedule for implementation, and estimated costs to implement the control measures. An overview of the permitting and other approvals needed to perform this work is provided, and details of the pre- and post-construction monitoring program are included. This Section also includes locations for the Rock Creek public notification system for overflow events.

- Section 5 details the maintenance and preservation plans for any GI control measure constructed to achieve the Amended Consent Decree requirements. The maintenance plan includes a description of DC Water's maintenance and asset management program for GI control measures. Implementation of the maintenance plan for GI constructed on both public and private properties is discussed in detail. The preservation plan includes methods to identify and track risks to installed GI. The preservation plan also includes tactics to mitigate these potential risks and any impacts to GI to ensure that future site or land use changes do not result in the loss of the runoff reduction benefits of the GI control measures installed pursuant to the GI Program Plan, unless that loss is compensated for by other control measures in the same sewershed.

- Section 6 outlines the GI public outreach and engagement plan. This plan describes DC Water's strategy and tactics for communicating and engaging with the general public, residents of the sewersheds, and other stakeholders to ensure input is gathered and incorporated into design and implementation for the GI Program Plan.

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# 2 Basis for Analyses

## 2.1 Introduction

This Section provides a synopsis of existing data and information used as the basis for the analysis to determine the strategy for GI application (approximate number and distribution of GI control measures) in the Rock Creek and Potomac River sewersheds to achieve the Amended Consent Decree requirements. The review of existing data included evaluating various properties within each sewershed for GI implementation, including sites located on publicly-owned property within the ROW as well as other publicly-owned properties (public schools, recreation centers, etc.), opportunities on private property, and the complete separation of partially-separated areas within the sewersheds. This Section also includes the investigation of potential GI technologies for these properties through applicable and relevant standards and programs at the local and national levels, and a summary of existing data that could influence design, including the geotechnical and environmental data for the sewersheds. This analysis was used to select appropriate GI control measures according to the space available within each sewershed. With the selection of GI technologies, the Section also discusses DCCR's methods for accounting for the stormwater managed within proposed GI control measures and the additional volume control potential from future retrofits under the District's stormwater management regulations (21 DCMR Chapter 5).

## 2.2 Overview of the Rock Creek and Potomac River Sewersheds

Ahead of determining GI opportunities, DCCR identified the spaces within each sewershed that would allow for GI implementation. As the sewersheds are located across in different neighborhoods within the District, as shown in Figure 2-1, the characteristics of the sewersheds vary, potentially influencing the types of GI that can be sited. To investigate these differences, geographic information system (GIS) data was obtained from the DC Office of the Chief Technology Officer (OCTO), which coordinates the sharing of GIS data amongst District agencies and the public. The GIS data was evaluated for the differences in the use of the neighborhood (e.g. residential vs. commercial), the distribution of buildings, property ownership (e.g. public vs. private), etc. within each sewershed (DC Water, 2015) by analyzing the following items:

- Land ownership types (both public and private);
- Land use (commercial, residential, and institutional);
- Development density (low to high); and
- Land cover (such as roads and alleys, buildings, and sidewalks).

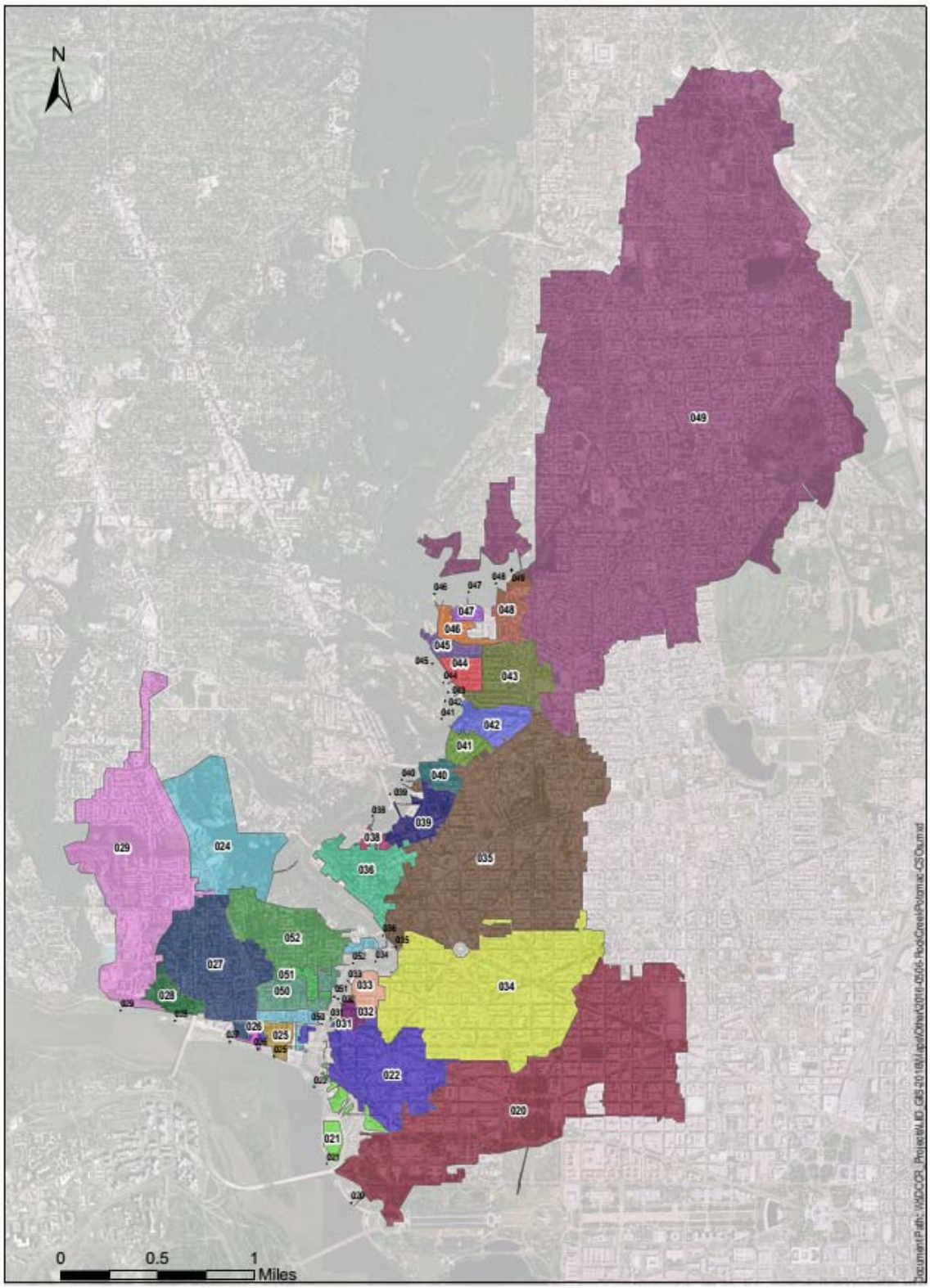


**Figure 2-1. Rock Creek and Potomac River Sewersheds and CSO Outfalls**

Source: DC Water (2015).

These factors were the initial criteria in determining the most effective areas for GI implementation. Because the size and/or type of impervious cover is directly related to its anticipated runoff volume, DCCR focused its identification of potential opportunities on the properties/property types with the greatest amount of impervious cover.

Rock Creek and Potomac River sewersheds are highly urbanized areas. With the exception of Rock Creek Park, the sewersheds are a dense mixture of impervious public ROW (roads, sidewalks and alleys), residential properties, and commercial areas. Figures 2-2 and 2-3 present the percent distribution of impervious land use categories for the Rock Creek and Potomac River sewersheds. For detailed acreage for each category by CSO drainage area, see Table 2-1 below.

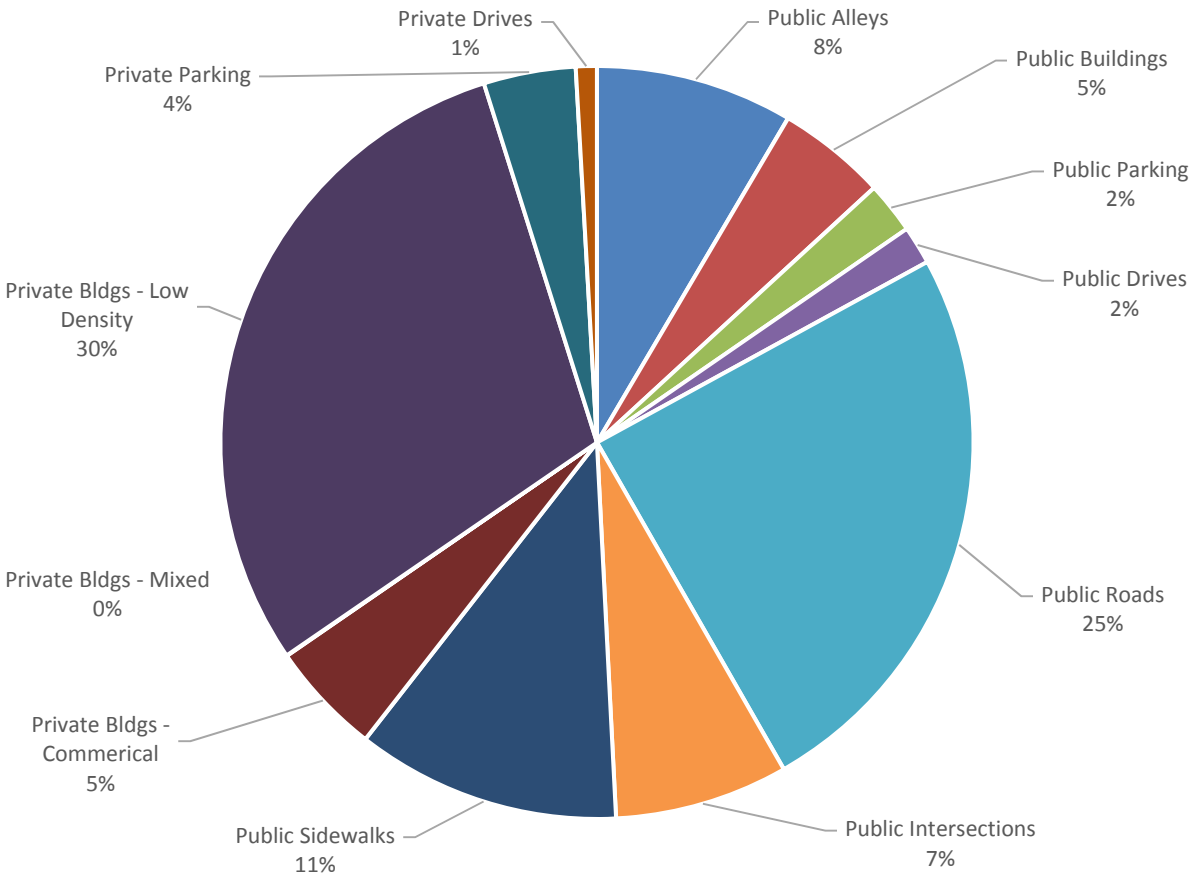


**Figure 2-2. Impervious Land Use for Rock Creek Sewershed (CSO 049)**
Source: Adapted from DC Water (2015), Appendix J.

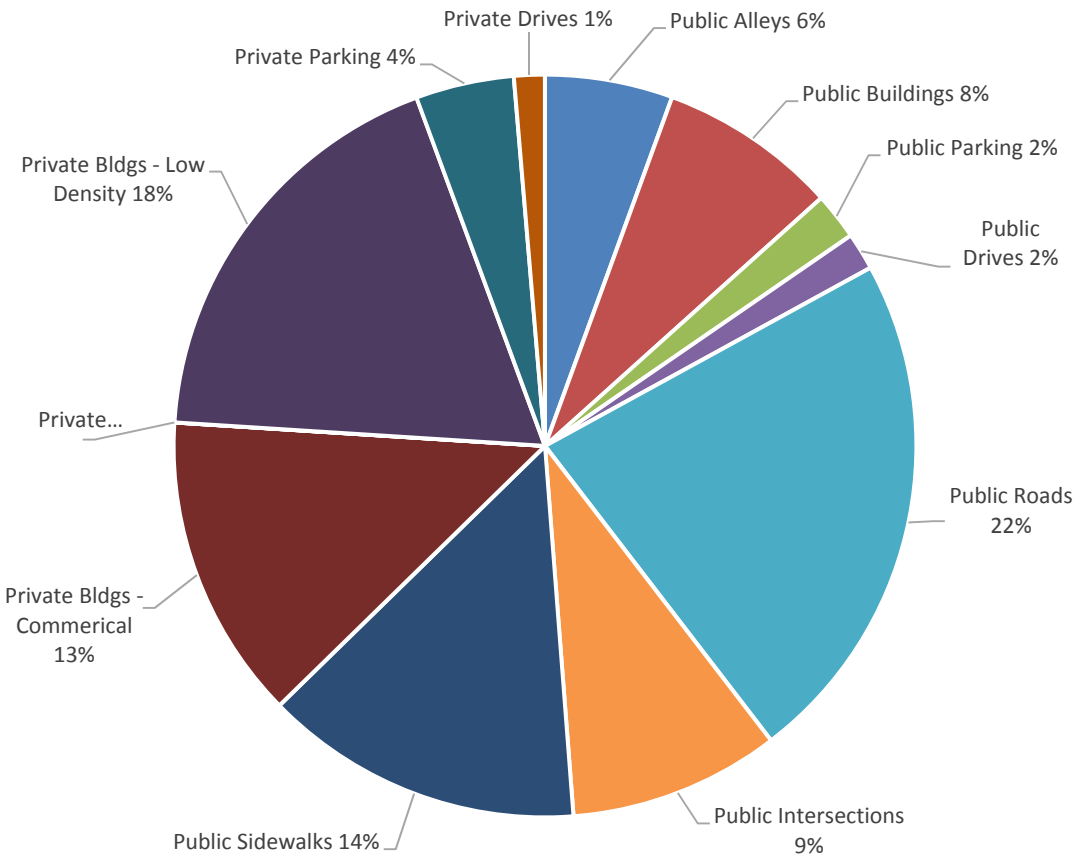


**Figure 2-3. Impervious Land Use for Potomac River Sewershed (CSOs 027, 028, 029)**
Source: Adapted from DC Water (2015), Appendix J.

**Table 2-1. CSO Sewershed Impervious Acreage**

| CSO Drainage Area | Total Acres | Impervious Acres | % Impervious | Public Property (Acres) | | | | | | | Private Property (Acres) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Alleys | Buildings | Parking Lots | Paved Drives | Roads | Intersections | Sidewalks | Bldgs. – Commercial, High-Density Residential | Bldgs. – Mixed Use | Bldgs. – Low and Low-Med. Density Res. | Parking Lot | Paved Drives |
| CSO 027 | 164 | 104 | 64% | 3.1 | 10.1 | 2.4 | 0.7 | 19.4 | 5.5 | 17.5 | 14.6 | 0.3 | 25.6 | 3.5 | 1.4 |
| CSO 028 | 21 | 13 | 61% | 0.0 | 1.6 | 0.7 | 0.7 | 3.1 | 0.7 | 2.6 | 1.8 | 0.0 | 0.9 | 0.6 | 0.1 |
| CSO 029 | 330 | 164 | 50% | 8.4 | 24.8 | 6.3 | 6.3 | 32.7 | 12.0 | 21.0 | 3.9 | 0.0 | 40.3 | 4.7 | 3.8 |
| CSO 049 | 2,329 | 1,215 | 52% | 103 | 57 | 27 | 20 | 300 | 90.6 | 138 | 59 | 0.3 | 361 | 48 | 11 |

Source: DC Water (2015), Appendix J.

### 2.2.1 Rock Creek Sewershed

The Rock Creek sewershed is comprised of 2,329 total acres, of which 52 percent is impervious (1,215 acres). Table 2-2 summarizes the Rock Creek sewershed area characteristics for CSO 049.

**Table 2-2. Rock Creek Sewershed – CSO 049**

| | CSO 049 |
|---|---|
| **Total Sewershed Area** | 2,329 acres |
| **Impervious Area** | 1,215 acres |
| **30% of Impervious Area** | 365 acres |

Source: DC Water (2015), Appendix J.

The Rock Creek sewershed land use map is shown in Figure 2-4. The land use categories (i.e., commercial) are depicted on the map, along with the base data, which includes buildings, roads, sidewalks, open water, sewershed boundaries, railroad, and CSO outfalls.

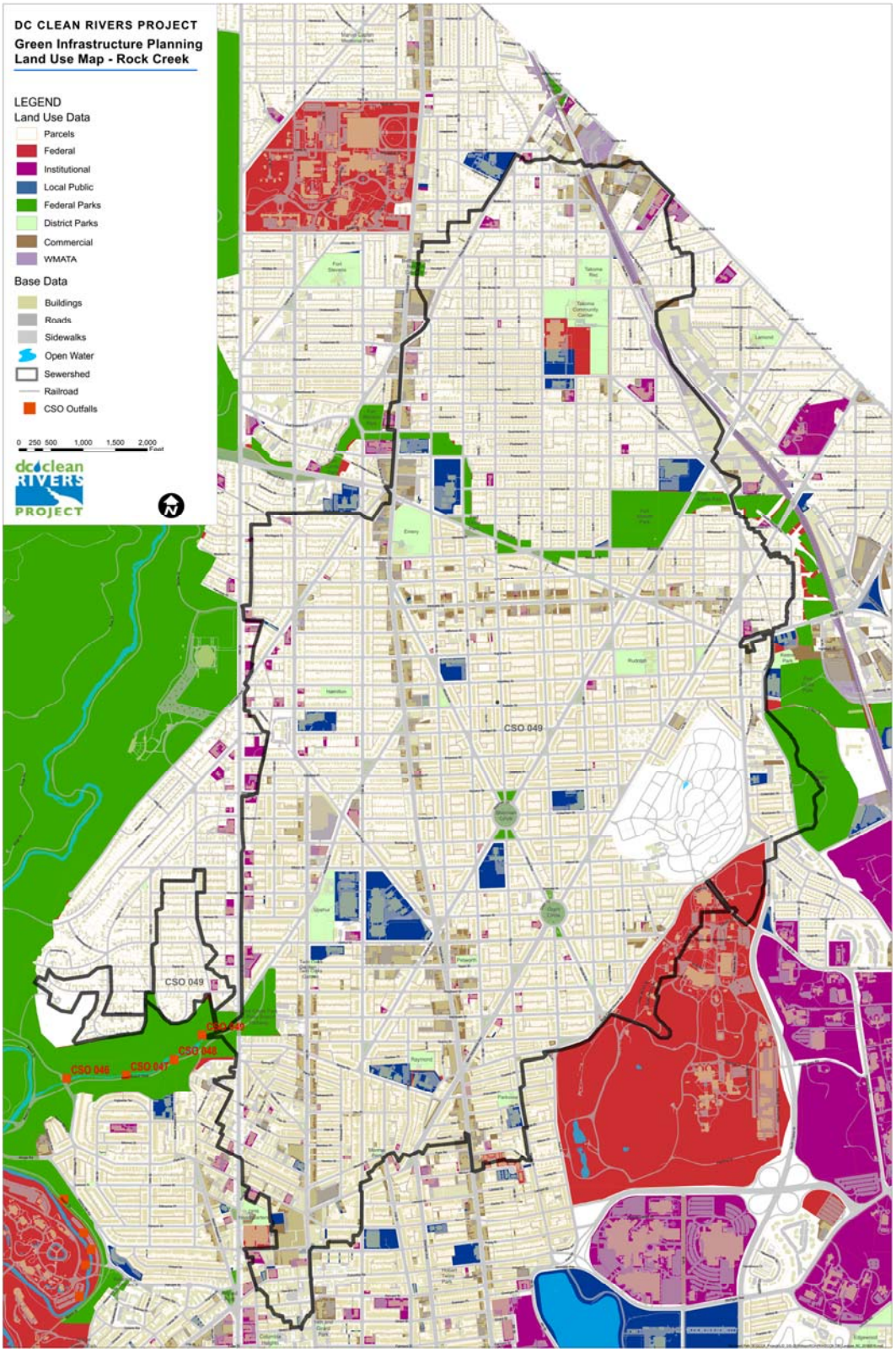


**Figure 2-4. Rock Creek Sewershed – Land Use Map**

Source: DC OCTO

### 2.2.2 Potomac River Sewershed

These three Potomac River sewersheds are comprised of 515 total acres, of which 55 percent are impervious (281 acres). Table 2-3 summarizes the Potomac River sewershed area characteristics for CSOs 027, 028, and 029.

**Table 2-3. Potomac River Sewershed – CSOs 027, 028, and 029**

| | CSO 027 | CSO 028 | CSO 029 |
|---|---|---|---|
| **Sewershed Area** | 164 acres | 21 acres | 330 acres |
| **Impervious Area** | 104 acres | 13 acres | 164 acres |
| **30% of Impervious Area** | 31 acres | 4 acres | N/A |
| **60% of Impervious Area** | N/A | N/A | 98 acres |

Source: DC Water (2015), Appendix J.

The Potomac River sewershed land use map is shown in Figure 2-5. The land use categories (i.e., commercial) are depicted on the map, along with the base data, including buildings, roads, sidewalks, open water, sewershed boundaries, railroad, and CSO outfalls.

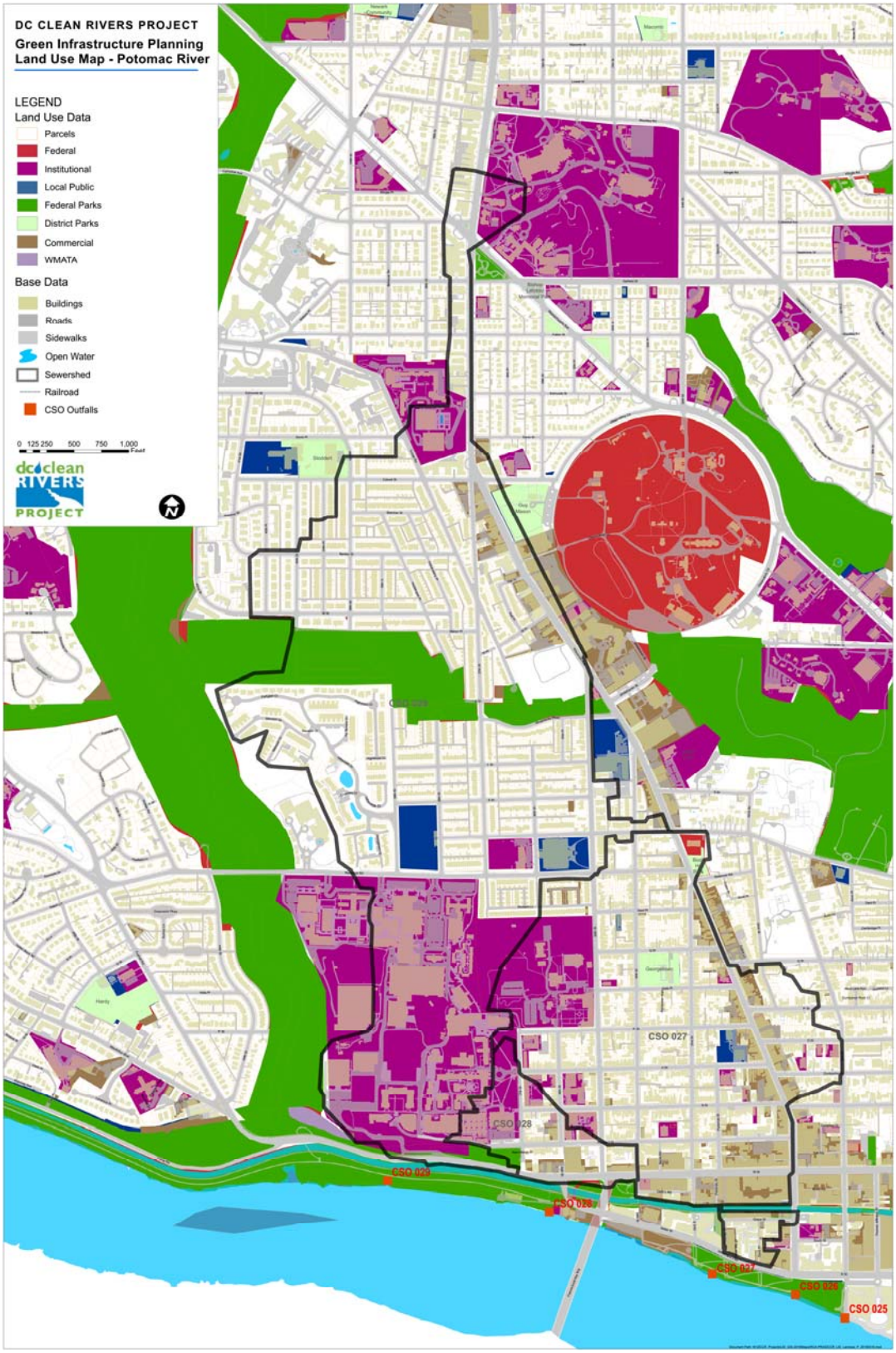


**Figure 2-5. Potomac River Sewershed – Land Use Map**

Source: DC OCTO

### 2.2.3 Overview of Opportunities for GI with Rock Creek and Potomac River Sewersheds

Using the GIS data, DCCR identified the largest categories of impervious area within each type of property in the sewersheds. Though the land uses, distribution of buildings, and building types varied across the sewershed, the types of impervious area were similar. These categories represented the impervious area that could be managed by a GI control measure.

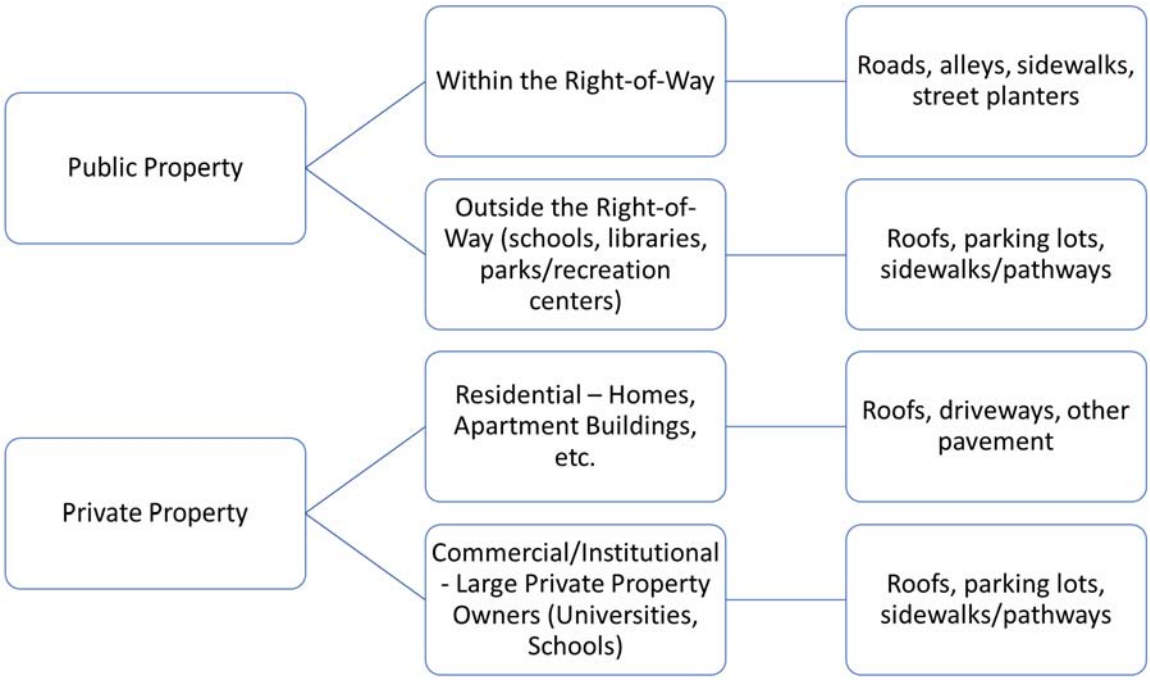


**Figure 2-6. Types of Impervious Area within Property Types**

## 2.3 Review of GI Technology Opportunities within the District and across the Nation

Following the identification of the large areas of impervious surfaces that could be targeted for managing stormwater, DCCR conducted an evaluation of relevant GI standards in the District and nationwide, to identify the types of GI control measures that could be used to manage the stormwater from those surfaces, with the intention of using standard designs for both the GI application analysis for the GI Program Plan as well as to assist in the development of GI design standards for use on all projects with the Rock Creek and Potomac River sewersheds. The review investigated both programs focused on GI implementation within the ROW as well as the programs focused on incentivizing GI on private properties. The following Section provides an overview of that review.

### 2.3.1 Review of District and National GI Standards for GI Application in the ROW

The majority of DCCR GI projects will be located on land that DCCR does not own, but will be instead located within the District public ROW. It is, therefore, imperative that DCCR work closely with appropriate agencies such as the District Department of Transportation (DDOT) and the Department of Energy and Environment (DOEE) in the District. Both of these agencies have guidance and requirements related to the design, siting, and construction of GI in the District and for DDOT in particular, have standardized GI designs for implementation in the ROW. To facilitate cooperation and agency approval, DCCR primarily evaluated and used the GI design elements in analysis from the details, specifications, and standards of these sister agencies, with modifications and/or additions from the review of other national standards as deemed necessary to achieve the goals of DCCR's GI Program Plan.

DOEE's stormwater management regulations are designed to protect water quality at the site level, to improve the quality of stormwater being directly discharged to the District waterbodies, public and private property, and public health. These regulations include requirements for managing both the quantity and quality of stormwater. DDOT has established design and construction standards and maintenance requirements for GI installed in the public ROW to ensure public safety, material quality, and effective use of public space in the public ROW. In contrast, protecting water quality in combined sewers is solely based on managing volume (quantity), because end of pipe flow is treated at the wastewater treatment plant except when the system overflows. To incorporate considerations for how to enhance the District's GI standards, DCCR extended its review to other CSO programs across the country that are using GI to identify how the approaches and adaptations could be applied to the DDOT standards to enhance the design of GI control measures constructed under the DCCR program for CSO control. A benchmarking study, which included a thorough review of national and municipal GI design standards and guidelines, served as an important tool in the development of the GI technologies used to demonstrate the GI application necessary to meet Amended Consent Decree requirements as well as the development of standard DCCR GI designs for the first project. Table 2-4 below provides an overview of the GI standards that were evaluated.

The benchmarking study revealed variations on designs and design elements that included examples such as alternate designs for contributing drainage area (CDA) ratios, underdrain configurations, inlet form and width, facility depths, curb and gutter configurations, grading of bioretention basins, guidance on construction sequencing, and many other elements for nearly every GI control measure type. At the same time, based on the review of standards, across the nation and within DC, there was consistency in the types of control measures that are used to manage stormwater from specific impervious areas within the ROW, which include:

- Permeable pavement to manage flows within alleys and along streets, usually in the parking lanes but also across the entire street; and
- Bioretention to manage flows from streets, either in the street planters between the sidewalks and the curb or as extensions of the curbs into the parking lanes.

With the consistency in control measures found in the evaluation of standards, DDOT's GI standards were selected to serve as the basis of design for the initial screening for GI application to achieve the Amended Consent Decree Requirements described later in this document. The DOEE Stormwater

Management Guidebook (2013) provided additional general guidance on GI siting, design, and construction. DDOT and DOEE standards were then adapted as needed to optimize performance for CSO control, by incorporating best practices resulting from a review of national standards, in order to meet DCCR program requirements. The enhancements to the DDOT standards were identified by looking for opportunities in other CSO programs' standards for design elements that facilitated maintenance, provided guidance for economical design and construction, met stormwater objectives, improved protection of public health and safety and existing infrastructure, and provided a consistent aesthetic.

For use with the first projects for Rock Creek and Potomac River sewersheds, DCCR is developing a set of GI standard details and specifications that will be reviewed and approved by the District targeted specifically to CSO volume reduction, beyond the level provided by typical GI control measures. The development approach consisted of national standards benchmarking process (as referred to above and detailed below), hydrologic and hydraulic modeling, and conceptual GI siting in the public ROW. DCCR GI designs will take into account siting criteria, design criteria, standard specifications, and construction and maintenance specifications that will be used to implement DCCR's GI Program Plan and will be a practical guide to maximizing storage capture and minimizing GI implementation costs.

**Table 2-4. Summary of District and National Design Standards Reviewed**

| | City/Agency | GI Standards |
|---|---|---|
| District Standards Consulted | District Department of Transportation | District of Columbia Department of Transportation Green Infrastructure Standards 2014 |
| | | 2011 DDOT Public Design Realm Manual, the 2009 DDOT Design and Engineering Manual, and the 2015 Standard Drawings and Specifications |
| | Department of Energy and Environment | 2013 Stormwater Management Guidebook |
| | DC Water | Green Infrastructure Utility Protection Guidelines |
| National Standards Consulted | San Francisco Public Utilities Commission (SFPUC), San Francisco, California | Green Stormwater Infrastructure Typical Details |
| | New York City (NYC) Department of Environmental Protection (DEP), New York, New York | NYC Green Infrastructure Program, ROW Bioswale Standard Design |
| | City Of Portland Bureau of Environmental Services Portland, Oregon | Stormwater Management Typical Details |
| | Seattle Public Utilities (SPU), Seattle, Washington | Seattle ROW Manual Typical Details |
| | Philadelphia Water Department (PWD), Philadelphia, Pennsylvania | Green City, Clean Waters Program; Maintenance Manual 2014; GI Standard Details; Stormwater Management Manual |
| | Prince George's County Department of Environmental Resources (DER), Maryland | Bioretention Design Details; Operation and Maintenance Manual |
| | Columbus Division of Sewerage and Drainage (DOSD), Columbus, Ohio | Blueprint Columbus Program |
| | Kansas City Public Works Department, Kansas City, Missouri | Manual of BMPs for Stormwater Quality 2012; Green Infrastructure Pilot Project Designs for CSO Subsheds |

### 2.3.2 Review of District-wide Stormwater Management Incentive Programs for GI Application on Private Property

Beyond publicly-owned properties in the District, the sewershed analysis had revealed a significant amount of impervious area that fell within private properties in the sewershed and the potential opportunity to manage stormwater with GI. For private property, DCCR investigated GI opportunities that included residential downspout disconnections combined with the use of rain barrels, green roofs, bioretention, and subsurface storage control measures. Ahead of investigating technically-feasible GI opportunities for private properties, DCCR reviewed local programs in the District that were currently incentivizing GI on private property for stormwater management and looked for ways to both learn from the existing programs as well as identify ways to complement these programs with a DCCR-specific program.

As is discussed in Section 4, DCCR's preliminary focus for GI opportunities on private property will be the implementation of a downspout disconnection incentive program combined with rain barrels. As such, DCCR reviewed existing local downspout disconnection and rain barrel programs. DCCR also interviewed the program administrators for two particular incentive programs: one currently incentivizing a wide variety of GI and a previous pilot program focused on incentivizing downspout disconnection. These programs are summarized below.

#### 2.3.2.1 DOEE's RiverSmart Program

As the entity in charge of managing the District's stormwater programs, DOEE strives to further reduce stormwater runoff pollution in the District. To achieve this goal, DOEE's Natural Resources Administration is currently implementing several programs for stormwater education and reductions under the brand RiverSmart. DOEE's RiverSmart program helps to reduce stormwater runoff to prevent polluted runoff discharging into the District's waterways and the Chesapeake Bay. The RiverSmart program provides financial incentives to help District property owners install GI such as rain barrels, green roofs, bioretention, permeable pavement, shade trees, etc.

The various programs that fall under the RiverSmart program include:

- RiverSmart Homes: for single-family residential properties, including a DOEE stormwater auditor performing an assessment of the property and making recommendations for potential projects
- RiverSmart Communities: for apartment buildings, housing cooperatives, condominiums, houses of worship, and locally-owned businesses
- RiverSmart Schools: for schools, including technical support, professional development, field trips to local rivers, community planting events, and assistance with installing outdoor classrooms
- RiverSmart Rooftops (also known as the Green Roof Rebate Program): for all properties that install green roofs
- RiverSmart Rebates: for property owners who do not want to wait for a stormwater audit through RiverSmart Homes, want to hire their own contractor, or want to "do-it-yourself"

- RiverSmart Targeted Watersheds: DOEE may provide higher incentives under the above programs for properties in targeted watersheds, with localized flooding and/or stream restorations. This has included the Bloomingdale, Hickey Run and Alger Park/Hillcrest sewersheds (specific neighborhoods that experience localized flooding) and other watersheds such as those in which DOEE is conducting a stream restoration.

#### 2.3.2.2 DOEE's Stormwater Fee Discount Programs

Two stormwater fee discount programs exist in the District: DOEE's RiverSmart Rewards and DC Water's Clean Rivers Impervious Surface Area Charge (IAC) Incentive Program. These programs are available to DC Water customers who manage stormwater on their properties using eligible best management practices (BMPs), such as rain barrels, pervious paving, green roofs, bioretention, and stormwater harvest/reuse systems. Discounts are calculated based on the volume of stormwater retained by BMPs, and the maximum discount is available for BMPs that retain the volume from the 1.2" storm. These programs help property owners save money on their water bills while contributing to cleaner, healthier rivers and streams. DOEE manages both programs. However, the rules for each differ in several ways.

- RiverSmart Rewards offers a discount of up to 55% on the DOEE Stormwater Fee.
- The Clean Rivers IAC Incentive Program offers a discount of up to 4% on the DC Water IAC.

The stormwater fees are based on the amount of impervious surface on each property. Impervious surface is measured in the number of Equivalent Residential Units (ERUs), on a property. Each ERU is based on the amount of impervious surface on a property. Single family residences are assessed a number of ERUs based on a tiered rate structure and the amount of impervious surface there is on a property.

#### 2.3.2.3 Rock Creek Conservancy's Downspout Disconnection Pilot Program

In 2010, DOEE awarded a grant to Rock Creek Conservancy, a local non-profit in the District, to pilot a residential downspout disconnection program. As part of this pilot program, a total of 38 roof downspouts were disconnected. Rock Creek Conservancy indicated that further disconnections were not completed due to the significant level of effort required to persuade property owners to disconnect, and the higher than anticipated personnel costs. Ultimately, the ongoing implementation of DOEE's RiverSmart Homes program (DOEE, 2015) superseded any extension of the Rock Creek Conservancy pilot, offering a wider range of GI incentives to property owners.

Based on the results of the residential downspout disconnection pilot study, Rock Creek Conservancy recommended the following:

- Integrate downspout disconnection into the RiverSmart Homes program;
- Implement a voluntary District-wide downspout disconnection rebate program; and
- Evaluate the possibility of a mandatory downspout disconnection program in combined sewershed (CSS) areas.

In its evaluation of a potential program to disconnect downspouts, any recommendations from this program were incorporated into the recommended program discussed in later sections of this GI Program Plan.

## 2.4 Summary of Volume Calculations for GI Technologies

Based on the opportunities for space for GI implementation within each sewershed as well as the potential GI technologies identified that could be employed within those spaces, DCCR developed the methodology to calculate volume both in analysis to determine the GI application to meet Amended Consent Decree requirements as well as the recommended volume calculation methodology for all of the GI projects. In that analysis, geotechnical and environmental data was considered due to its influence on infiltration and groundwater concerns and the suite of possible GI technologies that could be employed were considered. The following sections provide a summary of that analysis.

### 2.4.1 Geotechnical and Environmental Data

Geotechnical data from existing published reports, along with USGS soil classifications, were reviewed as part of an environmental and geotechnical data review to evaluate the feasibility of installing GI control measures within the Rock Creek and Potomac River sewershed project areas. The environmental and geotechnical data review also included identification of properties with potential environmental soil impacts based on a review of available environmental regulatory database data.

Additional geotechnical investigations, including soil borings, field and laboratory soil properties testing, soil environmental testing, and groundwater monitoring, are being performed for the first GI projects to establish broad geotechnical and environmental characteristics for each individual project area. These geotechnical and environmental investigations will provide the information necessary to properly design GI control measures to protect environmental quality and to protect occupational health of construction workers.

Field testing to be performed as part of these investigations includes:

- dynamic cone penetration testing to assess soil stability;
- falling-head infiltration testing to assess in-situ infiltration rates;
- screening of soil samples for total volatile organic compounds (VOC); and
- installation of monitoring wells to measure groundwater levels.

Soil samples have been collected in the field from all soil borings. Screening in the field was performed on all samples for potential environmental impacts by sight, odor, and testing for total VOCs, using a photoionization detector. If soil was identified in a sample that showed evidence of possible environmental impacts, that portion was used for laboratory testing. If no indications of environmental impacts were observed in the field, a composite sample was collected for testing. Laboratory testing of soil was performed for all soil borings to screen for environmental impacts included testing for Resource Conservation and Recovery Act metals, VOCs, semi-volatile organic compounds, total petroleum hydrocarbons (TPH) diesel range organics, and TPH-gasoline range organics.

Soil samples collected from boring locations were also tested for index properties, including visual classification, natural moisture content, grain size analysis, Atterberg limits and USDA classification. From the USDA classification, soil samples were given a hydrologic soil group identification.

For the first Rock Creek GI project, 55 borings have been performed and seven groundwater monitoring wells have been installed, which will be monitored for a period of one year. Investigations are ongoing for the first Potomac River GI project, and to date 75 borings have been performed and 12 groundwater monitoring wells have been installed. For both projects, throughout field investigations, observations have been reported regarding groundwater, infiltration, obstructing layers, and soil classification to provide information critical to the preliminary design. Figure 2-7 is an example map for preliminary work already performed within the Rock Creek sewershed for the first project. This example map is included to indicate general boring density. This approximate density of borings and testing protocol is anticipated to be used throughout the DCCR GI Program Plan.

Results of the geotechnical field testing will be used to inform the design-builder's design of excavation support and temporary construction measures. GI control measures will be designed using a conservative approach, to function effectively without in-situ infiltration. However, infiltration results from geotechnical field investigations will be used to inform long-term management of control measures, providing the potential opportunity to utilize in-situ infiltration in select locations for improved management.

In construction, results from the laboratory testing will be used to appropriately protect workers throughout construction and categorize the soil to be excavated so that it can be properly disposed. Impermeable liners shall be installed for any GI control measures located within an area where any chemical constituent tested for was found in excess of the residential Risk Screening Level published by the EPA was found, or for areas of confirmed or likely environmental impacts as noted in the review of the environmental regulatory database extract.

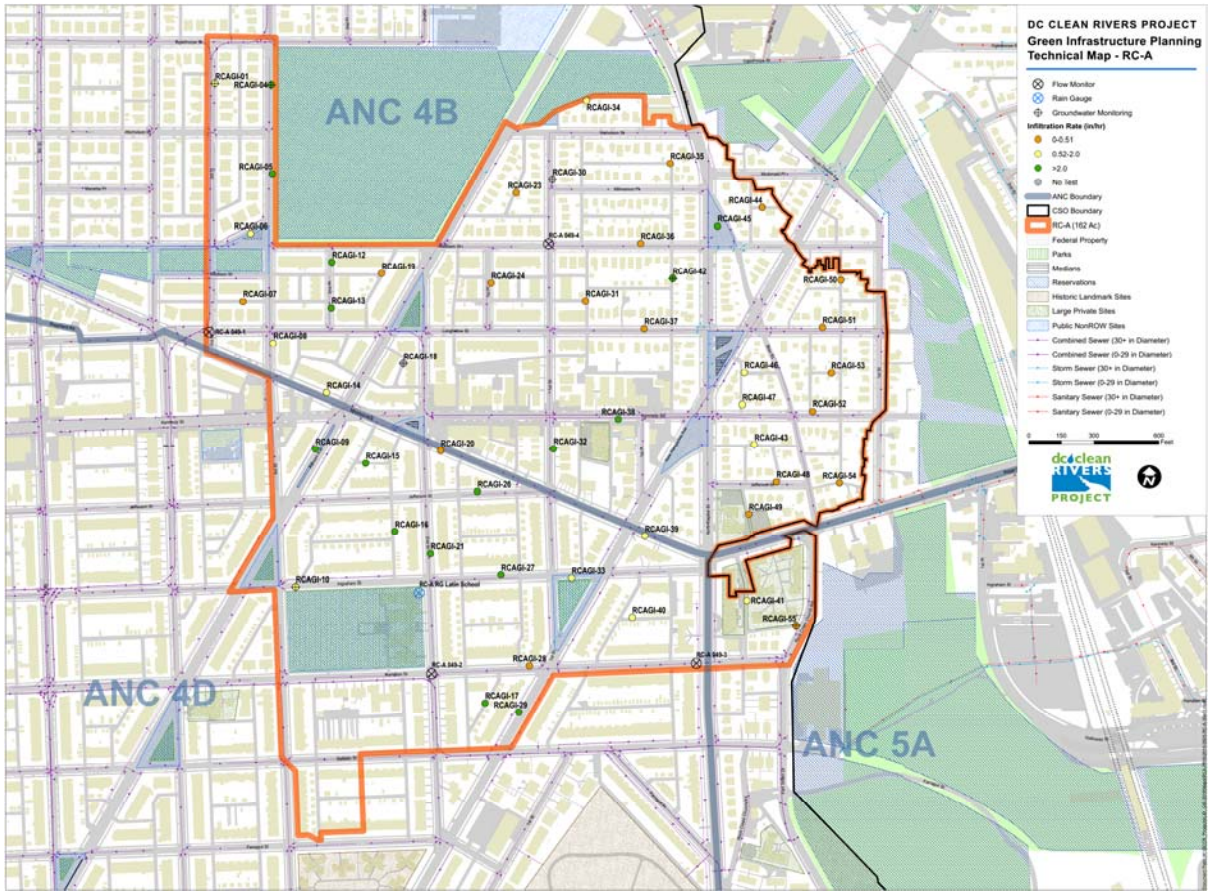


**Figure 2-7. Rock Creek Sewershed Example Borings Map**

### 2.4.2 Definition of 1.2" Retention Standard

As defined in the Amended Consent Decree, Section IV, Page 12, the "1.2" Retention Standard" is "the volume of water runoff produced by 1.2 inches of rain falling on an impervious surface". This Retention Standard refers to a storm that falls within the current 90$^{th}$ percentile rainfall event for the District, meaning that 90 percent of storms produce less than or equal to 1.2 inches of rain.

To achieve the Amended Consent Decree requirements, GI control measures for each project will be designed and constructed to collectively manage the required number of impervious acres to the 1.2" Retention Standard, as summarized in Table 2-5.

The volume managed by individual GI control measures will be maximized within site constraints, including but not limited to avoiding impacts to large existing trees, avoiding impacts to utilities, and protecting pedestrian and vehicular safety. If site conditions do not allow for any individual facility to detain the volume required to manage the 1.2" storm, multiple practices may be implemented in sequence to manage an equivalent volume within the collective drainage area. The 1.2" Retention Standard for any particular project will be achieved by managing 1.2" over the project area. Table 2-5 presents the volume equivalent for the Amended Consent Decree requirements.

**Table 2-5. Volume Management Requirements**

| Sewershed | Amended Consent Decree Requirements | |
|---|---|---|
| | Impervious Area Treated (acres) | Stormwater Volume to be Managed (MG)[1,2] |
| CSO 049 | 365 | 11.9 |
| CSO 027 | 31 | 4.3 |
| CSO 028 | 4 | |
| CSO 029 | 98 | |
| **Total** | **498** | **16.2** |

Notes:

1. Stormwater Volume to be Captured = Impervious Area Treated x 1.2" Stormwater
2. MG = Million Gallons

Source: Adapted from Amended Consent Decree (2016).

As defined in the Amended Consent Decree (Section IV, Item 7, Page 10), GI means both Low Impact Development (LID) and Low Impact Development Retrofit (LIDR). Further, in the same document LID is defined as "design and techniques that store, infiltrate, evaporate and detain runoff". LIDR is defined as "the modification of an existing site to accomplish LID goals". From the identification of GI technologies with potential for use on the GI projects, below are the selected GI control measures (and descriptions) that are discussed in the Amended Consent Decree and may be used as part of DCCR's GI Program Plan:

- **Bioretention facilities** are depressed, landscaped basins that allow stormwater to collect and infiltrate through plants and soils to an aggregate storage layer for temporary storage. Evapotranspiration also helps to manage the volume. These control measures may allow groundwater recharge by water infiltration through subgrade. In cases where infiltration is not feasible, underdrains can slowly release flow back into the sewer system.
- **Permeable pavement facilities** replace impervious, traditional paving surfaces with materials that provide the necessary structural support for vehicles and pedestrians while allowing stormwater to infiltrate into the underlying aggregate storage layer for temporary storage. Similar to bioretention, these control measures may allow groundwater recharge through infiltration but where infiltration is not feasible, underdrains can slowly release flow back into the sewer system.
- **Subsurface storage facilities** replace typical layers beneath existing surfaces (e.g. sidewalks, roads, pervious areas, etc.) with stormwater detention that reduces stormwater volumes flowing into the sewer. Subsurface storage may consist of an aggregate storage layer, underground tanks or chambers, or pipes and may either allow infiltration beneath the facility depending on the type of control measure or may use an underdrain to release flow back into the sewer system.
- **Rooftop collection practices** are a variety of control measures that collect runoff from roofs either on the roof or adjacent to the roof. These control measures can be used singularly or in combination with another GI control measure, including bioretention and subsurface storage practices, to maximize detention.

- **Downspout disconnection** in its simplest form involves the disconnection of a roof drain from the sewer system and the redirection of the stormwater flow from the disconnection to an adjacent pervious area. This control measure manages runoff close to its source by intercepting, infiltrating, filtering, treating, or otherwise reusing (e.g. rain barrel) the stormwater before it is conveyed from an impervious surface to the storm sewer. More complex arrangements may include disconnecting to a bioretention, infiltration, storage, or rainwater harvesting solution such as a rain barrel or cistern.
- **Cisterns, rain barrels, and rainwater harvesting** are storage control measures that capture and hold stormwater so it can be reused for non-potable uses or for on-site infiltration. Cisterns can be sized for large-scale commercial or small-scale residential applications. Residential cisterns are commonly referred to as rain barrels.
- **Green roofs** capture and store rainfall in an engineered growing media designed to support plant growth and retain water for plant uptake and atmospheric evaporation, which consequently reduces runoff volumes and rates.

- **Targeted sewer separation** separates the flows in a single-pipe combined sewer system into two pipes to carry stormwater and sanitary sewage in separate pipes. For any implementation of this technology, new sewers would be installed to convey either the sanitary sewage or the stormwater, and existing pipes would be used to carry the other flow. Because wastewater is separated from the influence of stormwater, wastewater is removed from any stormwater discharges to waterways during storm events.

A description of the typical formulas used to calculate the volume managed by the GI control measures are summarized in Table 2-6.

**Table 2-6. Calculations for Volume Managed by Each GI Control Measure**

| GI Control Measures | Calculation for Volume Managed by Each GI Control Measure (without infiltration)[3] |
|---|---|
| Bioretention<br>- Curb Extension Bioretention<br>- Planter Bioretention<br>- Open Area Bioretention<br>- Bioswale | [**Initial Storage Volume in GI Practice** from invert to overflow elevation[2] (including mulch, aggregate storage layer, subsurface storage used under adjacent sidewalks and/or bioretention soil media)] –<br>[**Volume Adjustment** due to utilities/utility protection, check dams within GI facilities, and other design factors] |
| Permeable Pavement<br>- Roads (Parking/Travel Lanes)<br>- Alleys<br>- Pedestrian Walkways<br>- Parking Lots | [**Initial Storage Volume in GI Practice** from upstream invert to overflow elevation[2]] –<br>[**Volume Adjustment** due to Utilities/Utility Protections, and/or Check Dams within GI Facilities] |
| Rooftop or Subsurface Storage | Volume of water stored in GI Practice from upstream invert to overflow elevation[2] |
| Downspout Disconnection | Roof Area x Runoff Coefficient[1] |
| Green Roofs | Not Applicable |
| Sewer Separation | Total Drainage Area Separated |

Notes:

1. Reference Table 3-8 for runoff coefficients for each sewershed.
2. All calculated volumes account for porosities of various materials used. Non-porous infrastructure within control measures is excluded from detention volume.
3. Pending the results of geotechnical investigations, infiltration may be utilized to manage runoff. In those cases, the volume managed equals the practice volume plus the design infiltration volume.

### 2.4.3 Volume Contributions from the District's Stormwater Management Regulations

DOEE undertook management of the Municipal Separate Storm Sewer System (MS4) permit in 2007. Within the current permit are requirements that all new development and large-scale redevelopment must implement stormwater retention Best Management Practices. Specifically, the permit requires "the design, construction and maintenance of stormwater controls to achieve on-site retention of 1.2" of stormwater from a 24-hour storm… for all development greater than or equal to 5,000 square feet." (DOEE, 2011). DOEE is also undertaking GI retrofits for properties that aren't undergoing construction that triggers the District's stormwater management regulations. To provide consistency for construction of GI projects in the public ROW, DDOT developed GI standards to standardize the types and designs of control measures to be used.

Beyond the regulations that require GI retrofits and to aid developers who cannot achieve stormwater management requirements using GI retrofits on their development, DOEE implemented a Stormwater Retention Credit (SRC) Trading Program that provides a financial incentive for property owners in

the District to voluntarily install BMPs that retain stormwater. Properties that do not trigger the regulations but install BMPs, or that exceed their retention requirements can generate SRCs to sell to regulated sites or bank for later use.

Because DOEE's permit requirements require District-wide implementation, GI will likely be implemented in the CSS, as well as MS4. DCCR will count volume managed by any GI control measure in the Amended Consent Decree CSSs installed to meet DOEE's regulations toward the Amended Consent Decree requirements. The approach to tracking that volume as well as the estimate of how much volume will be managed through these retrofits is discussed below.

#### 2.4.3.1 Approach to Tracking MS4 Retrofits

Each year by January 30th, DOEE will provide DC Water with GIS mapping of MS4 GI control measures constructed in the prior calendar year within the sewersheds for CSOs 027, 028, 029 and 049. This will include:

- Status of permits - issued, expired, closed out, and the reason if the latter applies;
- Facilities descriptions including type, drainage area, and capacity;
- Inspection and maintenance status; and
- Compliance status, along with any compliance directives issued.

#### 2.4.3.2 Estimated MS4 Retrofit Acreage

Between 2011 and 2014, 129,567 square feet within the Potomac River sewershed, and 168,012 square feet within the Rock Creek sewershed were retrofitted with BMPs (DOEE, 2015). The BMPs for these four years within the Rock Creek and Potomac River GI sewersheds are shown in Figures 2-8 and 2-9, respectively. The annual average area retrofitted over the four years is 0.74 acres for Potomac River and 0.96 acres for Rock Creek. Both of these averages are well below 1% of the total impervious area in each sewershed, as reflected in the projections included in Sections 4.2.3 and 4.3.3 below.

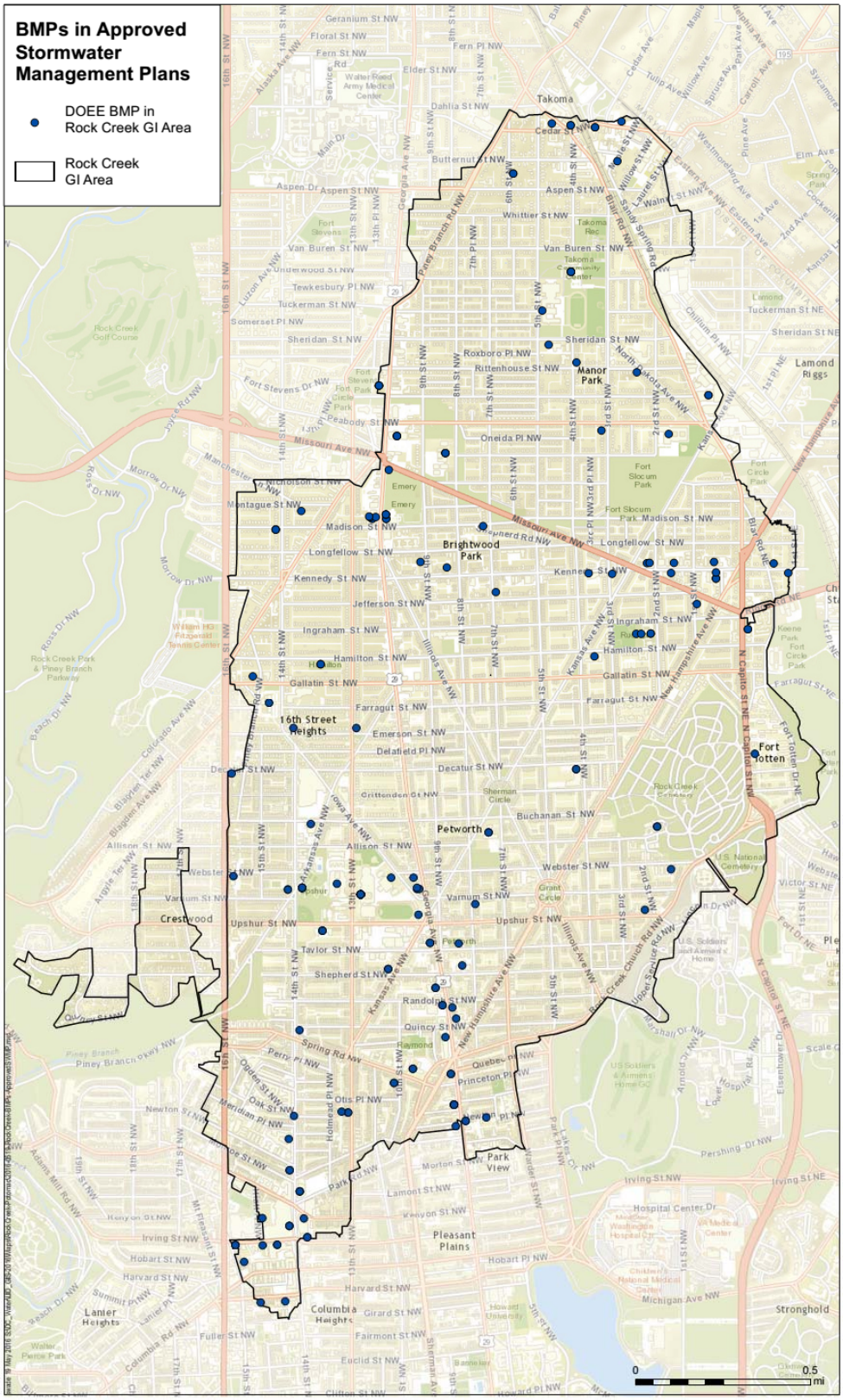


**Figure 2-8. BMPs in Rock Creek GI Sewershed, 2011 through 2014**

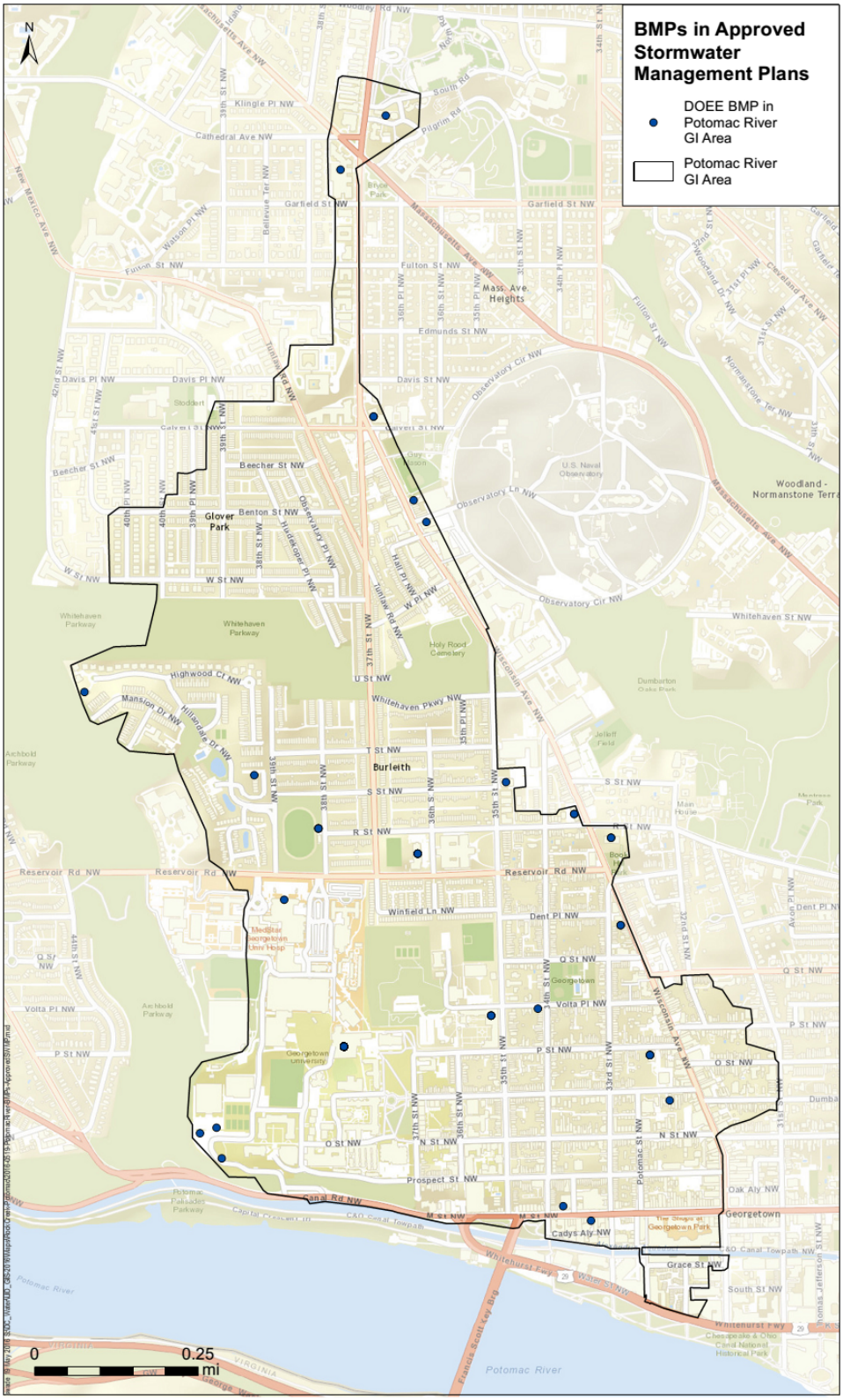


**Figure 2-9. BMPs in Potomac River GI Sewersheds, 2011 through 2014**

# 3 Rock Creek and Potomac River Sewershed Analyses

## 3.1 Introduction

This Section details the analyses of the Rock Creek and Potomac River Sewersheds that determined the GI application necessary to achieve Amended Consent Decree requirements and formed the basis of design for the GI projects. The analyses included modeling of GI to demonstrate equivalent volume managed, followed by a further investigation of GI potential for the public property within the ROW as well as other public properties (i.e. schools, recreation centers, etc.; termed "non-ROW sites"), private property sites, and partially separated areas. Stormwater runoff that flows off of properties adjacent to the ROW that could be managed by a GI facility in the ROW (off-site contribution) is taken into consideration as part of the analyses.

## 3.2 Overview of Analyses

As discussed previously, the Amended Consent Decree requirements stipulated the equivalent volume that would be managed by each of the GI projects in the sewersheds. DCCR conducted a series of analyses using GIS and hydrologic/hydraulic modeling to understand range in GI application necessary to manage 1.2" of runoff from 365 impervious acres in the Rock Creek sewershed, and 1.2" of runoff from 133 impervious acres in the Potomac River sewershed.

The GIS data introduced in Section 2 was evaluated to assess the type, level, and cost for GI implementation for each CSO sewershed. This analysis included the investigation of GI opportunities on ROW sites, non-ROW sites, and private property sites. These analyses were performed for the Rock Creek and Potomac River drainage areas, starting with identification of representative areas or categories (i.e. place of worship, school, park, residential block, commercial block, etc.) and representative sites within those areas/categories that could be used to better understand GI implementation at the site level and then relate it back to the broader sewershed. Site walks were completed for the representative sites to collect data aimed to further define typical site opportunities and constraints for GI control measure implementation. GI application ranges, including estimated volume managed and associated cost, were estimated through control measure siting at representative sites.

### 3.2.1 Right-of-Way Sites

Within the Rock Creek Sewershed, analyses were completed on CSO 049's public ROW sites. Analyses were completed for possible GI control measures in representative areas and representative blocks. Representative "areas" are large subdivisions of the sewershed defined based on land use characteristics, whereas representative "blocks" are much smaller areas, typically the size of a city block, and defined based on characteristics that match the larger "area".

Using the same approach as in the Rock Creek sewershed, analyses were completed for the public ROW in the Potomac River sewershed for CSOs 027, 028, and 029 for implementation of GI. CSO 029 is already partially separated. Partially separated areas are discussed at more length in Section 3.2.3.

#### 3.2.1.1 Identification of Representative Right-of-Way Areas

In each sewershed, non-ROW sites, large private property sites, and historical landmark sites were excluded from the representative areas for public ROWs. Initial criteria were set for the representative areas and to identify representative blocks for GI sites. Representative ROW areas fell into two distinct categories, residential areas which were made up of low to medium density residential neighborhoods, and corridors which consisted of high density residential streets, commercial streets, and major travelways throughout the District (arterials, major collectors, etc.). For residential areas, criteria were established for impervious cover, land use, tree density, and zoning. For corridors, criteria included DDOT street classification, dedicated parking lanes, number of travel lanes, and land use.

Table 3-1 summarizes the impervious surface characteristics within the residential representative areas. Table 3-2 summarizes the impervious surface characteristics within the corridor representative areas.

**Table 3-1. Residential Representative Areas in Public ROW**

| Residential Representative Areas (ac) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Residential Area** | **CSO Area** | **Alley** | **Rooftop** | **Road+Intersection** | **Sidewalk** | **Other** | **Total Impervious** |
| **Potomac River 1** | 029 | 8 | 35 | 15 | 5 | 3 | 66 |
| **Potomac River 2** | 027 | 3 | 29 | 9 | 7 | 3 | 51 |
| | 028 | 0 | 2 | 1 | 1 | 0 | 4 |
| **Rock Creek 1** | 049 | 35 | 137 | 98 | 35 | 16 | 320 |
| **Rock Creek 2** | 049 | 65 | 293 | 136 | 57 | 23 | 575 |
| **Grand Total** | | **11** | **495** | **259** | **104** | **46** | **1015** |

**Table 3-2. Corridor Representative Areas in Public ROW**

| Corridor Representative Areas (ac) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Corridor** | **Total Area** | **Alley** | **Rooftop** | **Road+Intersection** | **Sidewalk** | **Other** | **Total Impervious** | **Total Pervious** |
| **Potomac River 1** | 17 | 0 | 3 | 9 | 3 | 1 | 15 | 2 |
| **Potomac River 2** | 6 | 0 | 1 | 3 | 1 | 0 | 6 | 0 |
| **Potomac River 3** | 25 | 0 | 3 | 10 | 5 | 0 | 19 | 6 |
| **Potomac River 4** | 29 | 0 | 6 | 10 | 5 | 1 | 21 | 8 |
| **Rock Creek 1** | 37 | 0 | 4 | 19 | 6 | 2 | 31 | 5 |
| **Rock Creek 2** | 37 | 0 | 3 | 12 | 7 | 1 | 22 | 5 |
| **Rock Creek 3** | 45 | 0 | 0 | 18 | 5 | 1 | 25 | 20 |
| **Rock Creek 4** | 130 | 1 | 7 | 54 | 16 | 5 | 81 | 49 |
| **Grand Total** | **316** | **2** | **28** | **134** | **46** | **10** | **221** | **95** |

#### 3.2.1.2 Identification of Representative Blocks

Based on the representative area analysis, selection criteria based on values and ranges for these various characteristics were developed for the Rock Creek representative areas.

Selection criteria for identifying representative blocks for residential areas included the following:

- Impervious cover;
- Land use density;
- Tree density (trees per acre); and
- Zoning.

Selection criteria for identifying representative blocks for corridor areas included the following:

- DDOT street classification;
- Dedicated parking;
- Travel lanes;
- Land use;
- Planter width; and
- Utility conflicts.

For both corridor and residential representative areas, each representative block selected was required to be within one (1) standard deviation of the mean for each of the selection criteria within the representative corridor or area.

Figure 3-1 shows the two unique residential areas and four unique corridors that were identified as representative areas for GI sites in the Rock Creek sewershed, as well as the representative blocks within these areas. The two residential areas are the Rock Creek North and South areas.

Figure 3-2 shows the two unique residential areas and four unique corridors that were identified as representative areas for GI sites for the Potomac River sewershed, as well as the representative blocks within the areas. The two residential areas are the Potomac North and South areas.

Table 3-3 summarizes the impervious area for the four residential blocks in Rock Creek. Table 3-4 summarizes the impervious area for the four corridor blocks in Rock Creek. Table 3-5 summarizes the impervious area for the four residential blocks in Potomac River. Table 3-6 summarizes the impervious area for the four corridor blocks in Rock Creek.

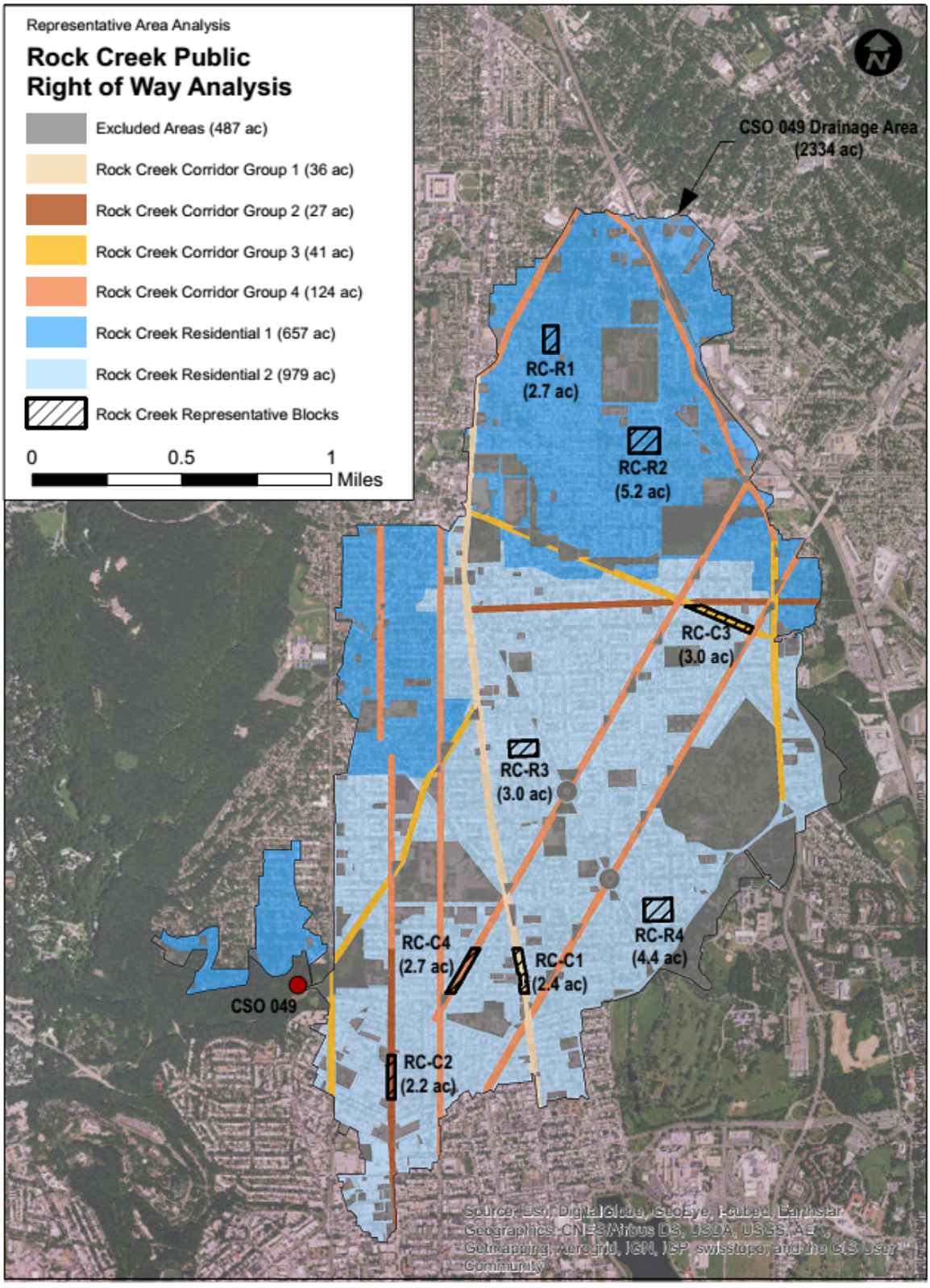


**Figure 3-1. Rock Creek Sewershed – Public Right-of-Way Analysis**

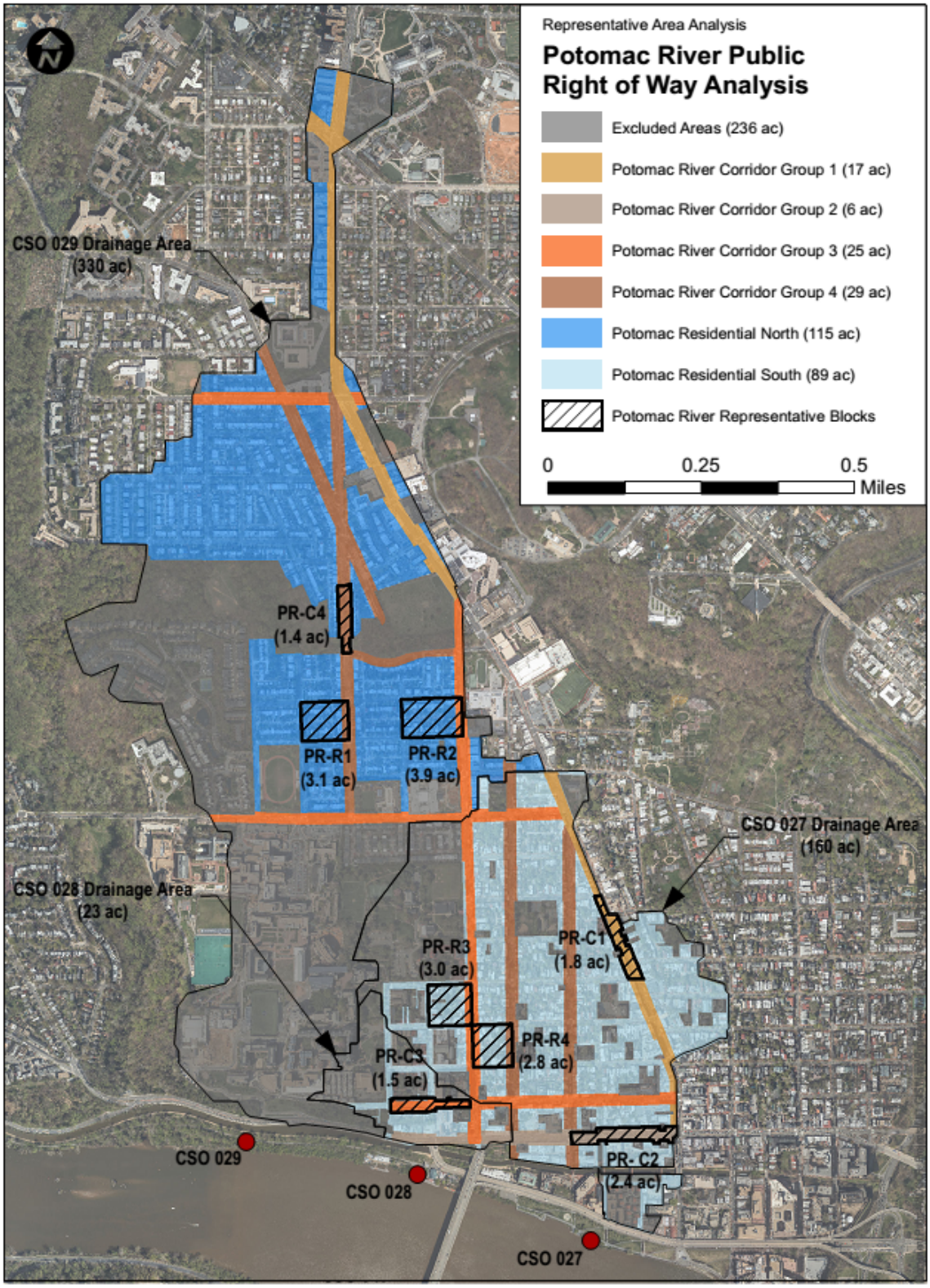


**Figure 3-2. Potomac River Sewershed – Public Right-of-Way Analysis**

## Table 3-3. Rock Creek Residential Design Block Impervious Area Breakdown

| Rock Creek Residential Design Block Imprevious Area Breakdown | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Residential Block # | Area ($ft^2$) | | | | | | | | Percentages | | | | | | |
| | Total Area | Alley | Rooftop | Road+Intersection | Sidewalk | Other | Total Impervious | Total Pervious | Alley | Rooftop | Road+Intersection | Sidewalk | Other | Total Impervious | Total Pervious |
| **RCR1** | 113902 | 9356 | 25047 | 17558 | 7314 | 0 | 59275 | 54627 | 8% | 22% | 15% | 6% | 0% | 52% | 48% |
| **RCR2** | 227203 | 14922 | 37825 | 29663 | 10014 | 6640 | 99063 | 128140 | 7% | 17% | 13% | 4% | 3% | 44% | 56% |
| **RCR3** | 127225 | 10109 | 42182 | 17237 | 8614 | 0 | 78141 | 49084 | 8% | 33% | 14% | 7% | 0% | 61% | 39% |
| **RCR4** | 188314 | 13609 | 50919 | 26065 | 10501 | 0 | 101094 | 87220 | 7% | 27% | 14% | 6% | 0% | 54% | 46% |
| **Grand Total** | **656644** | **47996** | **155972** | **90523** | **36442** | **6640** | **337574** | **319071** | **7%** | **24%** | **14%** | **6%** | **1%** | **51%** | **49%** |

## Table 3-4. Rock Creek Corridor Design Block Impervious Area Breakdown

| Rock Creek Corridor Design Block Imprevious Area Breakdown | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Corridor Block # | Area ($ft^2$) | | | | | | | | Percentages | | | | | | |
| | Total Area | Alley | Rooftop | Road+Intersection | Sidewalk | Other | Total Impervious | Total Pervious | Alley | Rooftop | Road+Intersection | Sidewalk | Other | Total Impervious | Total Pervious |
| RC-C1 | 69226 | 268 | 85 | 39786 | 10435 | 1232 | 51806 | 17420 | 0% | 0% | 57% | 15% | 2% | 75% | 25% |
| RC-C2 | 64306 | 169 | 9 | 36470 | 17499 | 13 | 54161 | 10144 | 0% | 0% | 57% | 27% | 0% | 84% | 16% |
| RC-C3 | 106185 | 3848 | 75 | 43876 | 11280 | 1914 | 60993 | 45192 | 4% | 0% | 41% | 11% | 2% | 57% | 43% |
| RC-C4 | 90415 | 1031 | 32 | 32868 | 11360 | 0 | 45291 | 45124 | 1% | 0% | 36% | 13% | 0% | 50% | 50% |
| **Grand Total** | **330131** | **5316** | **202** | **152999** | **50575** | **3159** | **212251** | **117880** | **2%** | **0%** | **46%** | **15%** | **1%** | **64%** | **36%** |

## Table 3-5. Potomac River Residential Design Block Impervious Area Breakdown

| Potomac River Residential Design Block Imprevious Area Breakdown | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Residential Block # | Area ($ft^2$) | | | | | | | | Percentages | | | | | | |
| | Total Area | Alley | Rooftop | Road+Intersection | Sidewalk | Other | Total Impervious | Total Pervious | Alley | Rooftop | Road+Intersection | Sidewalk | Other | Total Impervious | Total Pervious |
| **PRR1** | 135790 | 9418 | 31067 | 23728 | 7289 | 0 | 71501 | 64289 | 7% | 23% | 17% | 5% | 0% | 53% | 47% |
| **PRR2** | 169393 | 7084 | 46958 | 23779 | 10482 | 2078 | 90382 | 79011 | 4% | 28% | 14% | 6% | 1% | 53% | 47% |
| **PRR3** | 132678 | 0 | 38085 | 21479 | 14146 | 2335 | 76045 | 56633 | 0% | 29% | 16% | 11% | 2% | 57% | 43% |
| **PRR4** | 119396 | 3649 | 41859 | 17467 | 13205 | 0 | 76180 | 43216 | 3% | 35% | 15% | 11% | 0% | 64% | 36% |
| **Grand Total** | **557258** | **20151** | **157970** | **86453** | **45122** | **4413** | **314109** | **243149** | **4%** | **28%** | **16%** | **8%** | **1%** | **56%** | **44%** |

## Table 3-6. Potomac River Corridor Design Block Impervious Area Breakdown

| Potomac River Corridor Design Block Imprevious Area Breakdown | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Corridor Block # | Area ($ft^2$) | | | | | | | | Percentages | | | | | | |
| | Total Area | Alley | Rooftop | Road+Intersection | Sidewalk | Other | Total Impervious | Total Pervious | Alley | Rooftop | Road+Intersection | Sidewalk | Other | Total Impervious | Total Pervious |
| PR-C1 | 30123 | 0 | 132 | 18592 | 8020 | 507 | 27252 | 2871 | 0% | 0% | 62% | 27% | 2% | 90% | 10% |
| PR-C2 | 70136 | 0 | 892 | 53493 | 15451 | 157 | 69994 | 142 | 0% | 1% | 76% | 22% | 0% | 100% | 0% |
| PR-C3 | 44202 | 0 | 518 | 27208 | 15038 | 348 | 43113 | 1089 | 0% | 1% | 62% | 34% | 1% | 98% | 2% |
| PR-C4 | 54553 | 128 | 297 | 31571 | 9484 | 9 | 41489 | 13064 | 0% | 1% | 58% | 17% | 0% | 76% | 24% |
| **Grand Total** | **199014** | **128** | **1840** | **130865** | **47994** | **1022** | **181848** | **17166** | **0%** | **1%** | **66%** | **24%** | **1%** | **91%** | **9%** |

#### 3.2.1.3 Analysis of Off-Site Contribution

Since the majority of GI will be implemented in the ROW, there are many opportunities to manage offsite contribution of stormwater runoff from private property. Offsite contribution was accounted for based on the topography as indicated in the District's GIS files during design, and confirmed with field visits. Another opportunity is managing stormwater runoff from rooftops by disconnecting downspouts on private property. An inventory of the status of existing downspouts and drainage patterns was performed, in order to estimate the current and potential contribution from rooftop runoff and inform the development of a downspout disconnection program, as described in Section 4.6. Based on information generated by that inventory, rooftops were initially divided into the following categories:

- CND – Connected, cannot disconnect
- CCD – Connected, can disconnect
- CCDGI – Connected, can disconnect if GI is implemented
- CNS – Cannot see
- D – Disconnected

The CNS downspouts were re-categorized, based on the slope direction. If the slope drained toward the building, the "Cannot See" downspouts were assumed to be connected and that they will remain connected. These downspouts were re-categorized as "Connected, cannot disconnect". If the slope drained away from the building, the "Cannot See" downspouts were assumed to be connected and that they can be disconnected. These downspouts were re-categorized as "Connected, can disconnect". Lastly, the assumption was made that all blocks have GI, so all "Connected, can disconnect if GI is implemented" was assigned to "Connected, can disconnect."

In the final re-categorizing of downspouts as either connected or disconnected, all "Connected, cannot disconnect" (including the newly categorized CND) became "Connected", and all "Disconnected" remained "Disconnected". Of the re-categorized "Connected, can disconnect" from the previous step, 50% of all homes with one or more CCD were assumed to be disconnected, and 50% were assumed to stay connected. Results of this inventory and classification was input into GIS and made available for use in design.

This information will be used to appropriately size GI control measures during design, and inform outreach opportunities for downspout disconnection. Incorporating results from this inventory into the design process early on allows for the opportunity to effectively manage runoff from rooftops, currently connected to the combined sewer, that may be disconnected as part of the downspout disconnection program.

A GIS model was used to quantify the impact of downspout disconnection as a runoff volume reduction practice in comparison to other GI control measures. First, a baseline model run was completed, using the existing GI SWMM and MIKE URBAN models as a basis for this analysis. A baseline model scenario was developed to calculate the total runoff volume in: CSOs 027, 028, and 029 (Potomac River CSS); and CSO 049 (Rock Creek CSS). Total runoff volume was calculated based on the accepted 3-year "average year" period of 1988-1990 used for all DCCR modeling.

Annual runoff volume was calculated upstream of CSO diversion structures to account for all runoff from the surface. This was, and remains, equivalent to the methodology used to calculate runoff reductions from other GI control measures.

Downspout disconnection was represented in the model by re-routing runoff attributed to rooftops. In the baseline model, rooftop runoff was routed directly to the collection system. In the downspout disconnection scenario, rooftop areas were routed to the upstream end of the containing catchment, so that runoff had the opportunity to infiltrate and evaporate before entering the sewer system. The containing catchment was assigned the properties of the land surface surrounding the rooftops. For instance, in dense neighborhoods with high imperviousness or poor soils, the downspout disconnection would have less of an impact on runoff reduction. In neighborhoods with high amounts of pervious area and/or good soils, downspout disconnection has a greater impact on runoff reduction. The model was run for the 3-year period, and the total runoff reduction caused by re-routing rooftop runoff was calculated for each individual GI CSO area.

The total annual runoff reduction was normalized based on the area of rooftop in each of the sewersheds to calculate the runoff reduction per rooftop area. Additionally, this was normalized to a 1.2” rainfall event to equate results with other GI runoff reduction calculations based on capturing 1.2” of runoff over a contributing area. The runoff reduction volume statistics for the scenarios evaluated in this modeling exercise are shown in Table 3-7.

**Table 3-7. Downspout Disconnection Annual Runoff Reduction**

| Downspout Disconnection Percentage | Annual Runoff Volume (MG) |
|---|---|
| CSO 049 | |
| **0 (Baseline)** | 1016.0 |
| **50** | 903.7 |
| **100** | 760.3 |
| CSO 027 | |
| **0 (Baseline)** | 433.3 |
| **50** | 426.0 |
| **100** | 416.0 |
| CSO 028 | |
| **0 (Baseline)** | 3.7 |
| **50** | 2.8 |
| **100** | 2.0 |
| CSO 029 | |
| **0 (Baseline)** | 153.3 |
| **50** | 136.0 |
| **100** | 114.7 |

Table 3-8 displays the normalized runoff reduction results per rooftop area and the 1.2" rainfall event. The runoff coefficient is calculated as 1 (total runoff reduction attributed to downspout disconnection / runoff volume of 1.2" of rain falling on rooftop areas).

**Table 3-8. Normalized Runoff Reduction Results**

| Combined Sewer Area | Rooftop Area (SF) | Volume Difference (100%-0%) (MG) | Gallons per Square Foot of Rooftop Disconnected | Gallons per Square Foot of Rooftop per 1.2" of Rain | Runoff Coefficient |
|---|---|---|---|---|---|
| **CSO 049** | 20,791,188 | 255.7 | 12.30 | 0.360 | 0.52 |
| **CSO 027** | 2,204,136 | 17.3 | 7.86 | 0.230 | 0.69 |
| **CSO 028** | 187,308 | 1.7 | 9.08 | 0.266 | 0.64 |
| **CSO 029** | 3,005,640 | 38.7 | 12.86 | 0.377 | 0.50 |

#### 3.2.1.4 Application of Typical GI in Representative Areas and Blocks

Applicable GI technologies were selected based on the sewershed characterization, review of aerial mapping, and physical surveys of the drainage areas. Based on this review, the following GI control measures were selected as representative of the range of viable technologies in terms of volume managed, cost effectiveness, and applicability:

- Pervious Pavement; and
- Bioretention (Planter and Curb Extension).

Other GI technologies may also be feasible; however the above technologies were used to be representative of possible technologies.

Using the representative areas and blocks, a desktop analysis was conducted to assess implementation feasibility for the desirable mix of GI control measures. Field verification was performed to confirm such items as traffic/parking impacts, slopes, and available space for GI control measures. The design approach included maximizing volume capture, minimizing cost, avoiding utility relocation, and avoiding tree removal. DCCR conducted field investigations on each representative block, and then located GI control measures within the representative blocks based on the feasibility analysis.

Contributing drainage areas (CDAs) were determined based on topography and drainage area characteristics. Using the 1.2" Retention Standard, volume was then calculated for each CDA. Next, the size required for each GI facility was calculated using the ratio of CDA: SA (GI Facility Surface Area, where SA stands for surface area of a control measure).

Final sizing of the control measures was determined by site constraints, and for sites determined to be feasible, the volume managed by each GI facility was calculated using the volume and porosity of each media or ponding layer. Results of the volume managed for each category of representative block or corridor were tabulated, including the percent of impervious area managed and the total volume managed for each.

GI siting (by type and percent of volume capture) in the blocks was then projected onto the areas to calculate expected GI application rates and costs. The results of the GI sizing and siting for the representative areas and blocks informed the basis for DCCR's GI Program Plan as well as the identification of the extents of the first two projects, one each in Rock Creek and Potomac River sewersheds. Section 4 provides details on these first two projects as well as the six projects to be implemented in the future.

### 3.2.2 Non-ROW Sites and Private Properties

Public non-ROW sites and large private properties were analyzed for the potential inclusion into the GI Program Plan using a similar method of analysis. The goal of this analysis was to identify the stormwater volume contribution and associated cost of siting GI control measures on private and public parcels that were not included in the public ROW analyses. A total of 318 acres of non-ROW public sites and 141 acres of private sites were analyzed for this process. Historic Landmark sites

totaling 152 acres were excluded from the analysis, with the exception of a school and church located inside Rock Creek Cemetery. Table 3-9 breaks down the types of sites by area within each CSS.

**Table 3-9. Areas of Public Non-ROW, Large Private Sites and Historic Landmark Sites**

| Sites | Rock Creek CSS (acres) | Potomac River CSS (acres) |
|---|---|---|
| Public non-ROW Sites | 250 | 51 |
| Large Private Sites | 89 | 52 |
| Historic Landmark Sites | 131 | 21 |
| **Total** | **470** | **124** |

Figures 3-3 and 3-4 show each sewershed's non-ROW sites and large private property sites included in the analysis, along with historical landmark sites located within each area. Within each CSS, parcels were identified using DC GIS data and sorted into categories, based on ownership and use. The list was then further refined to identify the parcels with the greatest feasibility for GI siting.

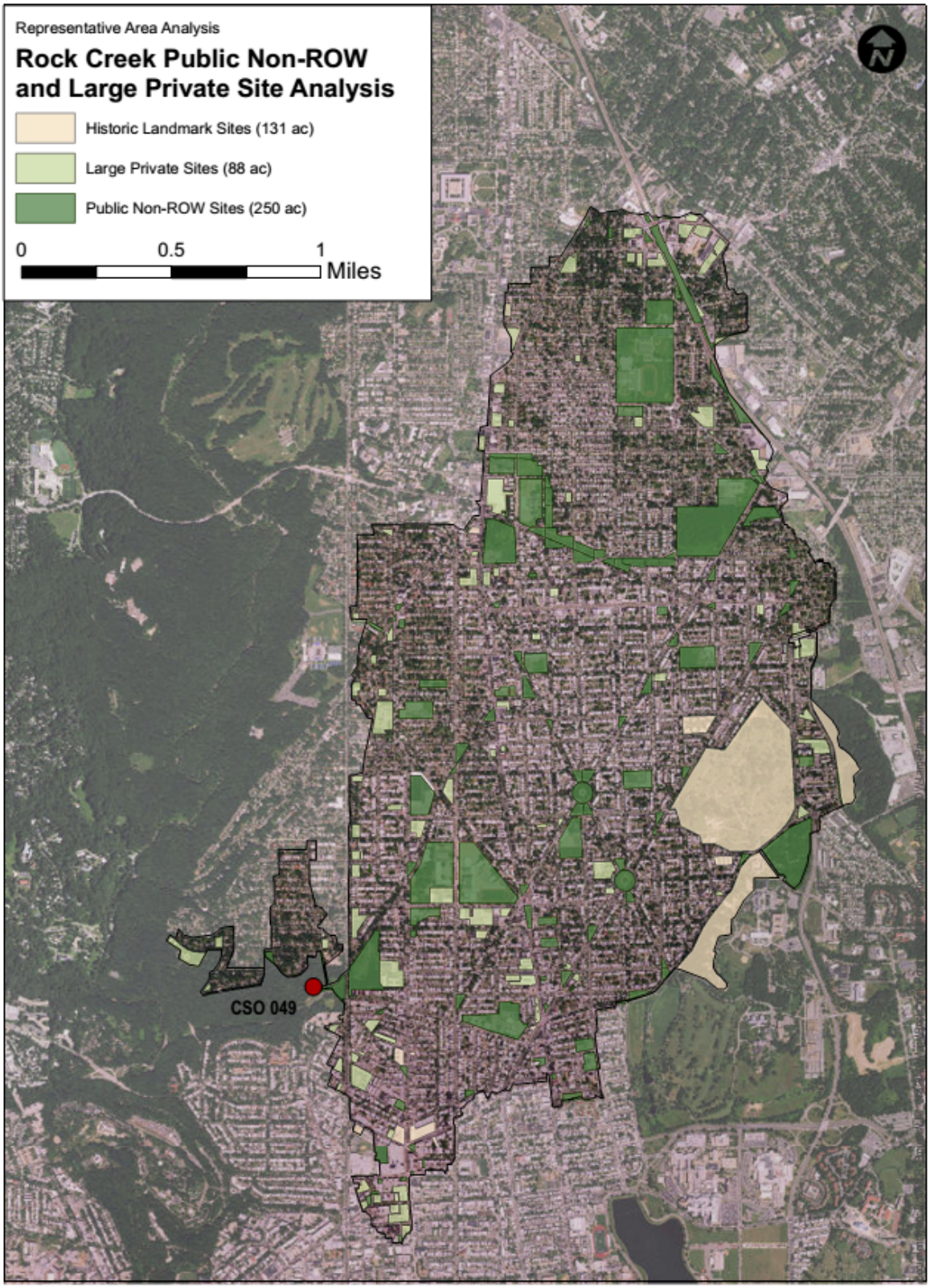


**Figure 3-3. Rock Creek Sewershed – Public Non-ROW and Large Private Site Analysis**

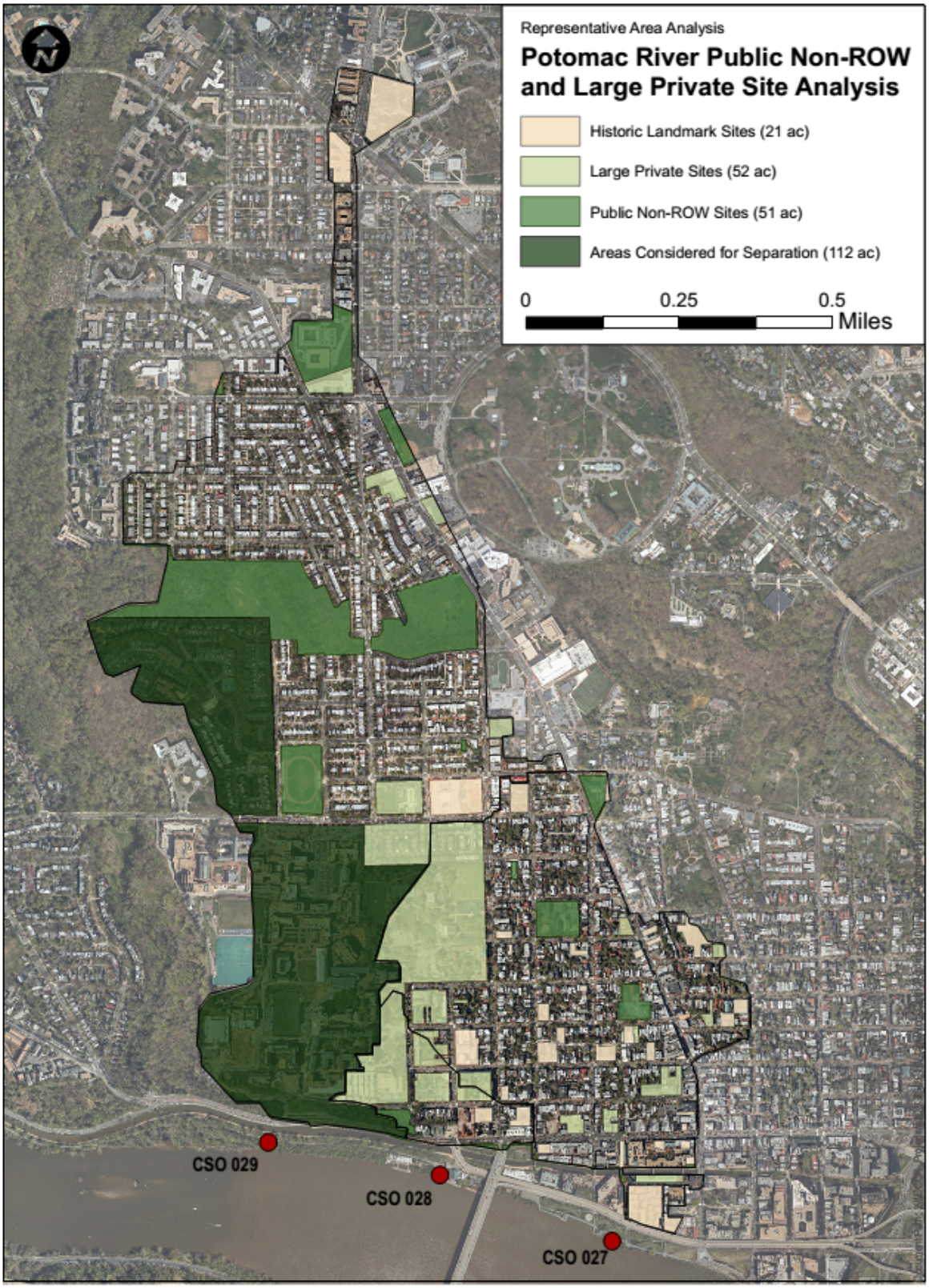


**Figure 3-4. Potomac River Sewershed – Public Non-ROW and Large Private Site Analysis**

#### 3.2.2.1 Identification of Sites

The non-ROW and private property site analysis was performed using GIS data, aerial photography, and field visits to selected sites. Sites were grouped into categories according to ownership (District, Federal, Washington Metropolitan Area Transit Authority (WMATA), or private) and use (schools, houses of worship, cemeteries, parks, police and fire stations, and public housing). A key assumption made for the analysis was that ownership or use would be a determinant of the type of GI sited on the parcel. For example, a school may prefer a bioretention facility to serve an educational purpose, while a fire station requires a paved facility.

Setting a minimum parcel size was necessary to screen parcels that were too small to feasibly site the planned GI control measure type. An analysis of impervious and pervious area revealed that most parcels require a minimum of 0.25 acres to feasibly site GI. Private sites, which have a greater percentage of impervious area, require a minimum of 0.5 acres to feasibly site GI.

Parks are an exception to the minimum parcel sizing restriction. Triangle parks are a unique parcel category that has strong potential for GI bioretention siting. These spaces, created by diagonal street intersections, are technically part of the public ROW but were incorporated into the parks category for ease of analysis.

Remaining sites were screened further to eliminate properties that were not feasible candidates for GI siting due to other factors. Privately-owned residences and commercial properties, extensively programmed sites, sites having buildings lacking external downspouts, heavily wooded properties, sites with steep slopes, and highly fragmented properties were all excluded from further consideration.

The initial site identification criteria are outlined in Table 3-10.

**Table 3-10. Initial Site Identification Criteria**

| Property Type | Minimum Parcel Size |
|---|---|
| Large Private Properties | 0.5 acres, with the exception that all Properties within the Hillandale Neighborhood and all properties owned by Georgetown University were included |
| Schools and Community Centers (Recreation Centers, Libraries, etc.) – Private and Public | 0.25 acres |
| Cemeteries | All |
| Places of Worship | 0.25 acres |
| Parks | 0.02 acres |
| DC-Owned Fire and Police Stations | 0.25 acres |
| WMATA Properties | All |
| Federal | All |
| DC Housing Authority Properties | All |

#### 3.2.2.2 Application of Typical GI at Non-Right-of-Way Sites

Specific GI siting methodologies were applied to sample parcels within each site category to determine the percentage of impervious area that could be captured by GI technologies. GI technologies were limited to either open area bioretention or permeable pavement. One or two GI application options were used for each parcel type. GI control measure sizes, capture volumes, and unit costs per gallon were derived from extent of impervious area treated for each parcel type.

Following a desktop analysis, site walks were conducted for private sites to confirm the extent of impervious surface shown on drawings. Any discrepancies (i.e. new paved areas, stairs or new buildings) were noted, along with the downspout conditions, and rooftops that could be isolated for drainage to GI. Criteria from the desktop analysis were confirmed, including approximate CDAs, areas of mature tree cover, areas of programmed space, utility locations, and preliminary assessment of available GI space.

As shown in Table 3-9, GI technologies assumed to be implemented for the various impervious area types were identified for both non-ROW public property and private property. Generally, a lower cost option (Option 1) and a higher volume managed option (Option 2) were applied to each of the representative sites as feasible. Table 3-11 details the two siting options.

**Table 3-11. GI Siting Options for Non-ROW and Private Property**

| Option | GI Technology | Consideration for Use | Ratio CDA:SA used for sizing | Layers for Volume Retention |
|---|---|---|---|---|
| Option 1 | Open Area Bioretention | Program value for parks, schools | 17:1 or 6% | Ponding<br>Media<br>Aggregate Storage |
| Option 2 | Permeable Brick Pavement | Does not alter use of site | 5:1 or 20% | Aggregate Storage |

Cisterns were not included in GI siting due to uncertainty that they will be emptied between rain events. Infiltration was not considered due to assumed low infiltration of urban soils underlying the DC area.

GI design tables were developed to calculate control measure sizes for each siting exercise. CDAs for each parcel type were determined based on impervious area characteristics, such as adjacent roadways, rooftops or parking internal to parcels. Retention volume (the volume of the storage layer) was then calculated from the 1.2” runoff over the CDA. Next, each GI facility size was calculated using the ratio of CDA: SA.

The GI control measure volumes were then calculated from the size of each GI facility. Bioretention volumes were calculated from facility length and width, depth of ponding, and media and storage layers. Permeable pavement volumes were calculated from each facility length and width, and depth of storage layers. Final outputs for each site category were also calculated, including the percent of impervious area managed and the total volume managed, both for each site type.

### 3.2.3 Partially Separated Areas

All four CSO sewersheds have potential locations for partial sewer separation. Per the Amended Consent Decree, targeted sewer separation is included as a potential GI control measure, and thus preliminary analyses have been conducted to determine feasibility and potential impervious area capture.

Within CSO 29, Georgetown University has a complex mixture of stormwater, sanitary and combined systems. Preliminary investigations indicate that sewer separation is feasible and appears to have been completed already in small areas throughout the sizable campus. It is certain that the diversion structure below the south entrance to the Georgetown University property is fed by both storm and sanitary sewers. Further north in the sewershed, the Hillandale neighborhood has comparatively newer infrastructure in relation to adjoining areas and was constructed with separate sewers that then connect to combined sewers. Both of these areas are prime candidates for targeted sewer separation, and given the large area that Georgetown University covers – upwards of 50 acres – targeted sewer separation has been selected to be included in the first project to be completed in the Potomac River GI sewersheds. (More details on this project are given in Section 4.) Smaller sewer separations may be included in future projects in the sewersheds.

CSOs 027 and 028 also contain a number of locations where smaller scale sewer separation is possible. Some of the locations evaluated include sewers in the vicinity of Volta Pl NW and 35$^{th}$ St NW (Volta Park); 37$^{th}$ and Prospect Sts NW; M and 25$^{th}$ Sts NW; and Cecil Pl NW, Grace St NW, Wisconsin Ave NW and Water St NW. All of these areas are relatively small (the Volta Park location would have the largest drainage area, at slightly more than 4 acres). Further, most of these projects would require storage outside of the public ROW, which would make permitting and coordination an additional consideration.

Similarly to CSOs 027 and 028, CSO 049 also contains a number of small locations where targeted sewer separation may be feasible.

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# 4 Recommended GI Program Plan

## 4.1 Introduction

This Section describes the GI Program Plan for the Rock Creek and Potomac River sewersheds. Proposed project locations and GI control measures are identified and described, along with a more detailed schedule for implementation, and estimated costs to implement the GI Program Plan. Permitting and other approvals needed to perform this work are reviewed, and details of the pre- and post-construction monitoring program are included. Specifics on the private property implementation include the residential downspout disconnection program, as well as additional GI opportunities on private property.

Throughout the course of the GI projects implemented in the Rock Creek and Potomac River sewersheds, an adaptive management approach will be utilized such that efficiencies in implementation and lessons learned can be incorporated into subsequent projects, with the overall goal of reducing long-term program costs over time. Based on this approach, the GI Program Plan summarized herein will be adapted over time as needed to account for the experience gained through each project.

## 4.2 Rock Creek Projects

The Rock Creek sewershed is comprised of 2,329 total acres, of which 52% is impervious (1,215 impervious acres). The CSO 049 outfall structure, which is located north of Piney Branch Parkway and 17$^{th}$ Street NW, discharges combined sewage to Rock Creek. Table 4-1 summarizes the Rock Creek sewershed area characteristics for CSO 049.

**Table 4-1. Rock Creek Sewershed Area**

| | **CSO 049** |
|---|---|
| **Total Sewershed Area** | 2,329 acres |
| **Impervious Area** | 1,215 acres |
| **Impervious Area to be Managed** | 365 acres |

Source: DC OCTO

As part of the Amended Consent Decree, GI will be constructed in the CSO 049 drainage area in Rock Creek, sized to manage the volume of runoff produced by 1.2” of rain falling on 365 impervious acres (30% of the impervious acres) in the sewershed. GI control measures will be constructed to manage the stormwater volume required in the Amended Consent Decree primarily in the public right-of way, allowing for some implementation on publicly-owned land outside of the ROW and on private property.

For the five projects within the Rock Creek sewershed outlined in the Amended Consent Decree, GI will be constructed to control the number of acres as shown in Table 4-2, below.

**Table 4-2. Impervious and Total Acres for Rock Creek Sewershed Projects**

| Project No. | Impervious Acres to Manage | Total Acres in Project Area |
|---|---|---|
| 1 | 20 | 161 |
| 2 | 75 | 488 |
| 3 | 90 | 582 |
| 4 | 90 | 556 |
| 5 | 90 | 547 |

### 4.2.1 Project Locations

Each of the five projects will cover a distinct area beginning at the upstream end of the sewershed and working sequentially downstream as the projects progress. This will allow for more effective flow monitoring, as installation of GI control measures in any given project area can be more effectively isolated by starting in the upstream parts of the sewershed. By moving sequentially from one area to the next downstream adjacent area, flow meters from the post-construction monitoring for each installed project may be left in place to support pre-construction monitoring for the next project. Consideration was given to defining projects by GI technology, for instance, all pervious alleys throughout the Rock Creek GI area. However, defining projects by geographic areas each containing a mixture of GI types, is preferable for a number of reasons in addition to supporting effective monitoring. For example, establishing defined geographic project boundaries supports the ability to perform effective and comprehensive public outreach by engaging ANCs and other localized organizations, streamlines coordination for permitting and with other construction work, minimizes customer disruption, and provides the opportunity to integrate implementation with the phasing of downspout disconnections.

The five project bounds are shown approximately in Figure 4-1 below, with all five draft Rock Creek project areas including major roadways, parks, and a variety of public facilities. Additionally all five are primarily lower-density residential neighborhoods. As detailed planning is currently underway for Rock Creek GI Project No. 1, the boundaries for this project area are well defined, and unlikely to change substantially. Figure 4-2 below delineates the current bounds of Rock Creek Project No. 1, which will be the first GI project to proceed under the Amended Consent Decree. For the remaining project areas, the delineations are approximate, to be finalized with subcatchment analysis as part of future design.

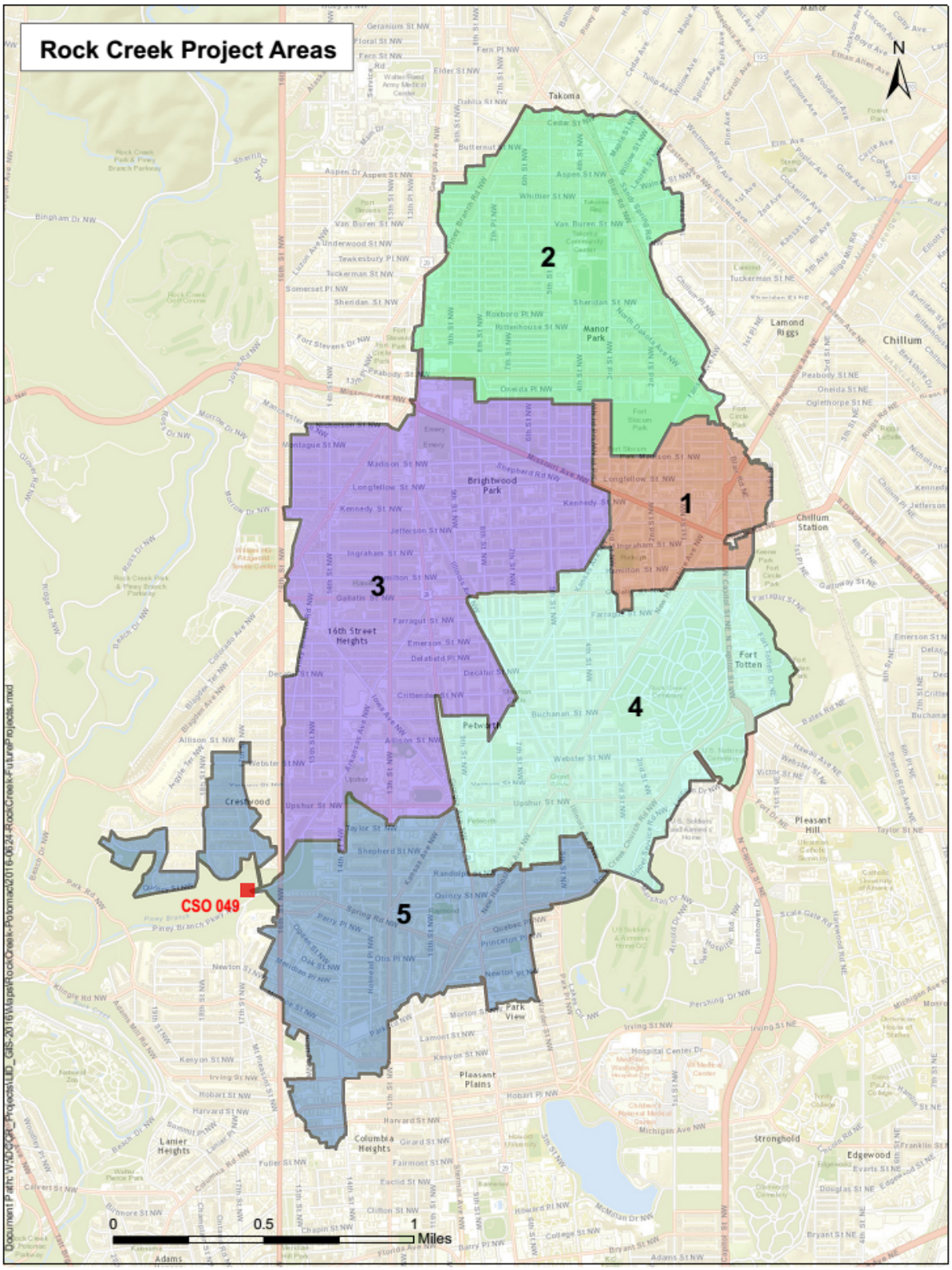


**Figure 4-1. Approximate Rock Creek GI Overall Project Locations**

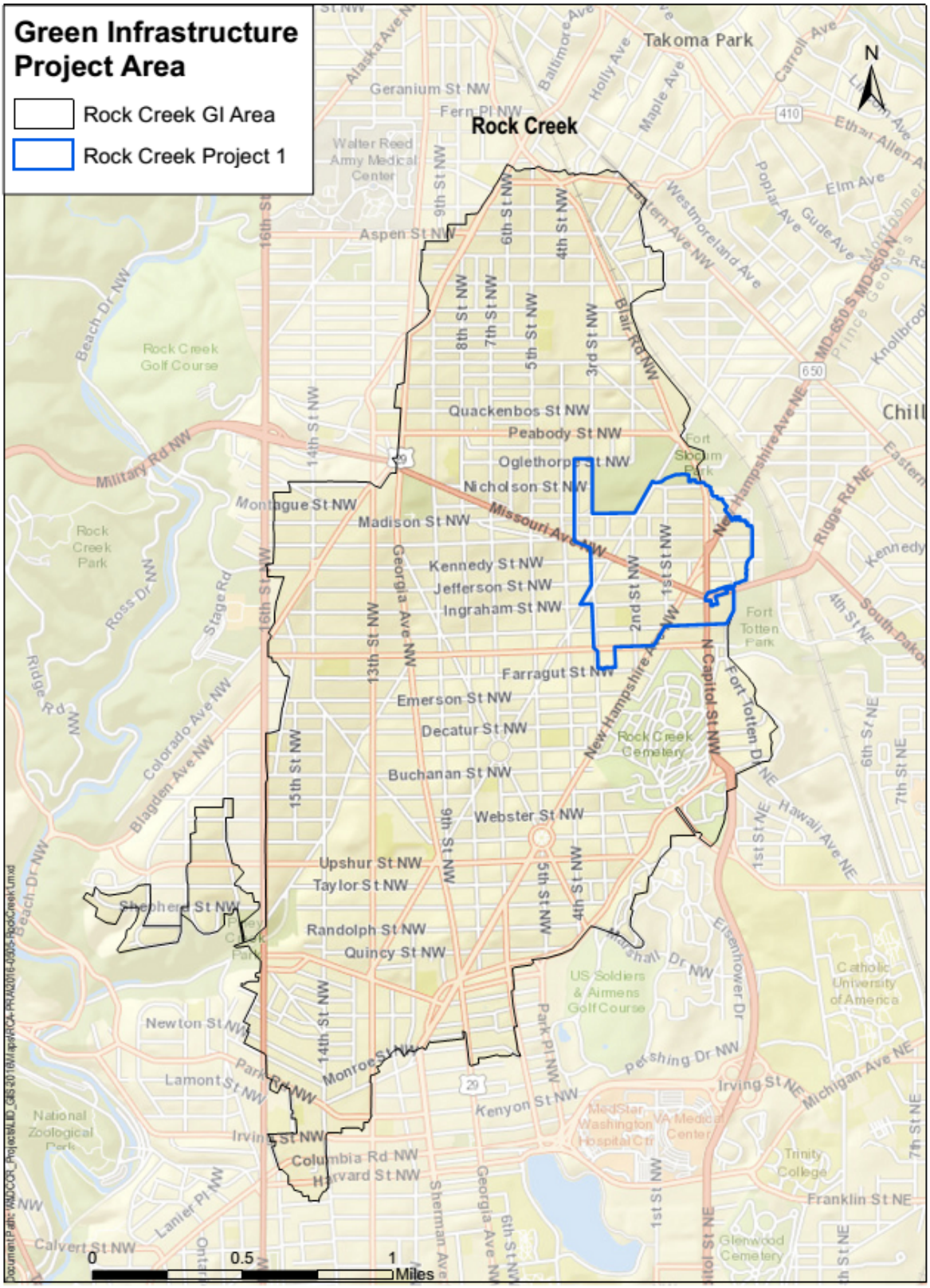


**Figure 4-2. Rock Creek GI Project No. 1 Location**

### 4.2.2 GI Control Measures

The majority of the GI control measures in the Rock Creek sewershed will be constructed in the public ROW. GI control measures to be implemented may include bioretention in the planter strip between the curb and the sidewalk, bioretention as curb extensions, subsurface storage, and permeable pavement in alleys and parking lanes. Downspout disconnections will also be implemented on some private properties.

Bioretention facilities collect runoff in shallow, vegetated depressions. They then filter and temporarily store the runoff before allowing it to infiltrate the in-situ soils or conveying it to the sewer system.

Planter bioretention facilities will be located between the curb and sidewalk. These control measures will include trees, shrubs, perennials, and groundcover plantings. Planter bioretention control measures will have a step-out zone located between the facility and the curb when parallel parking is adjacent to bioretention. Facilities will include perforated underdrains tied to the existing underground sewer infrastructure.

Bioretention curb extensions will be located along an existing curb and are typically located near intersections. Bioretention in the planter strip will be incorporated into curb extension bioretention where space allows. Curb extension bioretention will have vertical sides. Check dams will be incorporated, where needed due to slope, to prevent erosive velocities and to encourage ponding and infiltration based on the slope of the roadway.

A typical location for subsurface storage with infiltration is under sidewalks. Subsurface storage under sidewalks can run the width of the sidewalk, the length of the entire block, and up to 4 feet deep. The storage layer is constructed for infiltration along the bottom and contains a perforated underdrain that connects to a solid pipe at the conclusion of the subsurface storage control measure, where it connects to the larger sewer system. Subsurface storage may also be considered at other locations.

Permeable pavement will be used to replace (or in lieu of) traditional impervious pavements as they offer similar functionality with respect to vehicle and pedestrian traffic. Permeable pavement control measures will include perforated underdrains tied to the existing underground sewer infrastructure. Permeable pavement installations in roads and alleys include pervious concrete pavement, porous asphalt pavement, and permeable interlocking unit paver pavement.

Permeable pavement will likely represent the largest contribution to volume management in the Rock Creek sewershed due to the large CDAs in alleys within the sewershed boundaries. Under the Rock Creek projects, permeable pavement will be implemented in alleys as well as parking lanes. Bioretention facilities also will likely represent significant capture for the Rock Creek sewershed, with both bioretention curb extension and planter bioretention control measures within the project areas.

#### 4.2.2.1 Public Property

The majority of the Rock Creek sewershed is composed of residential blocks with a few concentrated commercial areas following major streets – Georgia Ave, Kennedy St, and 14th St – and clustered around the Columbia Heights, Petworth and Takoma metro stations.

The existing neighborhood aesthetic across the sewershed is fairly uniform. Most homes are constructed of brick, and have front porches with concrete walkways extending through a small yard to the concrete sidewalk. Some homes have brick or stone retaining walls along the sidewalk. The commercial areas typically have wide concrete or brick paver sidewalks extending from the face of the building to the curb.

There are multiple locations for GI design at triangle park sites throughout all five Rock Creek project areas. The designs for these sites would likely include open area bioretention, bioretention curb extensions, and permeable pavement. The rationale for the selection of these types of GI control measures is the same as that of the GI control measures for the public ROW areas. Considerations include topography, available space, land use, traffic loading, location of existing utilities, size of the CDA, street layouts including sidewalks and curbs, soil infiltration characteristics, and tree density and sizes, amongst others. Many of these variables were considered in preliminary analyses as detailed in Sections 2.2, 3.2.1 and 3.2.2.1.

#### 4.2.2.2 Private Property

Field investigations have been performed to catalogue the status of downspouts on private properties for the first Rock Creek GI project. Similar field investigations will be performed for subsequent projects. As there is a high level of homogeneity within the sewershed as a whole, these findings have been extrapolated to the entire GI area, to give an approximate overview of downspout disconnection potential throughout the Rock Creek sewershed.

Rock Creek GI Project No. 1 contains approximately 3,552 downspouts per GIS analysis and field survey. Of these downspouts, almost 65% are already disconnected. Another 15% of downspouts cannot be disconnected within the bounds of the initial project due to technical feasibility given the downspout configuration and/or the site topography. The remaining downspouts could potentially be disconnected. The goal is to disconnect as many downspouts as possible, through working with private property owners. There will be cistern/rain barrel options for homeowners who participate in the downspout disconnection program.

Extrapolating the field inventory data for the first Rock Creek GI project to the entire Rock Creek sewershed, gives an indication of the potential impact of downspout disconnections for the entire sewershed. These downspouts were categorized as shown in Table 4-3.

**Table 4-3. Rock Creek Sewershed Downspout Disconnection Categories**

| CSO 049 Area | Currently Disconnected | Cannot Be Disconnected | Potential Disconnects | Total |
|---|---|---|---|---|
| Approximate Rooftop Acres | 284 | 140 | 93 | 517 |
| Approximate % | 55 | 27 | 18 | 100 |

Note: Based on Rock Creek GI Project No. 1 field inventory and scaled to entire sewershed

### 4.2.3 Impervious Area Managed

The Rock Creek GI projects will be designed to meet the Amended Consent Decree requirement to manage 1.2" of stormwater runoff, as outlined in Table 1-1. Table 4-4 shows the estimated range of volume capture for each type of GI control measure.

The intent is that GI technologies to the left of the dashed line in Table 4-4 will sum to 100%, covering all of the volume capture required. If additional volume can be accounted for via downspout disconnections and MS4 credits, right of the dashed line and in the shaded section, these volumes can be credited towards the required volume to be managed.

**Table 4-4. Volume Capture by GI Control Measure Types for Rock Creek Sewershed Projects**

| Project No. | Impervious Acres Managed | Equivalent Volume (MG) | Approximate Location | Approximate Mix of GI Technologies (% of Impervious Acres Managed) – all values ± 20% | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Bioretention | Permeable Pavement | Subsurface Storage in ROW (Parking Lane, Sidewalk, etc.) | Targeted Sewer Separation | Downspout Disconnections | MS4 Credit |
| 1 | 20 | 0.65 | Figures 4-1 / 4-2 | 30% | 70% | - | - | 9% | 1% |
| 2 | 75 | 2.44 | Figure 4-1 | 30% | 60% | 5% | 5% | 2% | 1% |
| 3 | 90 | 2.94 | Figure 4-1 | 30% | 60% | 5% | 5% | 2% | 1% |
| 4 | 90 | 2.94 | Figure 4-1 | 30% | 60% | 5% | 5% | 2% | 1% |
| 5 | 90 | 2.94 | Figure 4-1 | 30% | 60% | 5% | 5% | 2% | 1% |
| Total | 365 | 11.91 | Figure 4-1 | 30% | 60% | 5% | 5% | 2% | 1% |

### 4.2.4 Schedule

The construction schedule for the five (5) GI projects in the Rock Creek sewershed is set by the Amended Consent Decree, as shown in Table 4-5.

The downspout disconnection program will start prior to contract award for all GI projects. This will allow the majority of the downspout disconnection work to be completed before construction in the right-of-way commences. This phased approach will have the downspout disconnections preceding the GI work for each project, as further detailed in Section 4.6.2.

**Table 4-5. Construction Schedule for Rock Creek Sewershed Projects**

| Project No. | Award Contract for Construction | Place in Operation |
|---|---|---|
| 1 | March 30, 2017 | March 30, 2019 |
| 2 | January 23, 2022 | January 23, 2024 |
| 3 | March 23, 2025 | March 23, 2027 |
| 4 | September 30, 2027 | September 30, 2029 |
| 5 | March 23, 2028 | March 23, 2030 |

Source: Adapted from Amended Consent Decree, Appendix F (2016).

Project placement into operation requires that all GI control measures within the project are complete and functional prior to the above dates.

### 4.2.5 Estimated Cost

Table 4-6 summarizes the capital cost in dollars per gallon of practice volume for each type of GI control measure included in the above project designs. These costs do not include any maintenance costs, however they do include labor using prevailing wage rates in Washington, D.C., all contractor mark-ups (overhead, permitting, general conditions, bonding, insurance), and contractor's contingency.

**Table 4-6. Capital Costs for Types of GI Control Measures in Rock Creek Sewershed**

| GI Control Measure | GI Control Location | Capital Cost[1] |
|---|---|---|
| Bioretention | Planter | $30/gallon - $50/gallon |
| | Curb Extension | $30/gallon - $50/gallon |
| Permeable Pavement | Alley | $30/gallon - $50/gallon |
| | Parking Lane | $30/gallon - $50/gallon |

Note:
1. Cost estimates are being prepared based on 100% Request for Proposal (RFP) documents for Rock Creek GI Project No. 1 and 90% RFP documents for Potomac River GI Project No. 1.

## 4.3 Potomac River Projects

The Potomac River sewershed (CSOs 027, 028 and 029) is comprised of 515 total acres, of which 55% is impervious (281 impervious acres). The locations for each of the Potomac River CSOs are summarized in Table 4-7 below.

**Table 4-7. Potomac River Sewershed CSO Locations**

| CSO | Location |
|---|---|
| 027 | Southeast of 33rd St and Whitehurst Freeway NW |
| 028 | Southwest of Whitehurst Freeway NW and Francis Scott Key Bridge |
| 029 | South of West Road at Canal Road NW |

Table 4-8 summarizes the Potomac River sewershed area characteristics for CSOs 027, 028 and 029.

**Table 4-8. Potomac River Sewershed Area**

| | CSO 027 | CSO 028 | CS0 029 | Total |
|---|---|---|---|---|
| **Total Sewershed Area** | 164 acres | 21 acres | 330 acres | 515 acres |
| **Impervious Area** | 104 acres | 13 acres | 164 acres | 281 acres |
| **Impervious Area to be Managed** | 31 acres | 4 acres | 98 acres | 133 acres |

Source: DC OCTO

As part of the Amended Consent Decree, GI will be constructed in the CSO 027, 028, and 029 drainage areas in the Potomac River sewershed, sized to manage the volume of runoff produced by 1.2" of rain falling on 133 impervious acres (30% of the impervious area in CSOs 027 and 028, and 60% in CSO 029) in the sewershed. GI control measures will be constructed to manage the stormwater volume required in the Amended Consent Decree primarily in the public right-of way, allowing for some implementation on publicly-owned land outside of the ROW and on private property.

For the three projects within the Potomac River sewershed outlined in the Amended Consent Decree, GI will be constructed to control a set number of acres as shown in Table 4-9, below.

**Table 4-9. Impervious and Total Acres for Potomac River Sewershed Projects**

| Project No. | Impervious Acres to Manage | Approximate Total Acres in Project Area |
|---|---|---|
| 1 | 44 | 219 |
| 2 | 46 | 154 |
| 3 | 43 | 435 |

### 4.3.1 Project Locations

The approach for the Potomac River projects is markedly different than that for Rock Creek. These three CSO sewersheds contain some currently existing sewer separation, limiting the areas in which GI would be required for CSO control. Further, there is sewer separation that can be done, mostly within CSO 029, and primarily on the grounds of Georgetown University which will require limited disruptions, based on preliminary investigations, as detailed in Section 3.2.3. Much of Georgetown University is already separated throughout the campus, however the diversion structure below the south entrance to the property is fed by both storm and sanitary sewers. Given the large area that Georgetown University covers – upwards of 50 acres - targeted sewer separation has been selected to be included in the first project to be completed in the Potomac River GI sewershed.

As with the Rock Creek sewershed, consideration was given to setting the project boundaries within the Potomac River sewershed by technology instead of geography. For instance, one project could have included all pervious pavement projects within the Potomac River sewershed. However, using distinct geographic areas, each with a mixture of GI types, is preferable for a number of reasons. These include public outreach with particular attention to ANCs and other localized organizations, permitting coordination, minimizing disruption, and phasing downspout disconnections. As detailed planning is currently underway for the first Potomac River GI project, this project area is well defined, and unlikely to change substantially. Figure 4-3 below delineates the current bounds of the first Potomac River GI project. The southern portion of this first project includes portions of the CSO 028 sewershed. The northern portion of the first Potomac River GI project contains portions of Glover Park and Burleith neighborhoods. The southwest portion of the project includes Georgetown University where targeted sewer separation will be used to achieve the capture goals for the first Potomac River GI project. For the remaining project areas, the delineations are approximate, to be finalized with subcatchment analysis as part of future design, as shown in Figures 4-4 and 4-5.

All three draft Potomac River project areas include a mixture of residential and commercial areas. The commercial areas are clustered primarily along M St NW and Wisconsin Ave NW, which is a well-known and heavily-trafficked shopping district.

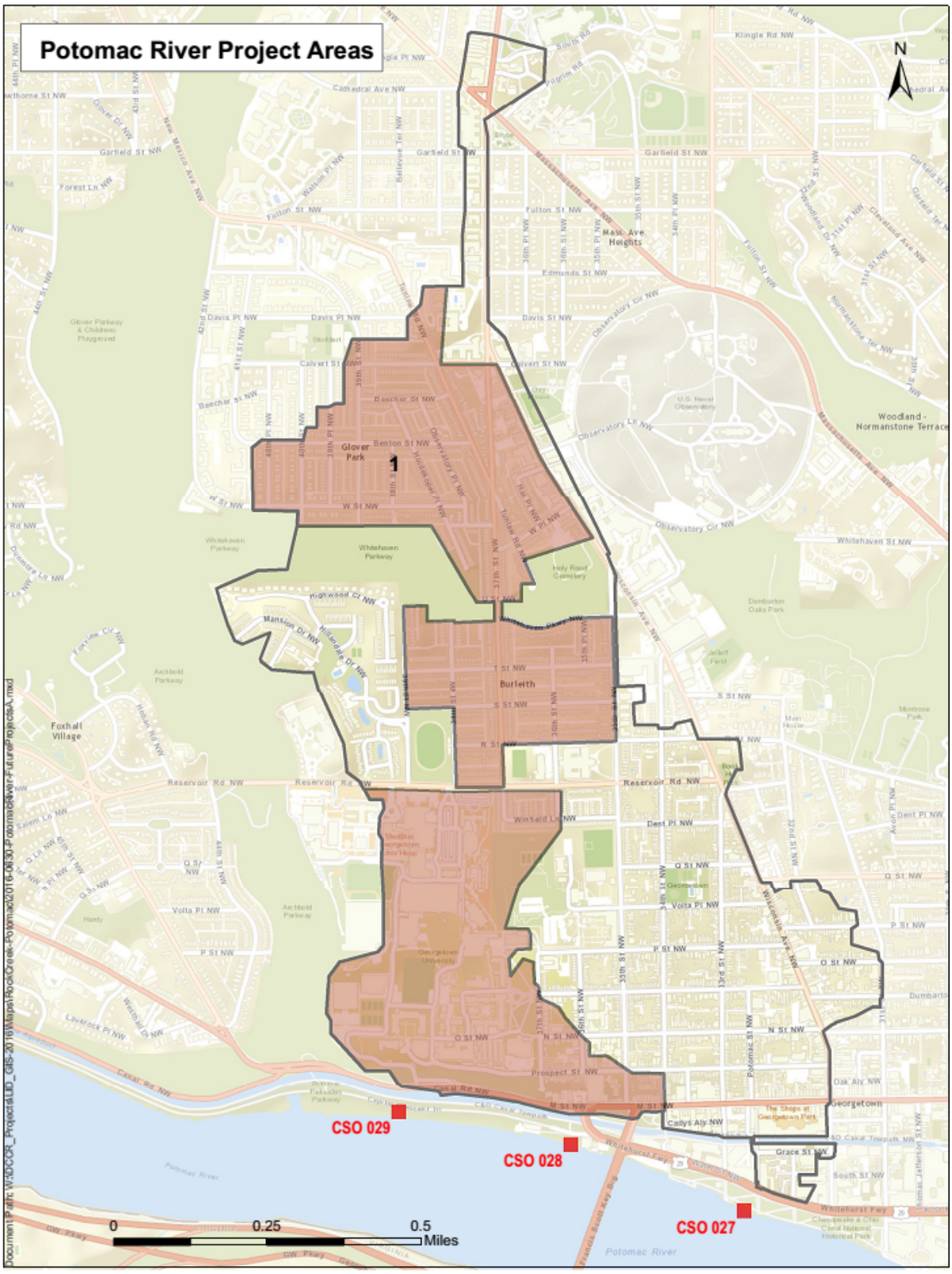


**Figure 4-3. Potomac River GI Project No. 1 Location**

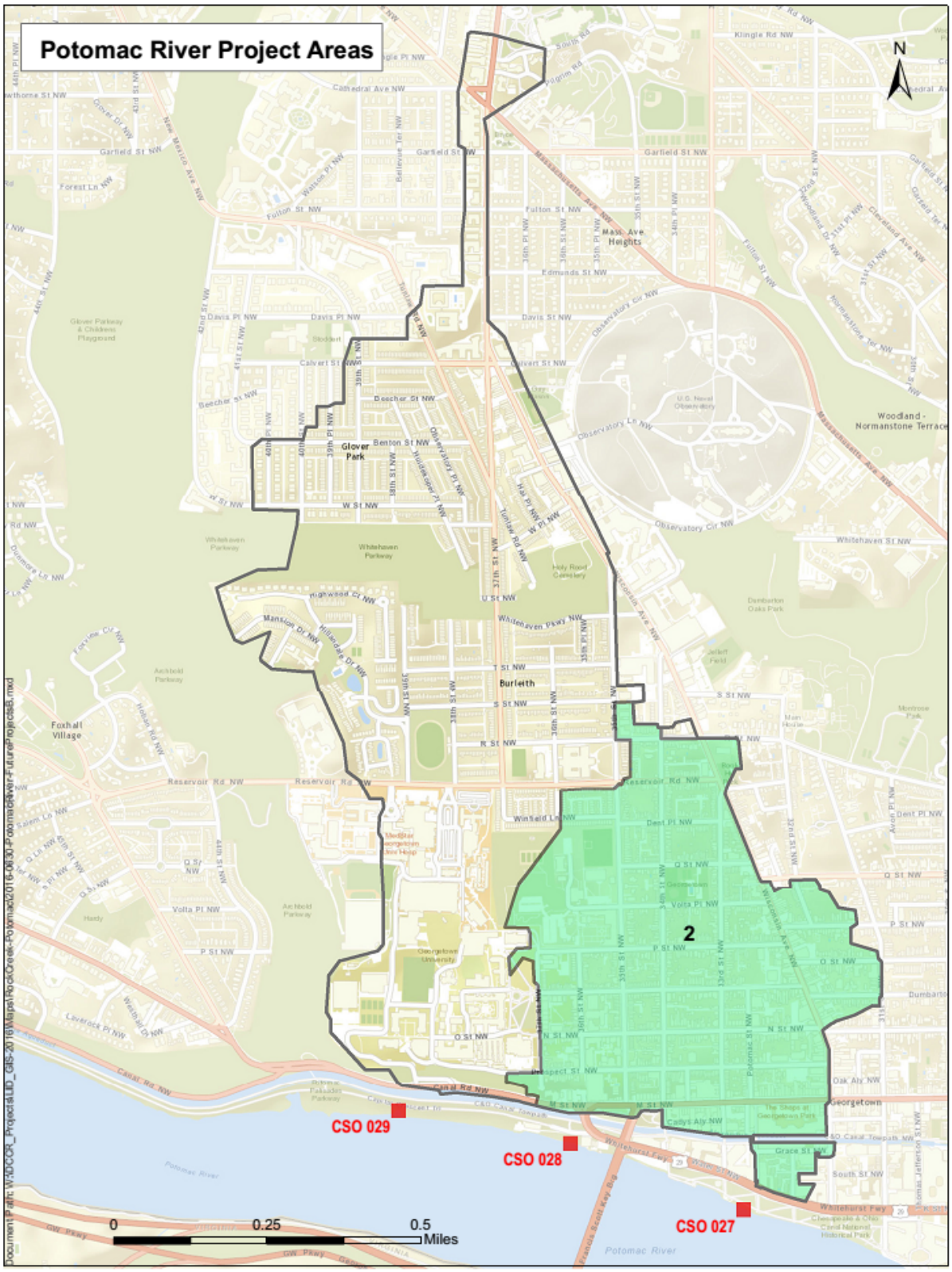


**Figure 4-4. Approximate Potomac River GI Project No. 2 Location**

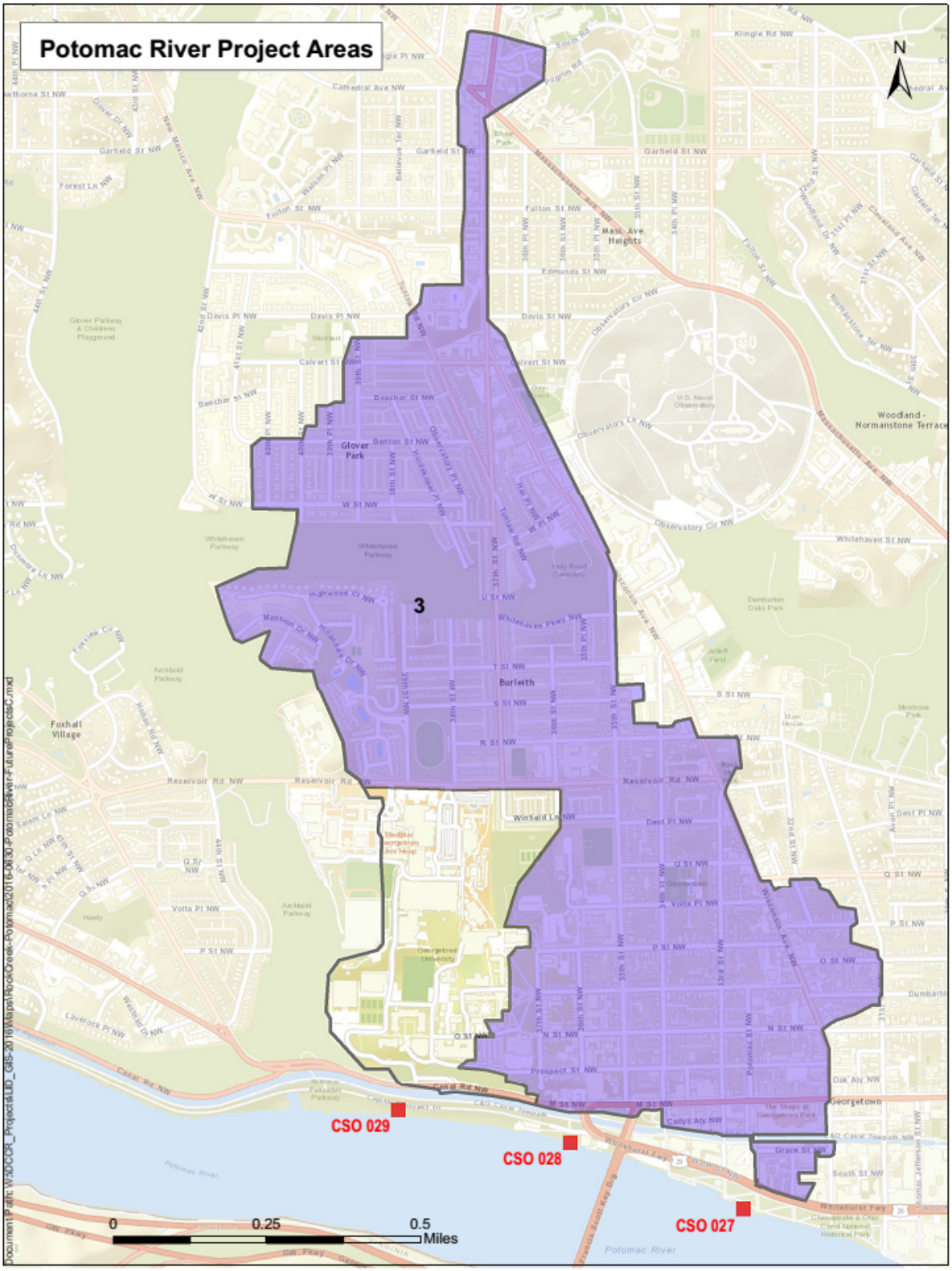


**Figure 4-5. Approximate Potomac River GI Project No. 3 Location**

### 4.3.2 GI Control Measures

The majority of the GI control measures in the Potomac River sewershed will be constructed in public ROW. GI control measures to be implemented may include targeted sewer separation, bioretention in the planter strip between the curb and the sidewalk, bioretention as curb extensions, subsurface storage with infiltration beneath parking lanes, sidewalks, crosswalks, and alleys; and permeable pavement in alleys and parking lanes. Downspout disconnections will also be implemented on some private properties.

Bioretention facilities collect runoff in shallow, vegetated depressions. They then filter and temporarily store the runoff before allowing it to infiltrate into the in-situ soils or convey it to a suitable outlet (such as an existing sewer or stormwater pipe).

Planter bioretention facilities will be located between the curb and sidewalk. Some planter bioretention control measures will have a step-out zone located between the facility and the curb. Step-out zones are required when parallel parking is provided. These facilities will include trees, shrubs, perennials, and groundcover plantings. Facilities will include perforated underdrains tied to the existing underground sewer infrastructure.

Bioretention curb extensions will be located along an existing curb and are typically located near intersections. Curb extensions will have vertical sides. Based on the slope of the roadway, check dams will be incorporated to prevent erosive velocities and to encourage ponding and infiltration based on the slope of the roadway.

A typical location for subsurface storage with infiltration is in parking lanes. Subsurface storage in parking lanes can be the width of the full parking lane, the length of the entire block, and up to 4 feet deep. The storage layer is constructed for infiltration along the bottom and contains a perforated underdrain that connects to a solid pipe at the conclusion of the subsurface storage facility, where it connects to the larger sewer system. Subsurface storage may also be considered at other locations.

Permeable pavement will be used to replace (or in lieu of) traditional impervious pavements as they offer similar functionality with respect to vehicle and pedestrian traffic. Control measures will include perforated underdrains tied to the existing underground sewer infrastructure. Permeable pavement installations in roads and alleys include pervious concrete pavement, porous asphalt pavement, and permeable interlocking unit paver pavement.

Permeable pavement will likely represent a large contribution to the volume management in the Potomac River sewershed due to the large CDAs in alleys within the sewershed boundaries. Currently, two of the three draft projects will implement permeable pavement in alleys within their bounds as well as possibly in parking lanes. Bioretention control measures also will likely represent significant capture for the Potomac River sewershed, with both bioretention curb extension and planter bioretention control measures within the project areas. Given the heavily developed nature of the commercial areas in Georgetown, subsurface storage will also be a substantial source of stormwater capture.

#### 4.3.2.1 Public Property

The majority of the Potomac River sewershed is composed of residential blocks with commercial areas throughout, following M St NW and Wisconsin Ave NW, as well as along the Georgetown waterfront. Georgetown University occupies a significant portion of all three CSO sewersheds.

The existing neighborhood aesthetic across the northern portion of the Potomac River project areas is fairly uniform. Most homes are constructed of brick and have front porches with concrete walkways extending through a small yard to a concrete sidewalk. Some homes have brick or stone retaining walls along the sidewalk. The commercial areas typically have wide concrete and brick paver sidewalks extending from the face of the building to the curb.

The southern portion of the Potomac River GI project areas is a densely-developed, highly impervious, historic and popular shopping district which is exacerbated by the influx of Georgetown University students. Wide concrete and brick paver sidewalks extend from the face of buildings to the curb throughout the commercial areas. The C&O Canal, a National Park, runs through the southern edge of these three sewersheds, and, to further challenge GI design, the ground south of M St NW steeply slopes towards the Potomac River. The Georgetown Historic District is bounded along the northern edge by Reservoir Rd NW, 35$^{th}$ St NW, Whitehaven St NW and R St NW.

#### 4.3.2.2 Private Property

Field investigations have been performed to catalogue the status of downspouts on private properties for the first Potomac River GI project. Similar field investigations will be performed for subsequent projects. As this project includes a significant portion of the densely developed Georgetown area, these findings are extrapolated below to cover the entire area, to give an approximate and conservative overview of downspout disconnection potential throughout the Potomac River sewersheds. This approach yields approximate numbers, which can then be applied to estimate the downspout disconnection potential throughout the sewershed.

The first Potomac River GI project contains approximately 3,167 downspouts per field inventory and GIS analysis. Of these downspouts, almost 34% are already disconnected. Another 41% of downspouts cannot be technically or feasibly disconnected due to downspout configuration and/or the site topography. The remaining downspouts could potentially be disconnected. The goal is to disconnect as many downspouts as possible, through working with private property owners. There will be rain barrel options for homeowners who participate in the downspout disconnection program.

Extrapolating from the field inventory data for the first Potomac River GI project to the entire Potomac River sewershed, gives an indication of the potential impact of downspout disconnections for the entire sewershed. These downspouts were categorized as shown in Table 4-10.

**Table 4-10. Potomac River Sewershed Downspout Disconnection Categories**

| CSO 027, 028, 029 Combined Area | Currently Disconnected | Cannot Be Disconnected | Potential Disconnects | Total |
|---|---|---|---|---|
| Approximate Rooftop Acres | 35 | 78 | 20 | 133 |
| % | 26 | 59 | 15 | 100 |

Note: Based on Potomac River GI Project No. 1 field inventory and scaled to entire sewershed.

### 4.3.3 Impervious Area Managed

The Potomac River GI projects are designed to meet the Amended Consent Decree requirement to manage 1.2" of stormwater runoff from 133 impervious acres, as outlined in Table 1-1. Table 4-11 shows the estimated range of volume capture for each type of GI control measure.

The intent is that GI technologies to the left of the dashed line in Table 4-11 will sum to 100%, covering all of the volume capture required. If additional volume can be accounted for via downspout disconnections and MS4 credits, right of the dashed line and in the shaded section, these volumes can be credited towards the required volume to be managed.

**Table 4-11. Volume Capture by GI Control Measure Type for Potomac River Sewershed Projects**

| Project No. | Impervious Acres Managed | Equivalent Volume (MG) | Approximate Location | Approximate Mix of GI Technologies (% of Impervious Acres Managed) – all values ± 20%[1] | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Bioretention | Permeable Pavement | Subsurface Storage in ROW (Parking Lane, Sidewalk, etc.) | Targeted Sewer Separation | Downspout Disconnections | MS4 Credit |
| 1 | 44 | 1.43 | Figure 4-3 | 12% | 23% | - | 65% | 8% | 1% |
| 2 | 46 | 1.50 | Figure 4-4 | 18% | 42% | 37% | 3% | 2% | 1% |
| 3 | 43 | 1.40 | Figure 4-5 | 7% | 8% | 35% | 50% | 2% | 1% |
| Total | 133 | 4.33 | | 12% | 25% | 24% | 39% | 4% | 1% |

Note:

2. Approximate project location area is identified and approximate GI technologies and application rates are shown. Other GI technologies may be evaluated during design and construction and application rates will be adjusted accordingly.

### 4.3.4 Schedule

The construction schedule for the three projects in the Potomac River sewershed is set by the Amended Consent Decree, as shown in Table 4-12.

**Table 4-12. Construction Schedule for Potomac River Sewershed Projects**

| Project No. | Award Contract for Construction | Place in Operation |
|---|---|---|
| 1 | June 23, 2017 | June 23, 2019 |
| 2 | June 23, 2022 | June 23, 2024 |
| 3 | June 23, 2025 | June 23, 2027 |

Source: Adapted from Amended Consent Decree, Appendix F (2016).

### 4.3.5 Estimated Cost

Table 4-13 summarizes the capital cost in dollars per gallon of practice volume for each type of GI control measure included in the above project designs. These costs do not include any maintenance costs. These are from estimates for the first Rock Creek GI Project, where design is currently

underway. Separate estimates will be developed for first Potomac River GI project and all subsequent Rock Creek and Potomac River GI projects as the design for each progresses, reflecting bids as contracts are awarded.

**Table 4-13. Capital Costs for Types of GI Control Measures in Potomac River Sewersheds**

| GI Control Measure | GI Control Location | Capital Cost[1] |
|---|---|---|
| Bioretention | Planter | $30/gallon - $50/gallon |
| | Curb Extension | $30/gallon - $50/gallon |
| Permeable Pavement | Alley | $30/gallon - $50/gallon |
| | Parking Lane | $30/gallon - $50/gallon |
| Subsurface Storage | Parking Lane | $30/gallon - $50/gallon |
| | Pipe Reservoir | |
| Targeted Sewer Separation | Not Applicable | $50,000 - $700,000/acre separated |

Note:
1. Cost estimates are being prepared based on 100% Request for Proposal (RFP) documents for Rock Creek GI Project No. 1 and 90% RFP documents for Potomac River GI Project No. 1.

## 4.4 Permitting/Approvals Needed

DC Water will be responsible for obtaining rights to construct the GI control measures from the Department of General Services, National Capitol Planning Commission, U.S. Commission of Fine Arts/Old Georgetown Board, State Historic Preservation Office, and the Washington Metropolitan Transit Authority (WMATA), as applicable. The remaining permitting responsibilities will fall largely on the design-builder. The split between the anticipated owner and design-builder permitting responsibilities is summarized in Table 4-14. Prior to issuing a contract, DC Water and the District will coordinate project locations. DC Water will coordinate with the District Fire and Emergency Medical Services (FEMS) and Homeland Security and Emergencies Management Agency (HSEMA).

**Table 4-14. Owner and Design-Builder Permitting Responsibilities**
(Applicability varies with project type)

| Agency | Approval or Permit | Responsibility[1] | |
|---|---|---|---|
| | | DC Water | Design-Builder |
| District Department of Consumer and Regulatory Affairs | Building Civil (BCIV) Permit within CSA | | x |
| | Building Permit | | x |
| | Miscellaneous Soil Boring Permit | | x |
| | Support of Excavation Permit | | x |
| | Building Permit for Site Trailers | | x |
| | After Hours Permit (As needed - Requires DCW Approval) | | x |
| | Environmental Intake Screening Form | x | |
| | Environmental Intake Form | x | |
| Department of Energy and Environment | Volume of Cut Fee | | x |
| | Generator Registration | | x |
| | Hazardous Waste Identification Number | | x |
| | Stormwater/Erosion and Sediment Control | | x |
| District Department of Transportation | Construction Permit | | x |
| | Occupancy Permit | | x |
| | Construction Permit for Support of Excavation | | x |
| | Construction Permit for Misc. Soil Boring | | x |
| | Tree Removal Permit (UFA) | | x |
| | Steel Plate Permit | | x |
| Environmental Protection Agency (EPA) | Notice of Intent | | x |
| | Stormwater Pollution Prevention Plan | | x |
| District of Columbia Water and Sewer Authority | Plan Review | | x |
| | Availability Certificate | | x |
| | Inspections Invoice | | x |
| | Temporary Discharge Authorization | | x |
| | Hydrant Use Permit | | x |
| Others as Needed (Inc. Utilities) | | | x |

Note:

1. Permitting responsibilities may be adjusted on a project specific basis.

## 4.5 Pre- and Post-Construction Monitoring and Modeling

DC Water will perform pre-construction monitoring for 12 months prior to construction of the first Rock Creek GI project (note: this monitoring commenced in January 2016). By March 23, 2019, DC Water must have designed and constructed Rock Creek GI Project No. 1, at which point 12 months of post-construction monitoring will be performed to evaluate the effectiveness of GI to determine continued implementation of GI to meet the Amended Consent Decree requirements. If the first Rock Creek GI project is deemed practicable, four additional GI projects will be implemented across the

entire contributing sewershed of CSO 049. Figure 4-6 exhibits the pre- and post-construction monitoring locations for the first Rock Creek GI project area.

For the Potomac River sewershed projects, DC Water will perform pre-construction monitoring for 12 months prior to construction of the first Potomac River GI project. By June 23, 2019, DC Water must have designed and constructed Potomac River GI Project No. 1, at which point 12 months of post-construction monitoring will be performed to evaluate the effectiveness of GI to determine continued implementation of GI to meet the Amended Consent Decree requirements. If the first Potomac River GI project is deemed successful, two additional GI projects will be implemented across the entire contributing sewersheds of CSOs 027, 028 and 029. Figure 4-7 exhibits the pre- and post-construction monitoring locations for Potomac River GI Project No. 1.

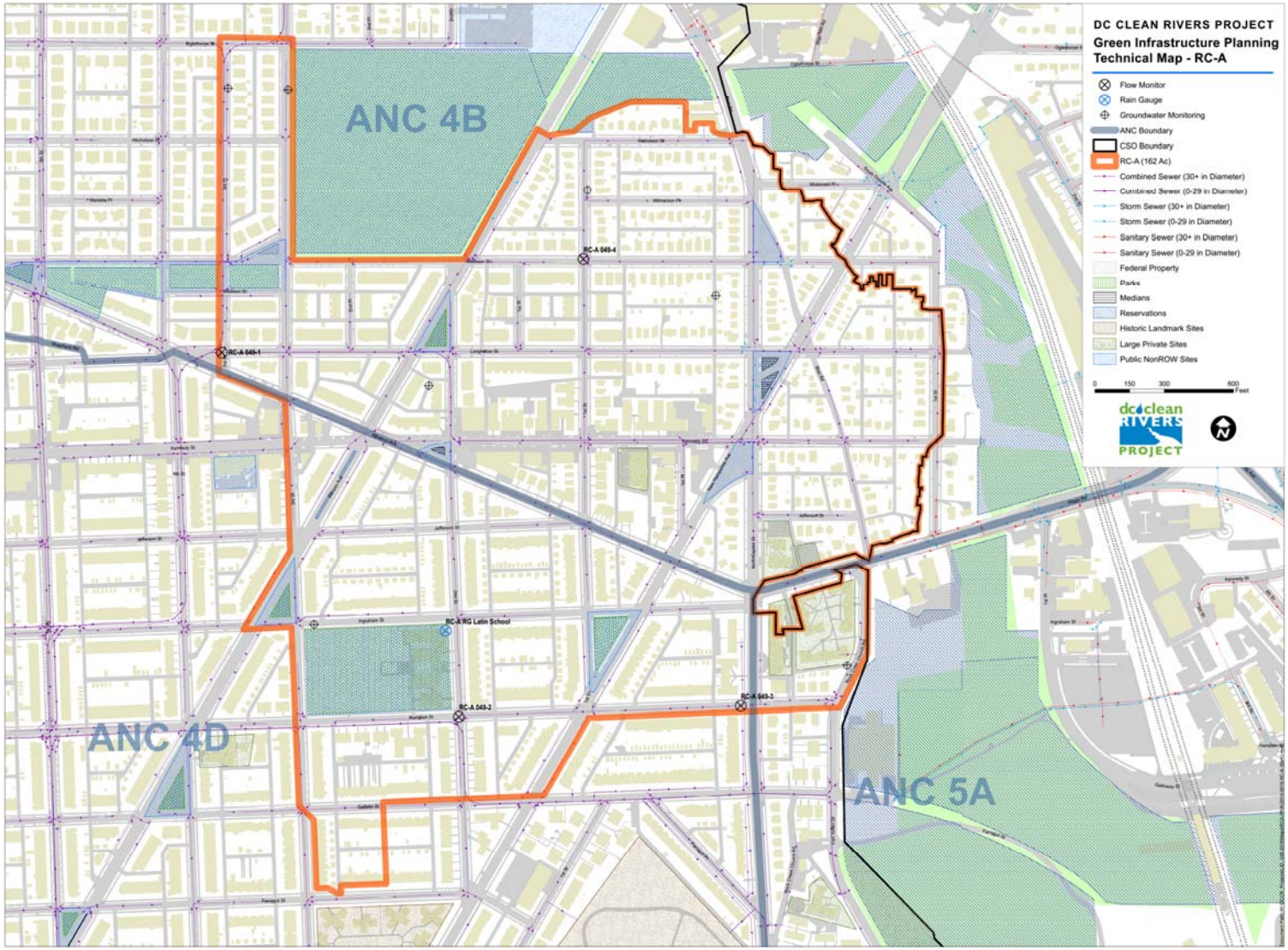


**Figure 4-6. Pre- and Post-Construction Monitoring Locations for Rock Creek GI Project No. 1**

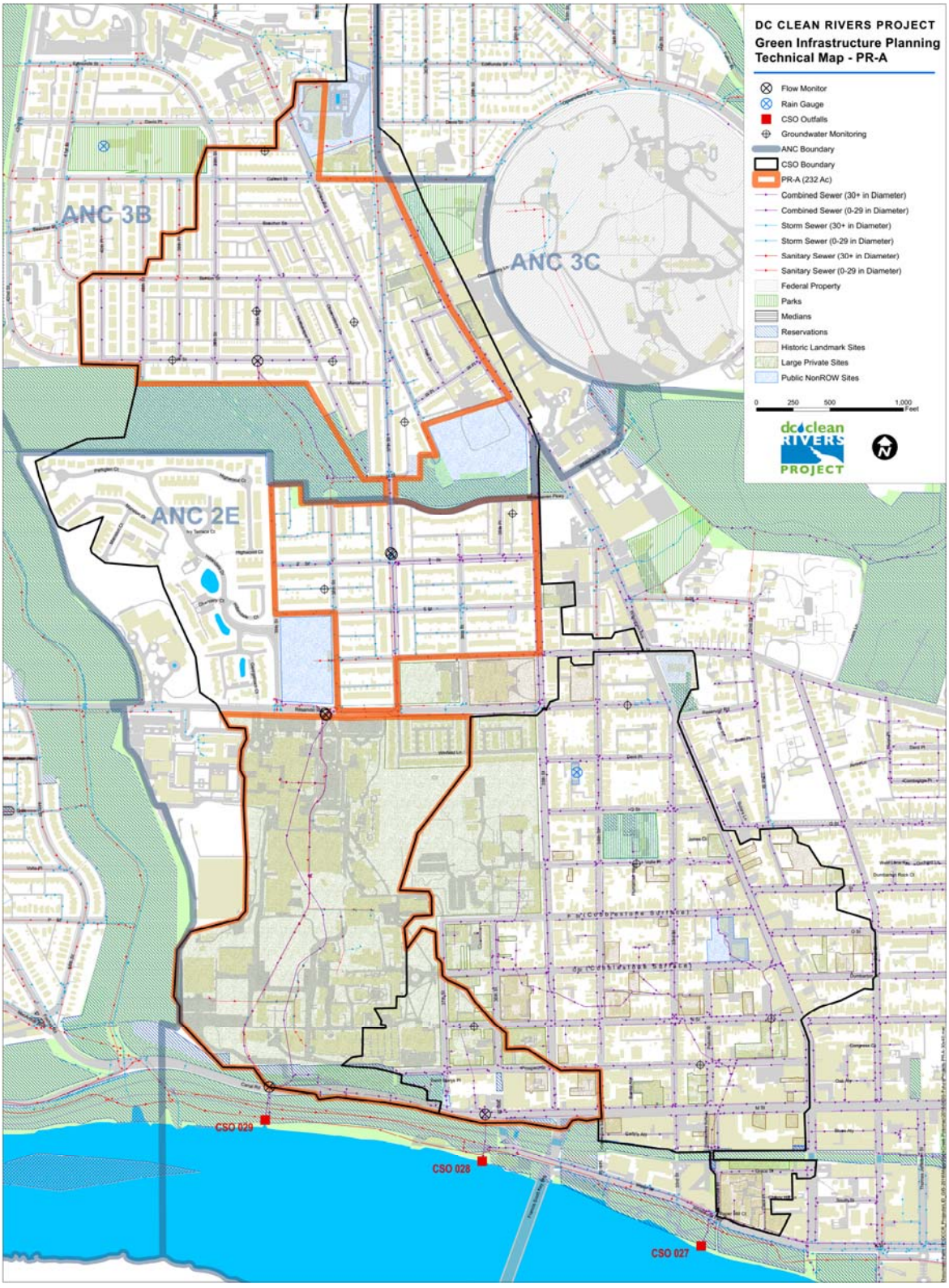


**Figure 4-7. Pre- and Post-Construction Monitoring Locations for Potomac River GI Project No. 1**

#### 4.5.1.1 Pre-Construction Monitoring and Modeling Approach

The existing conditions runoff quantities will be determined prior to the installation of GI control measures in each project area. The pre-construction monitoring program will require installation of a rain gauge and flow measuring device at predetermined locations in each project area. Pre-construction monitoring will be performed over a 12-month period, a year in advance of the construction contract award date. During this 12-month period, available water meter data will be collected to estimate the sanitary portion of the dry weather flow, and groundwater elevations at monitoring wells will be recorded to evaluate the relationship to infiltration.

The sewer system model will then be calibrated and validated for each project area. EPA SWMM5 has been selected as the runoff simulator used for GI modeling District-wide (DC Water, 2015, Appendix F). In addition to its wide acceptance as a reliable and robust hydrologic tool, EPA SWWM5 is capable of explicitly modeling the performance of a range of GI control measures. Upon the EPA SWWM5 model development, pre-construction datasets will be used for its calibration. The pre-construction monitoring will be compared to the rainfall analysis conducted between 1988-1990 to predict hourly flow and average flow versus time. Subsequently, simulations of the calibrated model will be run to investigate additional comparison scenarios. In this way, the GI effectiveness will be assessed for a variety of storm events, without being limited to those captured during the flow monitoring periods.

Time periods in an average year when runoff is occurring will be defined as rainfall time plus drain down time. A procedure will then be developed for extracting out the dry weather flow and infiltration amount to calculate the runoff. The final step will be to tabulate existing conditions stormwater runoff volume for each flow monitoring site, in gallons per average year.

The calibrated model used to determine the existing conditions runoff will also be used to determine the predicted conditions after GI control measures are installed in the project area. Performance data for each type of GI measure to be installed will be collected from literature and other sources. Each GI control measure type will then be modeled at the as-designed capacity and configuration.

The EPA SWWM5 model will then be run for the average year (1988-1990) to predict hourly flow and average flow versus time. The same time periods and procedures used in the existing conditions will be used in the predicted conditions to extract out the dry weather flow and infiltration to calculate runoff. The final step will be to tabulate the predicted stormwater runoff volume with the GI control measures in place, in gallons per average year.

#### 4.5.1.2 Post-Construction Monitoring and Modeling Approach

The actual stormwater runoff volume will be determined following the installation of the GI control measures. The post-construction monitoring program will require installation of a rain gauge and flow measuring device at predetermined locations at selected GI control measures for each project site. Flow meters will also be installed downstream of the selected GI control measures to calibrate the model by the type of GI control measures. Post-construction monitoring will be performed over a 12-month period. During this 12-month period, available water meter data will once again be collected to

estimate the sanitary portion of the dry weather flow, and groundwater elevations at monitoring wells will once again be recorded to evaluate the relationship to infiltration.

The sewer system model will be calibrated and validated separately for the first Rock Creek and Potomac River GI projects. Post-construction datasets will be used for the model's calibration. The post-construction monitoring will be compared to the rainfall analysis conducted between 1988-1990 to predict hourly flow and average flow versus time. The same time periods and procedures used in this model will be used to extract out the dry weather flow and infiltration to calculate runoff. The final step will be to tabulate the actual stormwater runoff volume with the GI control measures in place, in gallons per average year. The actual runoff will then be compared to the existing conditions runoff and the predicted conditions runoff.

## 4.6 Private Property Implementation

### 4.6.1 Introduction

This section describes the specifics on the private property implementation, namely the residential downspout disconnection program. There is the possibility of other GI on private property besides downspout disconnections and rain barrels/cisterns. The discussion below is applicable throughout both the Rock Creek and Potomac River sewersheds.

### 4.6.2 Residential Downspout Disconnection Program

The first GI projects in both Rock Creek and Potomac River sewersheds contain approximately 6,700 downspouts that were observed during field inspection. These downspouts were categorized during site visits and data analysis as shown in Table 4-15. Of these downspouts, approximately 50% are already disconnected. Another 27% of downspouts cannot be technically feasibly disconnected given the downspout configuration and/or the site topography. The remaining downspouts could potentially be disconnected. The goal is to disconnect as many downspouts as possible, through public outreach with private property owners. District past programs will be taken into account in coordination with DOEE, particularly RiverSmart Homes.

**Table 4-15. GI Program Downspout Disconnection Categories for Rock Creek and Potomac River Project No. 1 Areas**

| Rock Creek and Potomac River GI Project No. 1 Areas | Currently Disconnected | Cannot Be Disconnected | Potential Disconnects | Total |
|---|---|---|---|---|
| Approximate Rooftop Acres | 28.1 | 29.8 | 11.4 | 69.3 |
| % | 40.5 | 43.0 | 16.5 | 100.0 |

For projects beyond the first GI projects in both Rock Creek and Potomac River sewersheds, a similar analysis and field inspection approach will be taken towards downspout disconnections.

#### 4.6.2.1 Project Locations

Figures 4-1, 4-3, 4-4 and 4-5 show the project bounds for each of the eight planned projects. Downspout disconnections are intended to be a concurrent, complementary approach to ROW GI control measures in reducing rainfall runoff contributions to the combined sewer system. Given the nature of disconnections and the land use of these areas, it is anticipated that most downspout disconnections will be happening in lower density residential neighborhoods, as well as in other locations where properties are bordered by green space.

#### 4.6.2.2 Schedule

DC Water is planning to have outreach and subsequent disconnections begin approximately 6 months prior to construction contract awards for each of the eight projects. There is a gap after the construction of the first two GI projects, one in each sewershed, Rock Creek and Potomac River, to evaluate their effectiveness before undertaking the remaining projects, per the Amended Consent Decree.

#### 4.6.2.3 Program Administration and Tracking

As part of the maintenance, homeowners with disconnections will be inspected periodically by DC Water to ensure the continued operation. This is further detailed in Section 5.2.2.2. Further, the inspections will be documented to track compliance and assist with corrective measures and/or mitigation as need be.

##### 4.6.2.3.1 Estimated Cost

DC Water is in the process of estimating the cost range of an individual downspout. As it is difficult to predict a participation rate, these costs range in part due to uncertainty about the scale of the work that will take place. Other factors include contractor availability and work load, bid competitiveness, and DC labor market conditions and requirements.

##### 4.6.2.3.2 Coordination with Incentives and Rebates

DC Water is evaluating an incentives program to help achieve maximum property owner participation. A variety of incentives are under consideration, as is collaboration with other District agencies and organizations.

## 4.7 Rock Creek Public Notification System

Per the Amended Consent Decree, a public notification system needs to be installed for the Rock Creek sewershed to indicate CSO events, with a minimum of three locations situated at public access points to the receiving waters. Following these requirements, DCCR has chosen to use a system similar to that planned and installed for the Anacostia River as specified in the Amended Consent Decree. This CSO event indicator system will be used to notify users of Rock Creek of CSO events, with a pair of lights at each location. One will be configured for daylight conditions and the other for nighttime. Further, two colors of lights will be used – red for the duration of a CSO event, and yellow for the 24 hours after a CSO event has ended.

To adequately inform the public of CSO events, parking lots have been chosen as the preferred locations for this public notification system. These three locations are: near the mouth of Rock Creek at the Potomac River; at the National Zoological Park; and near the outfall of CSO 049 along Piney Branch Road. These locations are shown below in Figure 4-8. These location selections are preliminary; all three locations proposed are on National Park Service property, and will require coordination and agreement of the landowner to finalize appropriate locales.

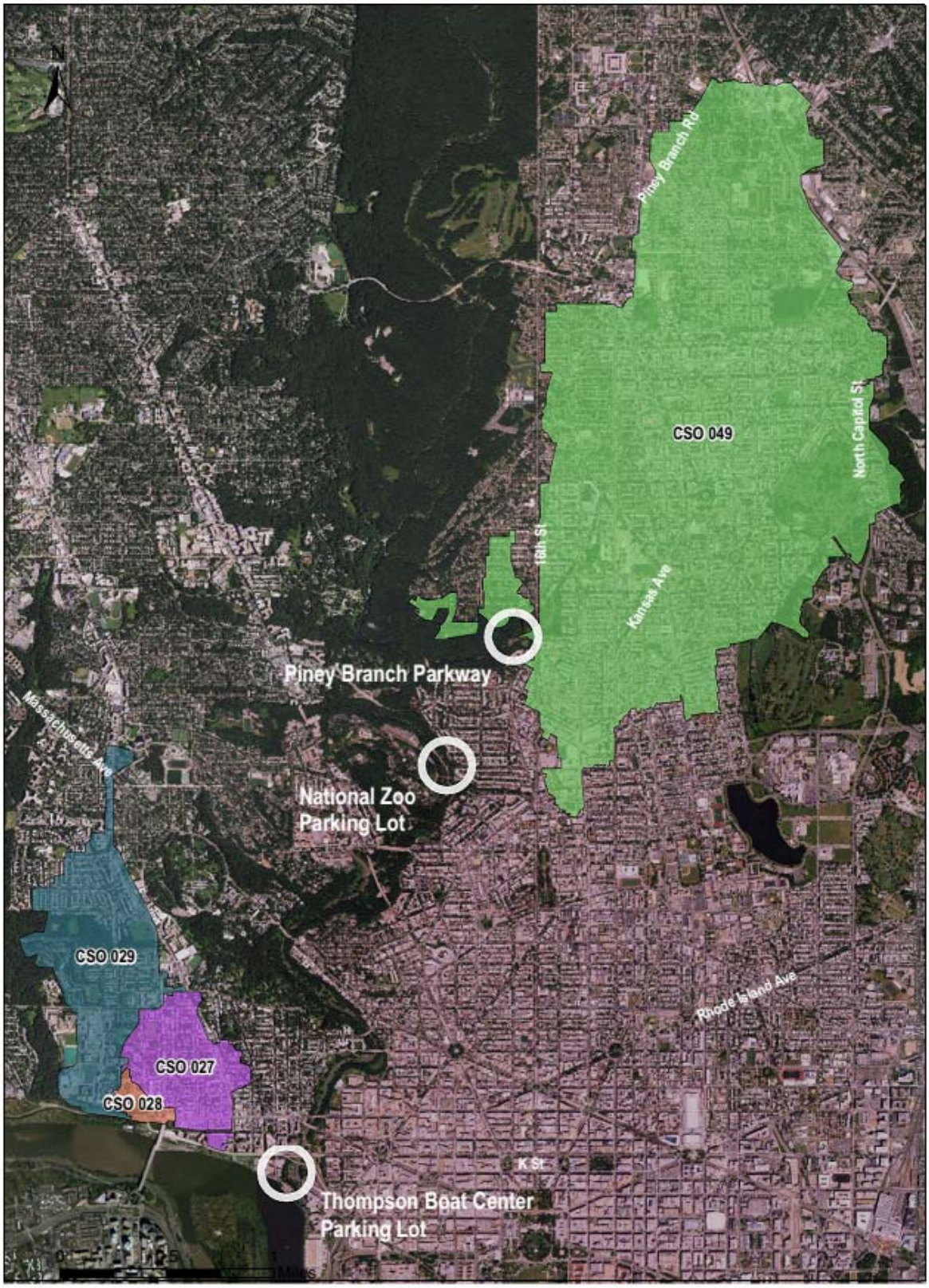


Figure 4-8. Rock Creek Public Notification System

# 5 Maintenance and Preservation Plans

## 5.1 Introduction

This section depicts the maintenance and preservation plans for the constructed GI projects. The maintenance plan includes a description of DC Water's formal maintenance program and asset management program for GI control measures. Implementation of the maintenance plan for GI constructed on both public property and private property is discussed in detail. The preservation plan includes methods to identify and track risks to installed GI. The preservation plan also includes mitigation for GI impacts to ensure that future site or land use changes do not result in the loss of the runoff reduction benefits of the GI control measures installed pursuant to the GI Program Plan, unless that loss is compensated for by other controls in the same CSO sewershed.

## 5.2 Maintenance Plan

### 5.2.1 Maintenance Program Framework

DCCR established maintenance goals related to the performance, safety, and aesthetics of GI measures to guide predicted future maintenance as well as development of an asset management process (Ray et al, 2015):

- Ensure GI function and performance to meet DC Water's water quality goals and Amended Consent Decree requirements;
- Ensure public and maintenance crew safety;
- Ensure original GI project aesthetic goal(s); and
- Ensure public use of the ROW, preservation of public infrastructure, protection of public and private properties, and minimization of nuisance conditions.

These goals are DCCR's foremost considerations in creating a maintenance plan.

DC Water is responsible for maintaining the GI control measures in accordance with DC Water's NPDES Permit. For GI control measures in the public ROW, access for inspection, maintenance and monitoring will be included in the annual blanket permit from DDOT for maintenance and access to water and sewer lines and manholes. Maintenance of GI control measures in the public ROW needs to be clearly coordinated between DDOT and DC Water. Further, an operation and maintenance manual for GI control measures will be prepared by DC Water and provided to the District prior to each GI project being placed into operation. Where DC Water will not be maintaining GI, DCCR will develop the necessary agreements and contracts to establish the roles and responsibilities of the GI implementing agency (DC Water) and the maintenance entity.

#### 5.2.1.1 Initial Warranty and Maintenance Periods

As part of the construction contract, there is a warranty period that begins when construction is substantially complete. This warranty period includes a contractually-obligated period, also referred to as the initial maintenance period, where the contractor/design-builder is responsible for maintenance of the GI project. The warranty and maintenance periods typically are identical throughout a project and tend to have durations of 1 to 3 years, depending on the type of GI control

measures installed. This is particularly important for vegetated GI control measures. The newly planted vegetation requires watering and protection from weeds while the root systems establish. As planting is generally the final step in construction of GI projects, this first maintenance effort and the establishment period usually start with construction completion. (DC Water, 2015, Appendix G). Further, the design-builder must provide as-builts and service manuals for non-DCCR standard elements.

#### 5.2.1.2 Formal Maintenance Program

The DCCR GI program is required to perform maintenance on the GI projects that contribute to the CSO or stormwater reduction requirements for the regulatory agreement (per Amended Consent Decree and MS4 permit requirements). The term "Formal Maintenance Program" is meant to differentiate between regulatory-required maintenance activities and the other maintenance efforts being put into place (DC Water, 2015, Appendix G). DC Water is responsible for all long-term maintenance of GI control measures, once the initial warranty and maintenance periods have lapsed. This maintenance will either be done by DC Water staff or by contractors. Maintenance typically includes tasks such as installation of specified plant species in bioretention control measures, removal of expired vegetation, grading and erosion control as needed, mulching, watering and related work. Maintenance also includes data collection, measurements and monitoring for further analysis of GI control measures.

DCCR currently has a number of GI assets that were constructed in recent years that served as the starting point for the GI asset management program framework development. These projects are located at either DC Water facilities or in the public ROW in the District and include 15 open area bioretention basins, two green roofs, and two locations with pervious pavement. With these projects in the ground and being maintained by various contractors (with DC Water oversight), DCCR is assessing and evaluating the following information for improved maintenance efficiency and performance, and longevity of the GI control measures:

- Current maintenance tasks and frequencies;
- The need for additional maintenance tasks;
- Contractor performance;
- Current GI designs; and
- The process for logging and tracking the completion of maintenance tasks.

The information learned through this process is currently informing development of the program (Ray et al, 2015).

#### 5.2.1.3 GI Asset Management Program

As the distributor of potable water and the entity responsible for the collection and treatment of wastewater in the District and several surrounding counties, DC Water maintains a diverse portfolio of gray infrastructure assets (water mains, sewers, pumping stations, and facilities at the Blue Plains Advanced Wastewater Treatment Plant). For these assets, DC Water uses a combination of two software programs to catalog assets and assign and track maintenance work: ESRI's Geographic Information System (GIS) and IBM's asset management program called Maximo Asset Management (Maximo). GIS serves as the data inventory and spatial representation of assets, while Maximo manages the generation of work orders according to a set schedule. The two software packages work

directly with each other, with GIS providing asset information to Maximo to allow the scheduling of maintenance tasks to each specific asset. Figure 5-1 below provides an overview of each software package and illustrates the flow of asset data from GIS to Maximo. Because of the extensive institutional knowledge associated with using these programs to maintain DC Water assets and the flexibility of these programs to handle GI, DCCR determined DC Water's existing gray infrastructure asset management program was the most efficient platform for the development of the GI asset management program (Ray et al, 2015). Data will be developed by the District and DC Water together, to assure that the GI data is produced in a format that can be used by both parties. Further, DC Water will respond to requests for maintenance from District residents.

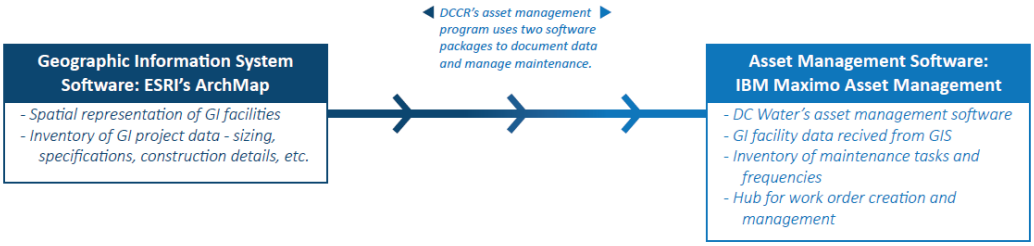


**Figure 5-1. Asset Data Flow between DC Water's Asset Management Software Programs: GIS and Maximo**

Building off the goals for maintenance, the goal for the GI asset management program additionally included a method to allow data to be collected on performance and maintenance of its GI and for maintenance protocols to be adapted over time to optimize control measure performance and minimize maintenance costs. Using the information gained from the survey of GI programs in the US and meetings with DC Water's GIS and Maximo teams, DCCR created the GI asset management program Development and Implementation Process, illustrated in Figure 5-2, intended to help frame and guide the program. The steps are described further in the sections that follow (Ray et al, 2015).

*Developing the GI Inventory Framework* – DCCR's initial step was to create the definition for the GIS framework. For GI asset management, GIS will serve as an inventory and database tool for the GI assets. DCCR intends that the data in GIS will be used to query assets based on specific project attributes. For example, a GIS query can quickly identify bioretention cells with similar specifications for the purpose of isolating common maintenance issues. Focused on gaining an understanding of common maintenance/design issues to address, this functionality will allow DCCR to utilize an adaptive management approach to inform future siting, design, construction, and operation and maintenance of GI control measures.

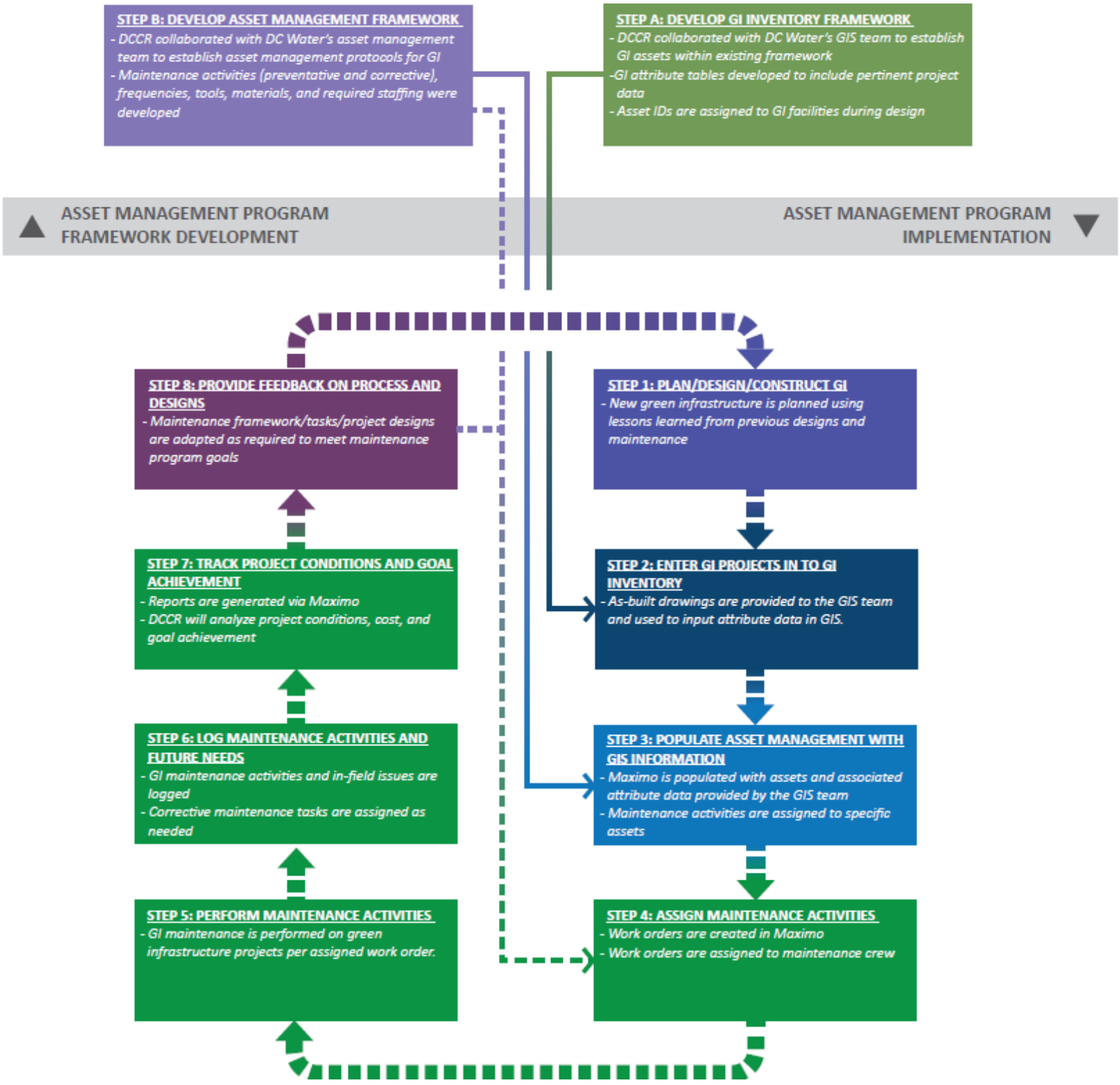


**Figure 5-2. DCCR's GI Asset Management Development and Implementation Process**

*Developing the Asset Management Framework* – Beyond GIS, DCCR also created the definition for the information to be included in the asset management software, Maximo. In the current framework, asset information from GIS is imported into Maximo, and specific maintenance activities and frequencies are linked to each GI asset in Maximo. For example, for bioretention control measures, information regarding the frequency, season, task duration, and materials required is provided for all tasks ranging from weeding to underdrain inspection. With those links in place, Maximo generates work orders and forwards them to assigned designees for the completion of maintenance.

Beyond creating the framework and hierarchy, DCCR also dedicated time to create the Asset ID system. This system allows maintenance crews to easily identify assets in the field as well as have a common ID for District residents for questions or concerns related to a specific asset. DCCR evaluated and defined how the projects would be identified. Figure 5-3 provides an illustration of the signs that were used for the initial GI assets as well the how asset IDs were defined. These signs were placed at all current assets and are intended to aid both the maintenance crews and District residents in identifying assets by name in the future.


**Figure 5-3. Example Sign used for Open Area Bioretention**

As part of the development of this framework, DCCR identified early on the need to move beyond the traditional DC Water approach to asset management tracking to obtain real-time data in the field on maintenance task completion and identified issues. To achieve this goal, DCCR is currently developing a mobile application for Maximo with the ability to manage work orders remotely on mobile devices in real time. DCCR believes that the efficiency gained through adding mobile capability will provide even greater reliability and data feedback on how to optimize maintenance long-term as DCCR moves into large-scale GI implementation (Ray et al, 2015).

### 5.2.2 Maintenance Program Implementation

DCCR is currently working on finalizing the framework for full implementation of the asset management program. The implementation phase of the program has eight steps that are established to operate in a feedback loop, adapting maintenance tasks and frequencies, and future GI designs as data on project performance and maintenance is gathered over time. Briefly, these eight steps are as follows (Ray et al, 2015):

- Planning, Designing, and Constructing Green Infrastructure;
- Entering GI Projects into GI Inventory Populating Asset Management with GIS Information;
- Assigning Maintenance Activities;
- Performing Maintenance Activities;
- Logging Maintenance Activities and Future Needs;

- Tracking Project Conditions and Goal Achievement; and
- Providing Feedback on the Process and Designs.

Maintenance can be divided into routine and non-routine – that which is preventative and is performed at regular intervals, and that which is in response to a particular performance issue. Typical activities and frequencies are discussed below for various types of GI control measures on private and public (both ROW and non-ROW) properties. In addition, DC Water will undertake maintenance in response public feedback. Factors that are taken into consideration in developing a maintenance plan for a specific installation include:

- Runoff volume;
- GI control measure type (i.e., bioretention, pervious pavement, rain barrel, etc.);
- Site specific factors (dependent on actual site conditions such as runoff volume, traffic loading, sediment loading, litter/debris loading, etc.);
- Seasonal variations (i.e., fall leaf drop, snow removal, etc.);
- Temporary adjacent site activities (i.e., construction); and
- Irregular weather events (i.e., hurricanes, wind storms, etc.).

#### 5.2.2.1 GI on Public Property: Maintenance Activities and Frequencies

A selection of typical maintenance activities for bioretention and permeable pavement is summarized below, in Table 5-1. It is anticipated that GI control measures within the CSO sewersheds 027, 028, 029, and 049 will also include subsurface storage and targeted sewer separation on public property, and there is potential for other technologies that may be incorporated. The specific activities will be finalized to best complement each project and the array of potential GI control measures within each. Inspection and maintenance will be performed to a degree and frequency required to achieve the CSO control performance objectives. Inspection and maintenance measures and frequencies will be adjusted based on actual experience (i.e. site specific conditions, etc.) with the facilities after they are constructed.

**Table 5-1. Typical Maintenance Activities for Permeable Pavement, Bioretention and Subsurface Storage GI Control Measures**

| GI Type | Typical Activities |
|---|---|
| Bioretention | Removal of trash, sediment and animal waste; inspection of curb cuts, swales, inflow points, velocity dissipaters, overflow inlets, weirs, outflow structures, etc. for debris and blockages |
| | Inspect and replace mulch in areas impacted by erosion/bare areas |
| | Inspect clean out pipes and underdrains |
| | Inspect for standing water after an average rainfall event; if standing water found, clear debris and/or blockage from underdrain or other structures as required |
| | Removal of weeds, plant debris and invasive plants; inspect and treat vegetation for disease and pest problems, using Integrated Pest Management Approach |
| | Watering when rainfall precipitation is inadequate for plant health |
| Permeable Pavement | Inspection of permeable pavement surface and underdrain clean outs to verify water flow and exfiltration; inspection of permeable pavement surface for heavy sediment buildup |
| | Vacuuming of the permeable pavement surface to prevent clogging and maintain permeability of the system; removal of any weeds; clean out of all underdrain clean outs and catch basins to ensure drainage of the system |
| Subsurface Storage | Remove sediment and oil/grease from inlets, pretreatment devices, flow diversion structures, storage practices and overflow structures |
| | Inspect the condition of stormwater inlets for material damage, erosion, or undercutting; repair as needed |

Source: DCCR, DOEE (2013b)

The maintenance for GI on public property includes both ROW and non-ROW control measures. For non-ROW properties, coordination with the property user(s)/owner(s) may be required, for instance if the non-ROW property is a fire station or a school.

#### 5.2.2.2 GI on Private Property: Maintenance Activities and Frequencies

On private property, it is anticipated that the majority of GI work will take the form of downspout disconnections, as previously discussed in Section 4.6. Below, in Table 5-2, are summarized some typical maintenance activities for downspout disconnections and rain barrels, as an example of maintenance for GI on private property. There are potential other technologies that may be incorporated on private property, including possibly rain gardens and green roofs. The specific activities and frequencies will be finalized to best complement each project and will reflect the types of GI installed in each, however at this time, downspout disconnections are the majority of the GI work planned for private properties.

**Table 5-2. Typical Maintenance Activities for Downspout Disconnections and Rain Barrels/Cisterns**

| GI Type | Typical Activities |
|---|---|
| Downspout Disconnections | Inspection of downspout, ensuring that downspout has remained disconnected; erosion control of the receiving area; ensuring the receiving area remains uncompacted and pervious |
| Rain Barrels/ Cisterns | Emptying rain barrels after major rain events (by program participants) |
| | Inspecting and cleaning prescreening, keeping gutters and downspouts free of leaves and other debris, patching holes in mosquito screens, and inspecting and cleaning lids, vents, spigots, and overflow pipes |

Source: DOEE (2013b)

Maintenance on private properties includes ensuring that homeowners understand maintenance requirements. This will start with a downspout disconnection 'welcome packet' to educate homeowners. The maintenance requirements will be outlined in the homeowner agreement, and checklists will be provided within. This contract will also include access agreements or coordination details for accessing their property for periodic inspections. Maintenance support from DC Water is anticipated to include:

- A point of contact for maintenance questions/issues;
- Online educational video and "how to" manual;
- Associated maintenance guidance for any extreme weather events; and
- Reminders for homeowner maintenance.

## 5.3 Preservation Plan

For the purposes of this GI Program Plan, preservation refers to ensuring that changes on a property containing a GI control measure (be they due to weather, accidents, changes in ownership, maintenance, property usage, physical structures, upstream development, or land use zoning) do not result in the loss of the runoff reduction relative to the installed functionality pursuant to the GI Program Plan, unless replaced by other control measures for compensation and mitigation, within the same CSO drainage area.

### 5.3.1 GI on Public Property

GI on public property is prone to any number of risks, including:

- Vandalism
- Adjacent construction
  - Infrastructure/utility work
  - Construction or rehabilitation work on adjoining private properties
  - Emergency work on infrastructure, utilities or adjoining private properties
- Accidental damage
  - Snow removal
  - Vehicular accidents
  - Trash and waste
  - Pedestrian damage

Most of these risks are more likely within the public ROW, but they are also possible on public non-ROW properties. Ensuring that future site or land use changes or impaired control measures (potentially due to some of the risks listed above), requires outreach and structured agreements with the various stakeholders within public property. Potential stakeholders are listed below, along with the agreements to outline responsibilities in the case of loss of GI, in Table 5-3.

The crux of DCCR's preservation plan for GI is repair where at all possible, and where necessary, replacement in kind, ensuring equivalent volume capture within each CDA. As the vast majority of work on public properties will require DC Water permitting, it is critical that GI projects are thoroughly documented so that future work can be well coordinated, including mitigation of any potential impacts of existing GI control measures.

A Memorandum of Understanding (MOU) is currently being finalized between DC Water and the Office of the City Administrator (OCA) of the District. GI control measures replaced or repaired will be constructed in accordance with DC Water's GI design standards. DC Water will be allowed to inspect the GI control measure during construction. The District will provide record drawings to DC Water shortly after completion, and once accepted by DC Water, DC Water shall be responsible for maintaining GI control measures reconstructed or repaired by the District.

Further, this MOU also will outline DC Water and DOEE responsibilities to provide one another with GIS files for tracking and volume accounting purposes. Those provided by DC Water will include: GI control measures placed in operation and GI control measures decommissioned; description of GI control measures including type, drainage area, and capacity; and status of inspections and maintenance activities. The files provided by DOEE will include: permits issued, permits expired, permits closed out and reason; description of facilities including type, drainage area, and capacity; status and details of inspections/maintenance; and compliance status and compliance directives issued. These files will include shapefiles for ease in considering footprints of GI infrastructure and calculating CDAs as needed.

DC Water permitting will also be an integral part of the preservation plan. As the vast majority of substantial construction in the District requires DC Water permitting, all projects that pass through the DC Water permitting process will be screened against GI control measure locations to ensure all work that may impact GI will be properly addressed or, better yet, relocated to eliminate any impact. This includes planned utility work.

**Table 5-3. Stakeholders, Risks and Mitigation for DC Water GI Control Measure Preservation**

| Agency/Entity | Risk(s) | Mitigation |
|---|---|---|
| DC Department of General Services | Change in land use, development, redevelopment | Coordination and permitting per MOU |
| DC Department of Transportation | Road maintenance and upgrades, planned or emergency | Coordination via permitting. For emergency work, documentation and correction as needed after. |
| DC Department of Parks | Change in land use, | Coordination and permitting per MOU |

| Agency/Entity | Risk(s) | Mitigation |
|---|---|---|
| and Recreation | development, redevelopment | |
| DC Water | Proximity of planned or emergency work to existing or proposed GI | Coordination via permitting. For emergency work, documentation and correction as needed after. |
| Washington Metropolitan Transit Authority | Bus stop relocation, proximity of planned or emergency work to existing GI | Coordination via permitting. For emergency work, documentation and correction as needed after. |
| Utilities:<br>• Comcast<br>• Pepco<br>• Washington Gas<br>• Verizon | Proximity of planned or emergency work to existing GI | Coordination via permitting. For emergency work, documentation and correction as needed after. |
| Private Developers | Proximity of planned or emergency work to existing GI | Coordination via permitting. For emergency work, documentation and correction as needed after. |
| Roadway Users, Irregular Weather Events | Accidental damage via snow removal, littering, traffic accidents, unusual weather events (i.e. hurricanes, derechos) | Proactive design – protective siting, visibility of aboveground elements. Periodic maintenance to ensure any damage incurred is addressed in a timely fashion. Documentation and correction of any correction after by DC Water. |

### 5.3.2 GI on Private Property

Under DCCR's current approach for private property, which focuses on downspout disconnections, the major risks to GI on private property are primarily reconnection of downspout disconnections (including the removal of a rain barrel). This is particularly likely to occur when property changes ownership. Another risk is that of redevelopment of a property resulting in downspout reconnection or relocation.

The stakeholders on private property are the various property owners. Each homeowner/property owner that agrees to a downspout disconnection or installation of a rain barrel will have an agreement with DC Water, permitting periodic inspections including access as needed. These inspections would allow DC Water to evaluate issues that would affect the runoff reduction. The agreement would also require homeowners to notify DC Water if they reconnect their downspout. If a disconnection is found to be reconnected, the downspout will either be disconnected again or the volume compensated elsewhere within the CDA. For large private properties, any substantial changes in use – a disturbance over 5,000 square feet – would result in the need for the owner to continue to manage the 1.2" Retention Standard for the same surface area per DOEE stormwater regulations.

Further incentives to maintain downspout disconnections and/or rain barrels via RiverSmart discounts and potentially incentives from DC Water for continued maintenance of GI control measures are being evaluated.

There is the possibility of other GI on private property besides downspout disconnections and rain barrels/cisterns. Any GI on private property would likewise be accompanied by a similar agreement, allowing for DC Water inspection and fostering a mutually beneficial relationship in maintaining and preserving GI.

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# 6 Public Outreach and Engagement

## 6.1 Introduction

The successful implementation of the DC Water GI Program Plan and its long-term functionality depends, to a great degree, upon community education, awareness, and active participation during the implementation of its GI projects. A comprehensive public outreach program will ensure adequate participation from the public during every stage of the DC Water GI Program Plan implementation, from design to construction through long-term maintenance.

This public outreach plan outlines a strategic approach for educating and engaging residents, property owners, key stakeholders, and the general public in the Rock Creek and Potomac River sewersheds to promote and facilitate installation of GI on the public ROW and private property through the implementation of DC Water GI program. The plan provides guiding principles, goals and strategies to reach stakeholders, property owners and the general public as well as targeted communications tools and key messages to bring the public education about GI, awareness of the DC Water GI Program Plan and generate overall support and encourage the public to positively and actively respond to a "call to action" when needed.

## 6.2 DCCR GI Public Outreach and Engagement

### 6.2.1 Public Outreach and Engagement Guiding Principles

The proposed public outreach and engagement plan is based on the following guiding principles:

- Public outreach is integrated though every phase of the projects.
- Public outreach processes invest in and foster long-term collaborative working relationships with community partners and stakeholders.
- Public dialogue and decision-making processes identify and encourage participation across a diverse community of stakeholders.
- Public involvement processes and techniques will be designed specifically to fit the scope, character, and goals of each GI project.
- Public decision-making processes are accessible, open, honest and understandable. Members of the public receive the information they need, with sufficient lead time to participate effectively.

## 6.3 Proposed Program-Wide Public Outreach and Engagement

Program-wide public outreach and engagement efforts are focused to create awareness and educate the public about GI, create goodwill and generate support for the successful implementation of the projects. Program-wide public outreach and engagement efforts will in some cases coincide with project-specific public outreach efforts; however they will be of a broader nature.

### 6.3.1 Public Outreach and Engagement Goals

Property owners in the Rock Creek and Potomac River sewersheds and other interested stakeholders will be engaged to promote and facilitate installation of GI in the public ROW and private property and to provide public input into the site selection and conceptual design process for the GI control measures that DC Water proposes to install as part of its GI Program Plan.

The following are the main goals of public outreach and engagement efforts throughout the life of DC Water GI program:

1. **Public Education** – Educate the community and stakeholders on what GI is and its benefits.
2. **Public Awareness** – Create public awareness and a positive perception of the DC Water GI Program Plan by using strategic messaging to communicate the wide range of benefits of GI to diverse audiences.
3. **Public Engagement** – Use early and consistent engagement throughout the GI Program Plan implementation to help the DC Water, community members and stakeholders adapt, learn, and understand more about one another.
4. **Public Call to Action** – Encourage the public to positively respond to specific calls to action, including learning more about GI, and actively participating during the DC Water GI Program Plan implementation as necessary.

### 6.3.2 Stakeholder Analysis

Throughout the life of the DC Water GI program, an ongoing in-depth stakeholder analysis is necessary; recognizing that it will grow and evolve as the program is implemented. Stakeholders include environmental groups, governmental agencies (including public schools), civic associations, residents, faith-based organizations and others. The stakeholders have been identified mainly based on focus, proximity to DC Water GI program areas, and general interest and support of the DC Water GI program. Many of the stakeholders have actively participated during the Amended Consent Decree comment period by submitting comments that shaped the current DC Water GI program.

### 6.3.3 Proposed Public Outreach and Engagement Strategies

The following strategies are proposed to be employed to meet the goals of this plan:

- **Engage the Public Early and Often** - Utilize community-based participatory planning. Keep community members and stakeholder well informed, engaged and regularly participating throughout the entire program
  - Get to know each neighborhood, define what is the best way to communicate with members of each community, and identify community leaders through local organizations
  - Develop consistent talking points to communicate with the public keeping in mind the need to adapt messages while addressing different audiences
- **Establish Purpose and Need** - Outline the purpose and need of GI regarding CSO control, but also with triple-bottom line benefits to help the public identify with, and to actively respond to DC Water GI program's call to action
- **Track and Use Public Opinion** - Track it, use it, report back, and use feedback for a successful implementation of current and future GI projects

- **Leverage Relationships** - Build on existing relationships developed during previous community engagement activities conducted by DC Water introducing the DCCR project and Amended Consent Decree
  - Learn from local partners who represent members of the community that participate the least and reach out to them in a targeted manner
  - Follow advice from the local partners/leaders on how to communicate with the community and stakeholders
- **Coordinate Outreach and Engagement Efforts** - Given that DC Water GI program is an integral part of DC Water's DC Clean Rivers program and DC Water's broader initiatives run by the DC Water's Office of External Affairs, all involved communications teams need to coordinate to ensure a consistent agency-wide message. Further, DC Water with coordinate specifically with the District and other agencies to effectively reach the project areas.
- **Create Synergies and Partnerships** - Coordinate communication and project implementation efforts with District agencies and organizations.
  - Identify synergies across projects to expand opportunities for implementation of GI within other District agency projects.
- **Enlist Media as Partners** - Coordinate efforts for inclusion of District-wide publications and community specific media outlets.

### 6.3.4 Proposed Public Outreach and Engagement Tactics

The following tactics are designed to carry out defined strategies and provide opportunities for the community and stakeholders to learn about the DC Water GI program and to actively participate during the implementation of its GI projects. In carrying out the proposed public outreach and engagement plan, traditional and non-traditional outreach tactics, tools, and materials will be utilized to fully and successfully engage the diverse community of Washington, DC.

Tactics to include:

- Participate and host innovative hands-on public meetings, events, and tours to GI project sites
- Present at schools, congregations, community groups such as neighborhood and businesses associations, etc.
- Participate in educational seminars, conferences, and festivals
- Utilize innovative tools such as social media and online surveys
- Utilize paid and earned mainstream, neighborhood, and ethnic based media to feature editorials and press releases as well as advertisements when appropriate
- Distribute literature through partnerships with schools, faith-based organizations, businesses, public libraries, community and recreational centers, as well as handed out door-to-door and at community events
- Work with trusted community leaders as intermediaries – known and trusted community leaders lend support to outreach invitations and opportunities
- Promote business owners and community leaders to encourage peer-to-peer information sharing
- Placement of construction signs and banners at project sites to help community members make the connection between DC Water GI program and its projects while being constructed

### 6.3.5 Coordination with Existing Green Infrastructure Program Initiatives

The public outreach plan will identify organizations both within the District and nation-wide currently or with future plans of implementing GI initiatives to develop relationships with the goals of leveraging resources implementing GI projects in a more efficient and/or larger scale, learning from other organizations' "lessons learned" during their GI program implementation and leveraging public outreach efforts to reach out and engage the public in a more efficient and effective manner.

### 6.3.6 Proposed Communication Vehicles and Collateral Materials

The proposed public outreach and engagement plan identifies the need to develop branding images, graphics and materials that reflect DC Water's high quality standards for designing and building its GI projects and its commitment to the best use of resources. DC Water's high standards need to be reflected in every step of its GI program implementation, from educational materials, to ways of engaging the community and stakeholders. Materials under consideration include videos, interviews, stickers, apparel, flyers, mailers, door-hangers and signage.

The need to build trust and support requires that messages are offered via a variety of mediums in a regular and consistent manner. The plan will incorporate multiple channels including face-to-face, print and electronic and social media.

Throughout the life of the DC Water GI program and on an ongoing basis, regular DC Water GI program updates will be made to District Council members, ANCs, community members, stakeholders and partners. Such outreach is already well underway. Specific calls to action are to be implemented in coordination with contract and project timing.

## 6.4 Proposed Project-Specific Public Outreach and Engagement

The DC Water GI program will be carried out in 5 GI projects for Rock Creek from 2015 through 2030 and 3 GI projects for Potomac River from 2015 through 2027. The first two GI projects to be implemented as part of DC Water GI Program Plan are as detailed in Sections 4.2 and 4.3 above.

### 6.4.1 Public Outreach and Engagement Project - Specific Goals

The main objective of the DC Water GI program public outreach and engagement effort at the project-specific level is to engage property owners in the Rock Creek and Potomac River sewersheds and interested stakeholders to promote and facilitate installation of GI on public and private property and to provide an opportunity for input on the site selection process and concept design for GI control measures proposed by DC Water.

These goals parallel the program-wide public outreach goals at a project specific level:

1. **Public Education** - Educate the community and stakeholders about what GI is and its benefits for the first Rock Creek and Potomac River GI projects area
2. **Public Awareness** - Create public awareness and recognition of opportunities from the first Rock Creek and Potomac River GI projects coming to specific neighborhoods and the need for public participation during their implementation

3. **Public Engagement during the first Rock Creek and Potomac River GI projects** - Early and consistent community engagement to help DC Water GI program, the community, and other stakeholders adapt, learn, and understand more about one another to support a successful implementation of current and future GI projects
4. **Public Call to Action** - Encourage audiences to positively respond to specific calls to action. Calls to action messaging topics would encourage learning more about GI, positively engaging in the implementation of the first (and future) Rock Creek and Potomac River projects, and participating in DC Water downspout disconnection program. The core message would foster a sense of stewardship by communicating that individuals can be a part of the solution to cleaning up Rock Creek and Potomac River.

### 6.4.2 Stakeholder Analysis

In planning for public outreach and engagement at project-specific level, an in-depth stakeholder analysis of each Rock Creek and Potomac River GI project area is necessary. Stakeholders include residents, businesses, governmental agencies, schools, faith-based organizations, advocacy/non-profit organizations, business organizations, etc. As public outreach efforts are implemented, there is a need to continue coordinating and building partnerships with advocates, key stakeholders, District departments, and elected officials that have been actively participating in prior outreach efforts conducted by DC Water. This effort is necessary to ensure that information is appropriately disseminated in a timely manner and that key messages are consistent, so that DC Water, its GI program and projects speak with one voice.

Key stakeholders currently identified for each project area include residents, businesses, faith-based organizations, schools, local and District government agencies (including DDOT, DOEE, and the DC Housing Authority), environmental groups and civic organizations. The list is expected to grow as program and project outreach moves forward.

### 6.4.3 Outreach Phases for Public Property GI Program

Four project phases have been identified for the implementation of GI within public space. Each phase is defined by the schedules for the first projects within the Rock Creek and Potomac River sewersheds. During each phase of a GI project, specific objectives are set and public outreach activities are planned to accomplish project goals and objectives. Due to the different projects' schedules, Phase 3 and 4 overlap in time/calendar but remain specific to each project.

#### 6.4.3.1 Phase 1 – GI Siting

During this phase, the design team will conduct desktop analysis and field investigations to identify GI siting within the project areas for the first GI Rock Creek and Potomac River projects.

<u>Outreach Objectives During Phase 1:</u>

- Continue to educate the community about GI, DC Water GI program and each specific GI project as well as GI benefits and opportunities for each project area
- Continue to develop relationships with community members, local organizations, and stakeholders to gain support within assistance DC Water with public outreach efforts for each specific GI project area

- Inform community members and stakeholders within each project area that GI projects are coming to their neighborhoods
- Encourage community members and stakeholders to begin actively participating in the early stages of GI projects implementation
- Encourage community members and stakeholders to assist in the identification process for potential locations to construct GI control measures

#### 6.4.3.2 Phase 2 Public Input and Feedback

During this phase, the design team conducts a second level of field investigations (soil borings and detailed survey) to further define feasibility of identified sites during Phase 1. Once field investigations are completed and sites are identified, the public will be informed of feasibility of proposed sites and asked for further input on the GI project when feasible.

Outreach Objectives During Phase 2:

- Continue to educate the community about GI, the overall program and each specific GI project as well as GI benefits and opportunities for each project area
- Continue to develop relationships with community members, local organizations, and stakeholders to gain support within assistance DC Water with public outreach efforts for each specific GI project area
- Continue to inform community members and stakeholders within each project area that GI projects are coming to their neighborhoods
- Call to action - Engage community members and stakeholders during the GI design process by gathering feedback based on knowledge and experience of their neighborhoods within each GI project

#### 6.4.3.3 Phase 3 Inform Public of Next Steps for Projects

During this phase, the design team has completed design for each GI project. Requests for Proposal (RFPs) are issued and proposals from contractors are received. The public is informed of each GI project design at regular intervals.

Outreach Objectives During Phase 3:

- Continue to educate the community about GI, the overall program and each specific GI project as well as GI benefits and opportunities for each project area
- Continue to develop relationships with community members, local organizations, and stakeholders to gain support within assistance DC Water with public outreach efforts for each specific GI project area
- Provide specific education and information about DC Water downspout disconnection program and encourage property owners to enroll

#### 6.4.3.4 Phase 4 Projects Construction

During this phase, proposals from contractors are analyzed and the winning teams are selected. Design, construction and construction management contracts are evaluated and approved by DC Water. Notice to proceed (NTP) is issued and final design process and construction of the first GI

projects begin in the Rock Creek and Potomac River sewersheds. The public is informed of each step of this process.

Outreach Objectives During Phase 4:

- Continue to educate the community about GI, DC Water GI program and each specific GI project as well as GI benefits and opportunities for each project area
- Continue to develop relationships with community members, local organizations, and stakeholders to gain support within assistance DC Water with public outreach efforts for each specific GI project area
- Continue to inform community and stakeholders on the progress of the first Rock Creek and Potomac River GI projects implementation
- Coordinate public outreach efforts with each GI project construction management public outreach team
- Continue to provide specific education and information about DC Water downspout disconnection program and encourage property owners to enroll

### 6.4.4 Outreach Phases for Private Property GI Program

The downspout disconnection program, as detailed in Section 4.6, will be implemented on private property within the first Rock Creek and Potomac River GI project areas and overlap with the last two phases of GI project implementation in the public ROW, creating opportunities to engage the community and stakeholders of each GI project area. During this phase, objectives are set, and public outreach activities planned to accomplish the GI projects goals and objectives.

#### 6.4.4.1 Launch of Downspout Disconnection Program

During the downspout disconnection program launch, logistics will be defined and public outreach project-specific efforts will be focused on intensively recruiting property owners to sign up for downspout evaluation and disconnection when feasible.

Outreach Objectives:

- Continue to educate the community about GI, DC Water GI Program Plan and each specific GI project as well as GI benefits and opportunities for each project area
- Continue to develop relationships with community members, local organizations, and stakeholders to gain support within assistance DC Water with public outreach efforts for each specific GI project area
- Continue to actively and constantly engage the community and stakeholders to promote a direct call to action: Enroll in the DC Water Downspout Disconnection Program

### 6.4.5 Communication Vehicles and Collateral Materials

The need to build interest, trust, and support; and take action requires that messages are offered via a variety of mediums. Project-specific public outreach incorporates multiple channels including face-to-face, print educational materials, electronic and media outlets and social media as well as an area-specific marketing campaign as summarized below:

Materials to be developed for the first Rock Creek and Potomac River GI projects include the following:

- Project-specific informational sheets (in various forms)
- FAQ
- Project-specific websites
- Posters

Face-to-face meetings/events under consideration include ANC meetings, DC Council members, DC Water public and town hall meetings, community events, stakeholder briefings, media relations, robocalls, advertisements, and traffic advisories.

Social media under consideration includes DC Water and project-specific websites, slogans, email addresses for public response/DC Water use/engagement, blogs, Facebook, Twitter, Instagram, YouTube, Nextdoor, SurveyMonkey, and electronic newsletters, amongst others.

Print material may include FAQ, project-specific information sheets, infographics, brochures, CSO Update newsletter, door hangers and mailers, comic/coloring books, posters, commercial type posters, and transit marketing printed material.

## 6.5 Proposed Public Outreach and Engagement Activities

Throughout the duration of the GI Program Plan, DC Water will continue to develop a calendar of public and private events to participate with GI presentations and educational activities that includes ANC meetings, District Council members' briefings, festivals, etc. This includes developing and establishing a regular schedule for DC Water GI site tours, and invitations to the public to participate in the events. Further development of the DC Water GI website will occur, and updates will be ongoing. DC Water will continue to post information on DC Water social media outlets with updates and information of events when practicable.

Throughout the series of GI projects, DC Water will continue to develop partnerships with residents, stakeholders and community-based organizations. At each GI project area, multiple public outreach meeting will be conducted, promoted by flyers, posters, both printed and electronically submitted beforehand. All investigations will be preceded by public notifications, as will construction work as projects progress. Downspout disconnections outreach will be rolled out ahead of the GI projects, with active participation strongly encouraged in multiple media paths. Factsheets and other informational materials will be produced as needed.

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# Appendix A
# Amended Consent Decree

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**UNITED STATES DISTRICT COURT**
**FOR THE DISTRICT OF COLUMBIA**

| | |
|---|---|
| **ANACOSTIA WATERSHED SOCIETY, et al.,**<br>**Plaintiffs,**<br><br>**v.**<br><br>**DISTRICT OF COLUMBIA WATER AND SEWER AUTHORITY, and THE DISTRICT OF COLUMBIA,**<br>**Defendants,**<br><br>**and**<br><br>**THE UNITED STATES OF AMERICA,**<br>**Plaintiff,**<br><br>**v.**<br><br>**DISTRICT OF COLUMBIA WATER AND SEWER AUTHORITY, et al., and THE DISTRICT OF COLUMBIA,**<br>**Defendants.** | **Consolidated**<br>**Civil Action No. 1:00CV00183TFH** |

**FIRST AMENDMENT TO CONSENT DECREE**

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WHEREAS, on February 2, 2000, the Plaintiffs, Anacostia Watershed Society, Kingman Park Civic Association, American Canoe Association, Friends of the Earth, Sierra Club, and Mary Stuart Bick Ferguson ("Citizen Plaintiffs") filed an action, Civil Action No. 1:00CV00183TFH, against the District of Columbia Water and Sewer Authority (hereinafter "DC Water") and its then General Manager, Jerry Johnson, pursuant to Sections 309(b) and (d) and 505 of the Federal Water Pollution Control Act, as amended by the Clean Water Act of 1977 and the Water Quality Act of 1987 ("Clean Water Act" or "the Act"), 33 U.S.C. §§1319(b) and (d), and 1365;

WHEREAS, on December 20, 2002, Plaintiff, the United States of America, on behalf of the United States Environmental Protection Agency ("EPA"), filed a Complaint against DC Water and the District of Columbia ("District"), which case was consolidated with the pending matter against DC Water for the alleged violations of the Clean Water Act;

WHEREAS, the Complaints alleged that DC Water violated the Clean Water Act, 33 U.S.C. §§1251 et seq., by failing to comply with the District of Columbia Water Quality Standards, effluent limitations and other conditions established in the National Pollutant Discharge Elimination System ("NPDES") Permit No. DC0021199 issued to DC Water by EPA under Section 402 of the Act, 33 U.S.C. §1342, and by failing to properly manage, operate and maintain all collection, pumping facilities, treatment and/or combined sewer overflow ("CSO") control facilities or combined sewer systems ("CSS") owned and/or operated by DC Water;

WHEREAS, the United States further asserted, inter alia, a claim against the District of Columbia pursuant to Section 309(e) of the Act, 33 U.S.C. §1319(e), and Fed. R. Civ. P. 19(a);

WHEREAS, the United States, the Citizen Plaintiffs, and DC Water have resolved the claims for alleged violations of the Nine Minimum Controls and for the performance of certain

projects in a partial consent decree, entered by the Court on October 10, 2003 ("Partial Consent Decree");

WHEREAS, in that Partial Consent Decree, DC Water agreed to pay a civil penalty and to perform Supplemental Environmental Projects and a Citizen Community Project;

WHEREAS, on April 26, 2004, Plaintiffs and Defendants entered into a stipulation which provided in essence that Defendants would not contest their liability for certain claims; that Plaintiff United States waived its claims for any additional civil penalties and dismissed with prejudice its claims under Count Three of its Complaint; and that Citizen Plaintiffs also waived their claims for civil penalties;

WHEREAS, DC Water submitted a draft Long Term Control Plan to EPA in June, 2001. Thereafter, DC Water finalized the Long Term Control Plan in July 2002 ("LTCP") and submitted it to EPA in August, 2002;

WHEREAS, DC Water provided for public participation in development of the Long Term Control Plan through public hearings at various locations throughout the District of Columbia, stakeholder meetings, and other means;

WHEREAS, the recommended control plan in Section 13 of the LTCP provides for, inter alia, three or more underground storage tunnels to hold up to 193 million gallons of the combined wastewater and stormwater during wet weather and to thereby reduce CSOs significantly;

WHEREAS, the Parties and the Citizen Plaintiffs stipulated and agreed and on September 22, 2004, the Court ordered, that issues pertaining to the scope of Section 402(q) of the Clean Water Act, 33 U.S.C. § 1342(q), including whether the measures proposed in DC Water's August, 2002 LTCP conform to the water quality standards of the District of Columbia, would

not be addressed in this consolidated action, but rather EPA agreed to address such issues outside the context of this lawsuit in, inter alia, the modification of DC Water's NPDES permit that was pending at that time;

WHEREAS, EPA is the permitting agency and noticed an NPDES Permit containing Phase II conditions for public comment on March 18, 2004. EPA issued the final version of the Permit on December 14, 2004. The Fact Sheet to the final permit states that EPA has determined that, "based upon current information, including but not limited to documentation in the LTCP and the District of Columbia Department of Health's analysis and interpretation of its water quality standards, DC Water has demonstrated, pursuant to Section II.C.4.b of the 1994 CSO Policy, that the CSO control program will not preclude the attainment of water quality standards or the receiving waters' designated uses or contribute to their impairment." The Fact Sheet further provides that this determination is subject to post-construction monitoring adequate to verify compliance with water quality standards, in accordance with Section II.C.4.b and II.C.9 of the 1994 CSO Policy;

WHEREAS, because DC Water is unable to comply with the water quality based CSO effluent limits in the Phase II conditions of its NPDES Permit until such time as it has completed implementation of the CSO controls in its LTCP, the Parties entered into a consent decree, entered by the Court on March 23, 2005 ("2005 Consent Decree"), to establish a judicially enforceable schedule for implementation of the CSO controls in the LTCP;

WHEREAS, in a March 19, 2008 ruling on a permit appeal, the EPA Environmental Appeals Board ruled that District of Columbia water quality standards required that any compliance schedules for attainment of effluent limits for total nitrogen ("Total Nitrogen Limit") and phosphorus must be included in DC Water's NPDES Permit;

WHEREAS, on August 31, 2010, EPA re-issued DC Water's NPDES permit. The re-issued permit requires DC Water to design, construct and Place in Operation (as defined below) the facilities needed for DC Water to attain the Total Nitrogen Limit in the re-issued NPDES permit, and sets forth a schedule for DC Water to place such facilities into operation and to attain compliance with the Total Nitrogen Limit;

WHEREAS, in 2008, DC Water prepared a first revision to its LTCP which is called "DC Water's Total Nitrogen Removal/Wet Weather Plan" ("TN/Wet Weather Plan"). The TN/Wet Weather Plan sets forth DC Water's proposal and schedule to attain the Nitrogen Limit and related limits for phosphorus in its NPDES Permit, to satisfy its wet weather treatment obligations, and to optimize operations at Blue Plains (as defined below). On September 23, 2008, DC Water submitted to EPA the Anacostia River Facility Plan summary report and detailed implementation schedule ("Summary Report"). The Summary Report, which was approved by EPA on July 27, 2010, provides plans for implementing the wet weather aspects of the TN/Wet Weather Plan. The Summary Report is attached as **Appendix D** to this First Amendment to Consent Decree ("Consent Decree");

WHEREAS, the plans for reconfiguring and enlarging the Anacostia River tunnels and related facilities have been expanded upon by DC Water in accordance with the Summary Report, and these facilities are now under design and construction;

WHEREAS, DC Water has also completed a number of additional CSO control projects since the Partial Consent Decree was entered, including, but not limited to, projects to separate combined sewers in the Anacostia and the Rock Creek sewersheds, rehabilitate the Main & O, East Side, and Poplar Point Pumping Stations, improve regulators, eliminate outfalls, and install Green Infrastructure at multiple sites throughout the District;

WHEREAS, the 2005 Consent Decree calls for DC Water to control CSOs in the Potomac River and Rock Creek sewersheds by implementing Gray CSO Controls, including storage tunnels in each sewershed with combined storage capacities of 67.5 million gallons in the aggregate, rehabilitation of the existing Potomac Pumping Station, constructing a new Potomac Tunnel dewatering pumping station, and CSO outfall diversion, consolidation, and separation;

WHEREAS, in 2013, DC Water prepared and submitted to EPA a second revision to its LTCP which proposed substituting Green/Gray CSO Controls in the Potomac sewershed and Green CSO Controls in the Rock Creek sewershed for the corresponding Gray CSO Controls proposed in the LTCP. The new controls proposed in the second revision to the LTCP are summarized and depicted in **Appendix E** to this Consent Decree. The analyses submitted by DC Water in support of the second revision to the LTCP demonstrated that these Green/Gray CSO Controls and Green CSO Controls are projected to provide a degree of control equivalent to the Gray Controls in the LTCP. Following EPA's response to the second revision to the LTCP, DC Water filed a request to modify the affected CSO controls and deadlines pursuant to Section VII of the 2005 Consent Decree (Modifications to Selected CSO Controls and Schedules).

WHEREAS, as required by Section XXII of the 2005 Consent Decree (Modification), DC Water conducted a public participation process prior to submitting its modification request. The public participation process also included the proposed amendments to incorporate the reconfigured and enlarged Anacostia tunnels and related facilities according to the Summary Report and the more efficient designs for the Anacostia River Selected CSO Controls;

WHEREAS, the Parties have agreed to enter into this Consent Decree to reflect the above-described changes to the Selected CSO Controls and Schedules;

WHEREAS, DC Water contends that, pursuant to Section 202 of its enabling legislation,

which provides, with certain exceptions not applicable here, that DC Water is subject to all laws applicable to offices, agencies, departments, and instrumentalities of the District government, DC Water is subject to the requirements of the Anti-Deficiency Act, 31 U.S.C. §§1341 et seq., to the same extent as other agencies of the District of Columbia;

WHEREAS, the Parties agree, without adjudication of facts or law, that settlement of this matter in accordance with the terms of this Consent Decree is in the public interest, and have agreed to entry of this Consent Decree without trial of any issues, and the Parties hereby stipulate that, in order to resolve the claims for alleged violations of water quality standards stated in the Complaint of the United States, and to provide for compliance with the water quality-based effluent CSO limits in DC Water's modified NPDES permit, this Consent Decree should be entered;

WHEREAS, the Court, upon consideration of the judicial record before it and review of this Consent Decree, also finds that settlement of this matter and entry of this Consent Decree is fair and in the public interest and will address the underlying causes of the violations. The Court also finds that it should exercise continuing jurisdiction over this matter to resolve disputes and, should the need arise, to modify the obligations in this Consent Decree;

AND WHEREAS, settlement and entry of this Consent Decree does not constitute an admission of liability by DC Water or the District of Columbia;

NOW THEREFORE, before taking any testimony, and without any adjudication of any fact or law, it is hereby ORDERED, ADJUDGED, and DECREED as follows:

## I. JURISDICTION AND VENUE

1. This Court has jurisdiction over the subject matter of this action, and over the Parties hereto, pursuant to Sections 309 and 505 of the Clean Water Act, 33 U.S.C. §§ 1319, 1365, and 28 U.S.C. §§ 1331, 1345, 1355, and 1367. Venue is proper in the District of Columbia

pursuant to Section 309 of the Clean Water Act, 33 U.S.C. § 1319, and 28 U.S.C. §§ 1391 and 1395(a).

## II. APPLICATION AND SCOPE

2. The provisions of this Consent Decree shall apply to and be binding upon the Parties to this action, and their agents, employees, successors and assigns, as well as to all persons acting under the direction and/or control of DC Water, including but not limited to third party firms, corporations, consultants, and contractors.

3. DC Water shall provide a copy of this Consent Decree to any consultant and contractor selected or retained to perform any activity required by this Consent Decree upon selecting or retaining such consultant or contractor.

4. No later than thirty (30) days prior to transfer of any ownership interest, operation, management, or other control of the CSS (as defined below), DC Water shall give written notice and provide a copy of this Consent Decree to any such transferee or successor in interest. DC Water shall require, as a condition of any such sale or transfer, that the purchaser or transferee agree in writing to be bound by this Consent Decree and submit to the jurisdiction of this Court for its enforcement. DC Water shall also notify, in writing, EPA Region III, the United States Attorney for the District of Columbia, and the United States Department of Justice, in accordance with Section XXI (Form of Notice), of any such planned transfer at least thirty (30) days prior to the transfer.

## III. OBJECTIVES

5. It is the express purpose of the Parties in entering this Consent Decree to further the objectives of the Act, as enunciated at Section 101 of the Act, 33 U.S.C. § 1251. All plans, reports, construction, and other obligations in this Consent Decree or resulting from the activities required by this Consent Decree shall have the objective of achieving full compliance with the

Clean Water Act, all applicable Federal and local regulations, and the terms and conditions of DC Water's NPDES Permit, and to meet the objectives of the 1994 CSO Policy (as defined below).

## IV. DEFINITIONS

6. Unless otherwise defined herein, the terms used in this Consent Decree shall have the meaning given to those terms in the Clean Water Act, 33 U.S.C. §§ 1251 et seq., the regulations promulgated thereunder, and EPA's 1994 CSO Policy.

7. The following terms used in this Consent Decree shall be defined as follows:

"Blue Plains" means the District of Columbia advanced wastewater treatment plant at Blue Plains.

"Collection System" means both the separate sanitary sewer and combined sewer systems within the District of Columbia.

"Combined Sewer Collection System" or "CSS" means the pipelines, pumping stations, treatment facilities and appurtenances in the District of Columbia which are designed to convey wastewaters and stormwater through a single pipe system to combined sewer overflow outfalls and/or treatment works. It includes the CSS and CSO facilities described in the NMC Report (as defined below), as well as any future additions or modifications required by this Consent Decree and the Partial Consent Decree.

"Combined Sewer Overflow" or "CSO" means a discharge from the CSS at a CSO outfall designated in the Permit.

"2005 Consent Decree" means the consent decree entered by the Court in this action on March 23, 2005.

"Consent Decree" or "Decree" means this First Amendment to Consent Decree, which amends and supersedes the 2005 Consent Decree.

"Consolidation" or "Outfall Consolidation" means elimination of a permitted CSO outfall by routing the discharge so that it is joined with one or more other permitted CSO outfall(s), or by connecting it with a storage/conveyance tunnel. Consolidation of outfalls does not reduce the volume of the overflow but does allow its location to be changed.

"Contract Award" or "Award Contract" means the date on which a contract is signed by both DC Water and the other party to the contract.

"Construction" means the act of building a facility.

"1994 CSO Policy" means EPA's April 19, 1994 CSO Control Policy, published at 59 Fed. Reg. 18,688, and incorporated into the Clean Water Act pursuant to the Wet Weather Water Quality Act, Section 402(q) of the Clean Water Act, 33 U.S.C. § 1342(q).

"DC Water" means the District of Columbia Water and Sewer Authority and any successors thereto.

"Detailed Design" means the final stage of preparing contract documents to be used to receive bids for construction of a facility.

"District" means the Government of the District of Columbia.

"Effective Date of the First Amendment to the Consent Decree" means the date on which this First Amendment to Consent Decree is approved and entered by the Court.

"Enhanced Clarification Facility" or "ECF" means those facilities at Blue Plains which are to replace the excess flow treatment facilities at Blue Plains. The ECF includes a combination of process units located on the end of the Blue Plains Tunnel ("BPT"), designed to empty the BPT and distribute flow from the BPT. Flows treated in and distributed from the ECF will be discharged as a CSO Bypass from Outfall 001 and/or Outfall 002 as provided in the NPDES Permit. Disinfection by chlorination will be followed by de-chlorination.

"Facility Plan" or "Facility Planning" means preparing an engineering study to develop additional definition of the Selected CSO Controls as may be necessary for preliminary design. Examples of Facility Planning activities include, but are not limited to, planning level geotechnical investigations, developing proposed alignments for the tunnels, identifying land acquisition and required approvals, establishing bases for design, establishing system hydraulics, siting shafts, regulators and pumping stations, and other elements needed to define the function and interaction of the Selected CSO Controls in the LTCP.

"Final Nitrogen Limit" means a limit on the discharge of total nitrogen from Blue Plains as specified in the NPDES Permit.

"Gray CSO Controls" means structural facilities, including but not limited to combined sewer separation, pumping stations, pipelines and conveyance and treatment facilities to control CSO discharges.

"Green CSO Controls" means the use of Green Infrastructure to control CSO discharges.

"Green/Gray CSO Controls" means the use of combinations of Green Infrastructure and Gray CSO Controls.

"Green Infrastructure" or "GI" means both LID and LIDR.

"Long Term Control Plan" or "LTCP" means the plan for controlling CSOs from DC Water's CSS that was prepared by DC Water pursuant to the 1994 CSO Policy and submitted to EPA as a final report in August, 2002, and all supplements thereto.

"Low Impact Development" or "LID" means design and techniques that store, infiltrate, evaporate and detain runoff, including, but not limited to, practices that mimic predevelopment site hydrology as identified in the District's stormwater management regulations and guidebook and in "Greening CSO Plans: Planning and Modeling Green Infrastructure for Combined Sewer

Overflow (CSO) Control", U.S. Environmental Protection Agency, March 2014, Publication # 832-R-14-001.

"Low Impact Development Retrofit" or "LIDR" means the modification of an existing site to accomplish LID goals. In this Decree, LIDR refers to both LID and LIDR.

"MGD" means million gallons per day.

"NMC Report" means the report entitled District of Columbia Water and Sewer Authority, EPMC III-Sewer System, "Combined Sewer System Nine Minimum Controls Summary Report", Draft, July 1999 (Engineering Program Management Consultant III, Greeley and Hansen, Program Manager).

"NPDES Permit" means National Pollutant Discharge Elimination System ("NPDES") permit number DC0021199 issued to DC Water pursuant to Section 402 of the Clean Water Act, 33 U.S.C. § 1342, and any future, extended, modified or reissued permit.

"Partial Consent Decree" means the Consent Decree in this consolidated action entered by this Court on October 10, 2003, resolving, inter alia, Plaintiffs' claim for failure to implement Nine Minimum Controls.

"Parties" means the United States of America, DC Water and the District of Columbia.

"Person" means an individual, corporation, partnership, association, State, municipality, commission, or political subdivision of a State, or any interstate body.

"Place in Operation" means to achieve steady state operation and to operate consistently in such a way as to accomplish the intended function, even though all construction close-out activities (such as completion of a punchlist and resolution of contract disputes or close-outs) may not yet be completed.

"Required Approvals" means approvals and/or permits required from agencies of the

District of Columbia government (other than DC Water itself), the federal government or any other governmental or private entity or person.

"Selected CSO Controls" or "Selected Controls" means the controls and projects that are comprised by the recommended control plan in Section 13 of the LTCP as subsequently modified and enumerated in Section VI (Selected CSO Controls and Schedules).

"Separation" or "Sewer Separation" means separation of sewers carrying stormwater and sanitary wastes, so that stormwater and sanitary wastewater each are conveyed through a separate system of pipes. For those portions of the CSS that are separated pursuant to this Decree or that were separated pursuant to the 2005 Consent Decree, the permitted CSO outfall may remain as a discharge point but shall discharge only stormwater after its separation. For Sewer Separation, in areas targeted for Green Infrastructure, the area managed by sewer separation may be accounted for as achieving the 1.2" retention standard for that area.

"Settling Defendants" means DC Water and the District of Columbia.

"Summary Report" means the Anacostia River Facility Plan summary report and detailed implementation schedule submitted by DC Water to EPA on September 23, 2008, and approved by EPA on July 27, 2010.

"The 1.2" Retention Standard" means the volume of water runoff produced by 1.2 inches of rain falling on an impervious surface.

## V. OVERVIEW

### A. Selected CSO Controls from the LTCP

8. The LTCP provides for control of CSO discharges to the Anacostia River, the Potomac River, and to Rock Creek and its Piney Branch tributary ("receiving waters"). The Selected CSO Controls comprise a system of underground storage tunnels and pumping stations designed to reduce CSO discharges to the receiving waters and to convey stored combined flow

to Blue Plains for treatment. Other elements of the LTCP include LIDR, Sewer Separation, Outfall Consolidation, CSO monitoring, public notification, intercepting sewers, regulator improvements and improvements to excess flow treatment facilities at Blue Plains.

**B. Total Nitrogen/Wet Weather Plan-Related Changes to the Selected CSO Controls for the Anacostia Sewershed**

9. The Summary Report **(Appendix D)** embodies certain changes to the Selected CSO Controls that implement the wet weather aspects of DC Water's TN/ Wet Weather Plan. Those changes, which are herein memorialized, include the use of enhanced clarification for treatment of certain wet weather flows consistent with the terms and conditions of DC Water's NPDES Permit, design and construction of a tunnel from the Main and O Street Pumping Station site to Blue Plains (the "Blue Plains Tunnel"), a 225 mgd Blue Plains Tunnel Dewatering Pumping Station, a 225 mgd Enhanced Clarification Facility ("ECF") to provide high-rate treatment of certain wet weather flows at Blue Plains, and other modifications to the Selected CSO Controls derived from the facility planning work summarized in the Summary Report.

**C. Green/Gray CSO Control-Related Changes to the Selected CSO Controls and Schedules for the Potomac and Rock Creek Sewershed.**

10. This Consent Decree also incorporates changes to the Selected CSO Controls and related schedules to incorporate substitution of Green/Gray CSO Controls in the Potomac sewershed and Green CSO Controls in the Rock Creek sewersheds as set forth in the second revision to the LTCP and summarized at Appendix E.

11. **Green/Gray CSO Controls for the Potomac Sewershed.** The Green/Gray CSO Controls in the Potomac sewershed are designed to take advantage of and build upon the additional conveyance and treatment capacity provided by the Blue Plains Tunnel, the Blue Plains Tunnel Dewatering Pumping Station, and the ECF. For Outfalls 025, 026, 027, 028 and 029, DC Water will implement a combination of targeted Sewer Separation and Green

Infrastructure for these outfalls. For Outfalls 020, 021, 022 and 024, DC Water will reduce the capacity of the Potomac Tunnel from 58 million gallons to 30 million gallons. Accordingly, the Green/Gray CSO Controls for the Potomac sewershed incorporated in this Consent Decree include substituting a smaller Potomac tunnel for the larger tunnel in the Selected CSO Controls from the LTCP, connecting the Potomac Tunnel to the Blue Plains Tunnel, the Green Infrastructure Program in **Appendix F** to this Decree, and targeted Sewer Separation. Because the Potomac and Anacostia Tunnel Systems will be interconnected, the total system storage available will not be less than 187 million gallons. The analyses submitted by DC Water in support of the second revision to the LTCP demonstrate that these Green/Gray CSO Controls and Green CSO Controls are projected to provide a degree of control equivalent to the Gray Controls in the LTCP.

12. **Green/Gray CSO Controls for the Rock Creek Sewershed.** DC Water will substitute Green Infrastructure for the Piney Branch Storage Tunnel. Accordingly, the Green CSO Controls for the Rock Creek sewershed incorporated in this Consent Decree include substituting the Green Infrastructure Program in **Appendix F** to this Decree for the Piney Branch Storage Tunnel.

## VI. SELECTED CSO CONTROLS AND SCHEDULES

DC Water agrees to and is ordered to implement the following Selected CSO Controls, which shall be operated in accordance with the NPDES Permit and shall have the minimum elements and capacities set forth below. Nothing herein shall be deemed to supersede the NPDES Permit and, in the event of a conflict, the NPDES Permit shall control.

### A. Anacostia River Projects

DC Water shall plan, design, and Place in Operation the following projects to control CSO discharges to the Anacostia River, at any time up to, but no later than, the schedules set

forth below, and thereafter operate them.

13. DC Water commenced work required under the Facility Plan for the Anacostia River Projects on April 4, 2005. On September 18, 2008 DC Water submitted the Summary Report to EPA pursuant to Section X of the 2005 Consent Decree (EPA Approval of Plans and Submissions). EPA approved the Summary Report and detailed implementation schedule on July 10, 2010. Except for the milestones in this subsection VI.A (Anacostia River Projects), the deadlines in the detailed implementation schedule approved on July 10, 2010, shall serve to track and report progress, but shall not be enforceable obligations of this Consent Decree.

14. **Rehabilitation of Main, "O" Street, and Eastside Pumping Stations.** DC Water has certified that these projects have been completed pursuant to the requirements of the Partial Consent Decree.

15. **Separate Fort Stanton Drainage Area (Outfall 006).** On April 1, 2010, DC Water certified that it had separated the combined sewer area tributary to CSO Outfall 006 on the east side of the Anacostia River, eliminating it as a CSO outfall.

16. **Storage/Conveyance Tunnel from Blue Plains to CSO 019.** DC Water shall construct a Storage/Conveyance Tunnel from Blue Plains to CSO 019 which shall store and convey combined sewer flow from the Main and O Street Pumping Station site and other CSOs along the Anacostia River in accordance with DC Water's NPDES Permit. This tunnel will be designed and operated to provide CSO storage and conveyance for CSO Outfalls 005, 007, 009, 010, 011, 011a, 012, 013, 014, 015, 016, 017, 018, and 019 on the Anacostia River. The storage capacity of the tunnel shall be at least 105 million gallons. The location of the tunnel shall be finalized during final design but its approximate location is depicted in the Summary Report. After the tunnel and its appurtenances are Placed in Operation, discharges to the Northeast

Boundary Facility may be discontinued and the Facility may be abandoned or demolished in accordance with applicable law. After the tunnel is Placed in Operation, in the event of weather causing the tunnel to be used for storage, DC Water shall dewater the tunnel to the CSS as soon as practicable, but in no event longer than 59 hours from the end of the last rainfall event, and shall convey the contents of the tunnel to Blue Plains for treatment in accordance with its NPDES permit. DC Water shall plan, design, construct, and Place in Operation the tunnel at any time up to, but no later than, the following schedule:

a. Award Contract for Detailed Design: Completed

b. Award Contract for Construction: Completed

c. Place in Operation: March 23, 2018

17. **Poplar Point Pumping Station.** Under the Partial Consent Decree, DC Water is required to make certain interim improvements to the existing Poplar Point Pumping Station. In addition, DC Water shall replace the existing Poplar Point Pumping Station with a new pumping station, which shall have a firm pumping capacity of not less than 45 MGD. DC Water shall design, construct and Place in Operation the new pumping station at any time up to, but no later than, the following schedule:

a. Award Contract for Detailed Design: Completed

b. Award Contract for Construction: Completed

c. Place in Operation: March 23, 2018

18. **Northeast Boundary Storage/Conveyance Tunnels.** DC Water shall construct: (1) a Storage/Conveyance Tunnel generally in the Northeast Boundary area, and (2) a Branch Tunnel from the Storage/Conveyance Tunnel in the area of First Street NW and Rhode Island Avenue. The purpose of these tunnels is to provide additional storage and conveyance for

combined sewer flow and to relieve street and basement flooding in the Northeast Boundary area. The tunnels shall capture and store the combined sewer flow, in accordance with DC Water's NPDES permit. After the tunnels are Placed in Operation, in the event of wet weather causing the tunnels to be used for storage, DC Water shall dewater the tunnels to the CSS as soon as practicable, but in no event longer than 59 hours from the end of the last rainfall event, and shall convey the contents of the tunnels to Blue Plains for treatment in accordance with DC Water's NPDES permit. The sum of the storage capacities of the Storage/Conveyance Tunnel from Blue Plains to CSO 019 and the Northeast Boundary Storage/Conveyance Tunnels shall be at least 157 million gallons. The locations of the tunnels will be finalized during final design but their approximate locations are depicted in the Summary Report. DC Water shall design, construct and Place in Operation the tunnels at any time up to, but no later than, the following schedule:

a. Award Contract for Detailed Design: January 2, 2016

b. Award Contract for Construction: March 23, 2020

c. Place in Operation: March 23, 2025

19. **M Street (CSO 016 and CSO 017) and 018 Diversion Sewers.** DC Water shall consolidate and direct all combined sewer flow from Outfalls 016, 017 and 018 in the vicinity of the Anacostia Marina to the Storage/Conveyance Tunnel from Blue Plains to CSO 019 by way of diversion sewers, thus eliminating Outfalls 016, 017 and 018 except in those rare cases where use of those outfalls is required to isolate the tunnels or their appurtenances for service or repair. DC Water shall consolidate these outfalls at any time up to, but no later than, the following schedule:

a. Award Contract for Detailed Design: Completed

b. Award Contract for Construction: Completed

c. Place in Operation: March 23, 2018

**B. Potomac River Projects**

DC Water shall plan, design, construct, and Place in Operation the following projects on the Potomac River to control CSO discharges to that river, at any time up to, but no later than, the schedules set forth below, and thereafter to operate them.

20. DC Water shall start the Facility Plan for the Potomac Storage Tunnel and the Potomac Tunnel Dewatering Pumping Station no later than January 1, 2017. No later than December 31, 2018, DC Water shall submit to EPA pursuant to Section X (EPA Approval of Plans and Submissions) a summary report and detailed implementation schedule for the Potomac Storage Tunnel. That detailed implementation schedule shall set forth anticipated completion dates for stages of work and shall include appropriate deadlines for filing all applications for all permits that DC Water knows will be necessary, and dates for notices to proceed with work and construction starts. Except for the milestones in this subsection VI.B (Potomac River Projects), the deadlines in the detailed implementation schedule that is submitted no later than December 31, 2018, shall serve to track and report progress and shall not be enforceable obligations of this Consent Decree.

21. **Rehabilitation of the Existing Potomac Pumping Station**. The existing Potomac Pumping Station is being rehabilitated pursuant to the Partial Consent Decree in this consolidated action.

22. **Potomac Storage Tunnel.** DC Water shall construct a Potomac Storage/Conveyance Tunnel which shall store combined sewer flow from CSO Outfalls 020, 021, 022, and 024 in accordance with DC Water's NPDES Permit. The storage capacity of the tunnel will be at least thirty (30) million gallons. The location of the tunnel will be finalized

during facility planning and design but its approximate location is depicted in **Appendix E** to this Decree. The tunnel will be dewatered by gravity to the Blue Plains Tunnel. After the tunnel is Placed in Operation, in the event of wet weather causing the tunnel to be used for storage, DC Water shall dewater the tunnel as soon as practicable, but in no event longer than 59 hours, and will convey the contents of the tunnel to Blue Plains for treatment in accordance with DC Water's NPDES permit. DC Water will design, construct and Place into Operation the tunnel at any time up to, but no later than, the following schedule:

a. Award Contract for Design: July 1, 2021

b. Award Contract for Construction: September 30, 2023

c. Place in Operation: March 23, 2030

23. **CSO Outfall Separation.** DC Water shall separate the CSS tributary to CSO Outfalls 025 and 026 and eliminate them as CSO outfalls at any time up to, but no later than, the following schedule:

a. Award Contract for Detailed Design: March 23, 2019

b. Award Contract for Construction: March 23, 2021

c. Place in Operation: March 23, 2023

24. **Environmental Impact Statement for the Potomac Storage Tunnel.** DC Water has certified that it has awarded a contract for preparation of the Environmental Impact Statement ("EIS") required by the National Park Service for the Potomac Storage Tunnel. DC Water shall proceed to complete preparation of the EIS in accordance with the requirements of the National Environmental Policy Act and applicable National Park Service regulations.

25. **Green Infrastructure Program.** DC Water shall implement the Green Infrastructure Program for the Potomac sewershed in accordance with the requirements and

schedules in **Appendix F** to this Decree.

**C. Rock Creek Projects**

26. **Green Infrastructure Program.** DC Water shall implement the Green Infrastructure Program for the Rock Creek sewershed in accordance with the requirements and schedules in **Appendix F** to this Decree.

27. **CSO Outfall Separation.** DC Water has certified pursuant to the Partial Consent Decree that it has separated the Luzon Valley CSS tributary to CSO Outfall 059. DC Water has also certified that it has separated the combined sewer areas tributary to CSO outfalls 031, 037, 053 and 058, and that the separation has eliminated them as CSO outfalls.

28. **Monitoring at CSO Outfalls 033, 036, 047 and 057.** DC Water represents that it has conducted hydraulic monitoring at CSO Outfalls 033, 036, 047 and 057 to obtain data to further characterize the overflows on Rock Creek, including their frequency and volume. DC Water submitted its monitoring data to EPA on April 15, 2005, and EPA approved the data on November 23, 2005. Subsequently, DC Water submitted its plan for controlling CSOs 033, 036, 047 and 057 on May 19, 2006 in a report titled *Control Plan: Rock Creek CSO Outfall Nos. 033. 036, 047 and 057*, Final, May 2006 ("Control Plan"). EPA approved the Control Plan on October 4, 2007. The Control Plan calls for diversion structure improvements and sewer construction to control CSOs 033, 036, and 057. Based on the monitoring, the Control Plan determined that CSO 047 was not predicted to overflow in the average year and that no additional controls were required. The location, sizing, and extent of improvements were finalized during final design. DC Water shall plan, design, construct, and Place in Operation the measures in the Control Plan at any time up to, but no later than, the following schedule:

a. Award Contract for Detailed Design: Completed

b. Award Contract for Construction: Completed

c. Place in Operation: Completed

29. **Piney Branch Diversion Structure Improvements.** DC Water shall modify diversion Structure No. 70 at Piney Branch to improve diversions to the interceptor system at any time up to, but no later than, the following schedule:

a. Award Contract for Detailed Design: March 23, 2016

b. Award Contract for Construction: March 23, 2018

c. Place in Operation: March 23, 2020

**D. Blue Plains Wastewater Treatment Plant Projects**

DC Water shall plan, design, construct, Place in Operation and operate the following projects at Blue Plains, at any time up to, but no later than, the schedules set forth below.

30. **Blue Plains Tunnel Dewatering Pumping Station ("TDPS") and Enhanced Clarification Facility ("ECF").** The locations of the ECF and TDPS will be finalized during the final design. Their approximate location is depicted in the Summary Report. DC Water shall design, construct, and Place in Operation the TDPS and ECF at Blue Plains at any time up to, but no later than, the following schedule:

a. Award Contract for Detailed Design: Completed

b. Award Contract for Construction: Completed

c. Place in Operation: March 23, 2018

**E. Public Notification**

31. A visual notification system shall be installed as part of the construction of the tunnel storage projects for the Anacostia River, the Potomac River and for Rock Creek. The system shall be installed at a minimum of three locations on each receiving water at public access locations. The system shall be designed to notify the public of the occurrence of overflows based on flow monitoring at representative CSO outfalls on each receiving water. The

system shall comprise a series of colored lights, flags or pendants that shall operate as follows:

a. Color A shall be displayed as long as flow is detected from the representative outfall;

b. Color B shall be displayed for 24 hours after flow is no longer detected from the representative outfall;

c. When operational, the visual notification system shall be described and explained on DC Water's web site.

32. DC Water shall finalize the details of the public notification system (e.g., selection of representative outfalls, locations, warning devices, and colors) during Facility Planning for each receiving water. DC Water shall submit its plan with the final details to EPA for approval pursuant to Section X (EPA Approval of Plans and Submissions).

## VII. MODIFICATIONS TO SELECTED CSO CONTROLS AND SCHEDULES

33. DC Water agrees that the original 20 year implementation schedule and the work set forth in Section VI of the 2005 Consent Decree (Selected CSO Controls and Schedules) remain feasible and equitable, based on current information, assumptions and financial and other projections. Some of the information originally available to DC Water and its original assumptions and projections are set forth in, inter alia, the LTCP appended at **Appendix A**. DC Water's original financial assumptions and projections for the 20 year implementation schedule are set forth in, inter alia, **Appendix B**.

34. The Parties recognize that the information currently available to DC Water as well as DC Water's current assumptions and projections may change during implementation of the Selected CSO Controls. The schedule and/or the Selected CSO Controls in Section VI (Selected CSO Controls and Schedules) may be modified based on a significant change in the information currently available to DC Water, or in DC Water's current assumptions or

projections, whether or not such change is anticipated, that renders the Consent Decree no longer feasible and equitable. Unless the Parties otherwise agree, a request for modification shall not relieve DC Water of its obligations pursuant to Section VI (Selected CSO Controls and Schedules) and DC Water shall continue with implementation of the Selected CSO Controls until the request for modification is either agreed to by the Parties, approved by the Court, or ruled on by the Court under Section XXII (Modification). Any dispute as to whether or not implementation of the Selected CSO Controls should continue during the pendency of the modification request shall not be subject to judicial review or to dispute resolution.

35. The United States on behalf of EPA has accepted the Selected CSO Controls and the 20 year schedule. **Appendices A, B, D and E** are not stipulations, however, and the United States reserves its right to disagree with or to contest particular statements or facts contained therein. In the event that DC Water seeks a modification to extend the schedule based upon a significant increase in costs or other changes in financial circumstances, DC Water shall provide to EPA an update of the information contained in **Appendix B** and, at EPA's request, an update of the key financial variables listed at **Appendix C**.

36. The failure of DC Water and/or the District to seek, approve, or enact timely and adequate rate changes or to obtain bond or other financing to implement the work according to the schedule contained herein based on current information, assumptions and projections shall not constitute a significant change in circumstances under this Section nor shall such failure by itself justify any change in or reassessment of the interim milestones or the 20 year schedule in this Decree.

37. **Grant Funding.** The schedules contained herein assume no federal appropriations, grants, or funding from sources other than DC Water for performance of the

work described in Section VI (Selected CSO Controls and Schedules). In the event that DC Water receives grant funding from federal or other sources for such work, it shall report to EPA in writing the source, amount, and timing of any such grant funding when it learns that it will be appropriated or otherwise received. DC Water has the option but is not required to accelerate the schedule contained in Section VI (Selected CSO Controls and Schedules) based on grant funding.

38. Modifications made pursuant to this Section shall follow the procedures set forth in Section XXII (Modification).

39. In the event that DC Water, after consultation with the District, requests a modification to the schedule or to the Selected CSO Controls, and the United States does not agree to the proposed modification, DC Water and/or the District may invoke the dispute resolution procedures of Section XIV (Dispute Resolution).

40. If DC Water, after consultation with the District, requests a modification because it has decided that it needs to rebid a contract to construct a project, and if DC Water has made best efforts to communicate with the appropriate personnel at EPA Region 3 to obtain a response to a request for modification and has promptly responded to any requests for information from EPA Region 3 related to the requested modification, but EPA does not act on the request for modification within sixty (60) days after receiving the modification request, DC Water may initiate informal dispute resolution and issue a notice of the dispute under the dispute resolution procedures. For all other requests for modification, if DC Water has made best efforts to communicate with the appropriate personnel at EPA Region 3 to obtain a response to a request for modification, and has promptly responded to any requests for information from EPA Region 3 related to the requested modification, but EPA does not act on the request for modification

within one hundred twenty (120) days after receiving the modification request, DC Water may initiate informal dispute resolution and issue a notice of the dispute under the dispute resolution procedures.

41. Compliance with the terms of this Decree is not conditioned upon the receipt of federal or state grant funds and DC Water's failure to comply is not excused by the lack of federal or state grant funds, or by the processing of any applications for the same, subject solely to a force majeure event due to the Anti-Deficiency Act provisions in Section XIII (Force Majeure).

## VIII. CONTROL SYSTEM COMPLIANCE AND POST-CONSTRUCTION MONITORING

### A. Individual Construction Project Certification.

42. Within sixty (60) days of Placing in Operation each project required under Section VI (Selected CSO Controls and Schedules), DC Water shall certify under Section XX (Certification of Submissions) that such project has been designed, constructed and will be operated in accordance with the terms of this Consent Decree and its NPDES permit.

### B. Post-construction monitoring.

43. When the Selected Controls set forth in Section VI (Selected CSO Controls and Schedules) have been Placed in Operation, DC Water shall comply with the post-construction monitoring program set forth in its NPDES permit.

44. Following the Effective Date of the First Amendment to the Consent Decree, DC Water shall include with its next application for NPDES permit renewal proposed revisions to the post-construction monitoring program to reflect the modifications to the Selected CSO Controls for the Potomac River and Rock Creek.

## IX. LOW IMPACT DEVELOPMENT RETROFIT

45. DC Water shall promote LIDR in the District of Columbia by performing projects as set forth in this Section. Such projects shall constitute additional work that DC Water agrees to perform in addition to the injunctive relief set forth in Section VI (Selected CSO Controls and Schedules).

46. As set forth in the LTCP, DC Water shall incorporate LIDR techniques into new construction or reconstruction on DC Water facilities for demonstration projects up to a total expenditure of $3 million and shall maintain the LIDR projects for at least five (5) years after each project is Placed into Operation. DC Water shall monitor such projects to obtain data regarding the effectiveness of LIDR in reducing run-off reaching combined sewers and surface waters. These LIDR projects shall be in addition to those constructed as a Supplemental Environmental Project or financed as a Citizen Environmental Project pursuant to the Partial Consent Decree.

47. DC Water submitted a plan to EPA for approval and a schedule for implementing and monitoring LIDR on its own property, which plan and schedule have been approved by EPA. DC Water Placed in Operation all LIDR projects by March 18, 2014. DC Water shall monitor the LIDR projects for twelve (12) months after Placing in Operation all LIDR facilities.

## X. EPA APPROVAL OF PLANS AND SUBMISSIONS

48. After review of any plan, report, or other item that is required to be submitted pursuant to this Consent Decree (with the exception of requests for modification pursuant to Section VII (Modifications to Selected CSO Controls and Schedules)), EPA shall in writing: (a) approve the submission; (b) approve the submission upon specified conditions; (c) approve part of the submission and disapprove the remainder; or (d) disapprove the submission.

49. If the submission is approved, DC Water shall take all actions required by the plan, report, or other item, as approved. If the submission is conditionally approved or approved

only in part, DC Water shall, upon written direction of EPA, take all actions required by the approved plan, report, or other item that EPA determines are technically severable from any disapproved portions, subject to DC Water's right to dispute only the specified conditions or the disapproved portions, under Section XIV (Dispute Resolution).

50. If the submission is disapproved in whole or in part, DC Water shall, within 45 days or such other time as the Parties agree in writing, correct all deficiencies and resubmit the plan, report, or other item, or disapproved portion thereof, for approval. Any Stipulated Penalties applicable to the original submission, as provided in Section XII (Stipulated Penalties), shall accrue during the 45-day period or other specified period, but shall not be payable unless the resubmission is untimely or is disapproved in whole or in part; provided that, if the original submission was so deficient as to constitute a material breach of DC Water's obligations under this Decree, the Stipulated Penalties applicable to the original submission shall be due and payable notwithstanding any subsequent resubmission.

51. If a resubmitted plan, report, or other item, or portion thereof, is disapproved in whole or in part, EPA may again require DC Water to correct any deficiencies, in accordance with the preceding Paragraphs of this Section, subject to DC Water's right to invoke Dispute Resolution and the right of EPA to seek Stipulated Penalties, as provided in the preceding Paragraphs of this Section.

## XI. REPORTING

52. Progress reports are to be provided at quarterly intervals for all milestone events one year or longer in duration. Each progress report shall summarize the status and progress of work required for completion of the next milestone and the impact of any delays on completion of said milestone, and shall be submitted on the 28th day of the month following each calendar quarter.

53. Beginning with the first CSO Quarterly Report due after the Effective Date of the First Amendment to the Consent Decree, and for every calendar quarter thereafter until this Consent Decree terminates in accordance with Section XXVI (Termination), DC Water shall submit written status reports to U.S. EPA, certified pursuant to Section XX (Certification of Submissions), and post them on the DC Water website. In each report, DC Water shall provide the following:

a. a statement setting forth the deadlines and other terms that DC Water is required by this Consent Decree to meet since the date of the last quarterly statement, whether and to what extent DC Water has met these requirements, and the reasons for any noncompliance;

b. a statement tracking DC Water's progress against the detailed implementation schedules required to be submitted under Section VI (Selected CSO Controls and Schedules) upon the completion of Facility Planning for each receiving water, whether there have been any delays, the reasons for the delays, and the actions DC Water is taking or intends to take to overcome the delays.

c. a general description of the work completed within the three-month period, and a projection of work to be performed pursuant to this Consent Decree during the next three-month period. Notification to U.S. EPA of any anticipated delay shall not, by itself, excuse the delay.

## XII. STIPULATED PENALTIES

54. DC Water shall be liable for stipulated penalties for the failure to satisfactorily achieve any deadline for the start of Facility Planning, submission of a detailed implementation schedule and summary report on Facility Planning, Award of Contract for Detailed Design and the Award of Contract for Construction in Section VI (Selected CSO Controls and Schedules), as

follows:

| Period of Noncompliance | Penalty Per Day Per Violation |
|---|---|
| 1st to 30th Day | $ 500 |
| 31st to 59th Day | $ 1,000 |
| 60th day until submitted | $ 1,500 |

55. DC Water shall be liable for stipulated penalties for the failure to satisfactorily Place in Operation any of the required projects by the final deadline set forth for that project in the schedules in Section VI (Selected CSO Controls and Schedules), as follows:

| Period of Noncompliance | Penalty Per Day Per Violation |
|---|---|
| 1st to 30th Day | $ 1,000 |
| 31st to 59th Day | $ 2,000 |
| After 60 Days | $ 5,000 |

56. DC Water shall be liable for stipulated penalties for each failure to properly perform the CSO monitoring required in its NPDES Permit after the Selected Controls are Placed in Operation, as follows:

| Period of Noncompliance | Penalty Per Day Per Violation |
|---|---|
| 1st to 30th Day | $ 1,000 |
| 31st to 59th Day | $ 2,000 |
| 60th day until submitted | $ 2,500 |

57. DC Water shall be liable for stipulated penalties for failure to timely submit any progress or completion report required in Section XI (Reporting) , as follows:

| Period of Noncompliance | Penalty Per Day Per Violation |
|---|---|
| 1st to 30th Day | $ 500 |
| 31st to 59th Day | $ 1,000 |
| 60th day until submitted | $ 2,000 |

58. Other Violations: If DC Water fails to comply with a requirement or provision of this Decree not expressly listed above, it shall be liable for stipulated penalties as follows:

| Period of Noncompliance | Penalty Per Day Per Violation |
|---|---|
| 1st to 30th Day | $ 500 |
| 31st to 59th Day | $ 1,000 |
| 60th day until submitted | $ 2,000 |

59. General Provisions. Stipulated civil penalties shall automatically begin to accrue on the first day DC Water fails to meet any of the schedules required by this Consent Decree or to satisfy any obligation or requirement of this Consent Decree and shall continue to accrue each day until DC Water achieves compliance with such schedule, obligation or requirement; provided, however, that if DC Water submits an appropriately documented request for modification under Section XXII (Modification) 180 days prior to an affected deadline or compliance date, and EPA does not act on such request for modification prior to the deadline or compliance date, stipulated penalties shall not accrue for DC Water's failure to satisfy the deadline or compliance date until EPA's approval or disapproval. This provision shall not apply if DC Water does not have a reasonable basis to make the request for modification or if the request is made for purposes of delay. In the event EPA approves or disapproves DC Water's request for modification after passage of the affected deadline or compliance date, stipulated penalties shall begin to accrue from the time EPA acts on the request for modification.

60. Failure to Meet Award of Construction Contract Deadlines Due to Rebidding. If DC Water elects to rebid a construction contract for a project described in Section VI (Selected CSO Controls and Schedules), it may request a modification under Section VII (Modifications to Selected CSO Controls and Schedules). In the alternative, DC Water may rebid and elect to have any stipulated penalties for failure to meet the Award of Construction Contract deadline due and owing but to defer their payment. If DC Water meets its deadline for Placing in Operation the specific project for which penalties were deferred, stipulated penalties for failure to meet the deadline for Award of Construction Contract will be excused. If DC Water fails to meet the deadline for Placing in Operation the specific project for which penalties were deferred, stipulated penalties for the failure to meet both the Award of Construction Contract and the

Placing in Operation deadlines will be due and payable on demand by the United States. When DC Water elects a deferral of stipulated penalties for failure to meet an Award of Construction deadline due to rebidding a project, it shall give written notice to EPA that it intends to rebid the project and to defer stipulated penalties. When it awards the contract for construction of that project, DC Water shall so notify EPA and advise it in writing of the amount of stipulated penalties accrued pursuant to Section XII (Stipulated Penalties) that are due and owing but deferred.

61. Stipulated civil penalties shall be paid within thirty (30) days of the date of a demand for payment of stipulated civil penalties for any non-compliance with any of the schedules of performance or requirements set forth in this Consent Decree.

62. In the event that a stipulated penalty is not paid according to the instructions in a written demand from the United States, the stipulated civil penalty shall be payable with interest from the original due date to the date of payment, at the statutory judgment rate set forth at 28 U.S.C. § 1961(a).

63. Stipulated civil penalties shall be paid electronically or by submitting a certified or cashier's check payable to "Treasurer, the United States of America", and tendered to the United States Attorney for the District of Columbia. Simultaneously, DC Water shall send copies of the certified or cashier's check, together with a letter describing the basis for the penalties, to Chief, Environmental Enforcement Section, United States Department of Justice, Post Office Box 7611, Ben Franklin Station, Washington, D.C. 20044, and to Section Chief, Compliance and Enforcement Branch, Water Protection Division, US EPA Region 3, 1650 Arch Street, Philadelphia, PA 19103. The transmittal letter shall reference the caption, the civil action number, and DOJ Number 90-5-1-1-07137.

64. Payment of stipulated civil penalties as set forth above shall be in addition to any other rights or remedies which may be available to the United States or its agencies by reason of DC Water's failure to comply with the requirements of this Consent Decree and all applicable Federal, state or local laws, regulations, wastewater discharge permit(s) and all other applicable permits. Where a violation of this Consent Decree is also a violation of such laws, regulations, or permits, DC Water shall be allowed a credit, in the amount of any Stipulated Penalties paid, as a set-off against any statutory penalties imposed for such violation.

65. If DC Water invokes dispute resolution and the Court resolves the dispute against DC Water, stipulated penalties which have accrued during the pendency of the dispute shall be payable, as set forth herein, upon resolution of the dispute; provided, however, that in the event that the Director of the Water Protection Division requires more than sixty (60) days to issue a final agency decision concerning the dispute, DC Water shall be liable only for sixty (60) days of stipulated penalties for the period from submission of the final Statements of Position or written Reply until issuance of the final agency decision, as set forth in Section XIV (Dispute Resolution). Stipulated penalties shall begin to accrue again upon issuance of the final agency decision.

## XIII. FORCE MAJEURE

66. "Force Majeure" for the purposes of this Consent Decree is defined as an event arising from causes beyond the control of DC Water or the control of any entity controlled by DC Water, including its consultants and contractors, which delays or prevents the performance of any obligation under this Consent Decree. Nothing in this Section is intended to relieve DC Water of its duty to use due diligence to complete the requirements of this Consent Decree in a timely manner or of DC Water's obligation to meet all discharge limitations and other obligations contained in DC Water's NPDES Permit. Unanticipated or increased costs or

changed financial circumstances are not Force Majeure events, except as provided in Paragraph 68 (Anti-Deficiency Act Events) below, although in certain instances they may constitute the basis for a request for modification pursuant to Section VII (Modifications to Selected CSO Controls and Schedules).

67. **Permitting:** Failure to apply for a required permit or approval, or to provide in a timely manner all information required to obtain a permit or approval necessary to meet the requirements of this Consent Decree, are not Force Majeure events. However, failure of a permitting authority to issue a necessary permit in a timely fashion is an event of Force Majeure where the failure of the permitting authority to act is beyond the control of DC Water and DC Water demonstrates that it has taken all steps available to it to obtain the necessary permit, including but not limited to:

a. Promptly providing reasonably known permitting authorities with copies of this Consent Decree, when lodged, as well as briefing each such authority, both orally and with written materials if necessary, on the projects and schedules contained therein in order to coordinate permitting submittals and approvals;

b. submitting a complete permit application within two (2) months of the date identified in the detailed implementation schedule to apply for permits that are known to be required, and in a prompt fashion for those permits not known to be required or previously identified in the schedule;

c. responding to requests for additional information by the permitting authority in a timely fashion;

d. making regular inquiry, approximately every 45 days, both verbally and in writing, with the permitting authority after initial or supplemental permit filings, to determine the

status of the permit application;

e. seeking relief from higher management officials within the permitting authority where permit processing delays threaten to cause noncompliance with any deadline in this decree;

f. accepting lawful permit terms and conditions; and

g. prosecuting appeals of any unlawful terms and conditions imposed by the permitting authority in an expeditious fashion.

68. **Anti-Deficiency Act Events:** Nothing in this Decree shall be construed to require an expenditure, obligation or contract in violation of the Anti-Deficiency Act, 31 U.S.C. §§ 1341 et seq. Where an expenditure, obligation or contract is subject to the Anti-Deficiency Act, DC Water's obligations shall be subject to the availability of appropriated funds. In such case, DC Water must identify the portion of its budget related to implementation of this Consent Decree that is comprised of appropriated or other funds, and demonstrate why the unavailability of those appropriated or other funds will delay specific obligations.

69. To the extent made necessary by lack of appropriated funds, DC Water may obtain deferral of compliance with an obligation of this Consent Decree until its next annual budget cycle if, within sixty (60) days after DC Water knew or should have known of the event described in Paragraph 70 below, it provides in writing to EPA Region III a statement which shows the following:

a. That it included in its annual budget, which accompanies the District of Columbia budget submitted to the President for transmission to the Congress pursuant to Section 446 of the District of Columbia Home Rule Act, D.C. Code Sec. 1-204.46 (2001), sufficient money to carry out such objective;

b. That it made diligent efforts to obtain Congressional enactment of that part of the budget act;

c. That it expressly identified in the annual fiscal year adopted budget prepared for Congressional use such obligation (not necessarily to include reference to this Decree as such) together with the amount of money tied to performing such obligation; and

d. That Congress acted expressly to eliminate such amount of money or to reduce it below the level necessary to perform the obligation, or that Congress made an across the board reduction in DC Water's appropriation as shown in DC Water's adopted budget without expressly saving such obligation and the across the board reduction, as applied proportionately to the amount of money shown in the adopted budget for such obligation, left an insufficient amount to carry out that obligation.

70. **General Requirements:** When circumstances are occurring or have occurred which may delay the completion of any requirement of this Consent Decree, whether or not due to a Force Majeure event, DC Water shall so notify EPA, in writing, within fifteen (15) days after DC Water knew, or should have known, of the delay or anticipated delay. The notice shall describe in detail the basis for DC Water's contention that it experienced a Force Majeure delay, the anticipated length of the delay, the precise cause or causes of the delay, the measures taken or to be taken to prevent or minimize the delay, and the timetable by which those measures will be implemented. Failure to so notify the United States shall constitute a waiver of any claim of Force Majeure as to the event in question.

71. If the United States finds that a delay in performance is, or was, caused by a Force Majeure event, it shall extend the time for performance, in writing, for a period to compensate for the delay resulting from such event and stipulated penalties shall not be due for

such period. In proceedings on any dispute regarding a delay in performance, the dispute resolution provisions of Section XIV (Dispute Resolution) shall apply and DC Water shall have the burden of proving that the delay is, or was, caused by a Force Majeure event, and that the amount of additional time requested is necessary to compensate for that event.

72. Compliance with a requirement of this Consent Decree shall not by itself constitute compliance with any other requirement. An extension of one compliance date based on a particular event shall not automatically extend another compliance date or dates. DC Water shall make an individual showing of proof regarding the cause of each delayed incremental step or other requirement for which an extension is sought. DC Water may petition for the extension of more than one compliance date in a single request.

## XIV. DISPUTE RESOLUTION

73. This Court shall retain jurisdiction for the purpose of adjudicating, in the manner provided by this Section, all disputes between DC Water and the United States that may arise under the provisions of this Consent Decree. Unless otherwise expressly provided in this Consent Decree, the dispute resolution procedures of this Section shall be the exclusive mechanism to resolve disputes arising under or with respect to this Consent Decree. However, the procedures set forth in this Section shall not apply to actions by the United States to enforce obligations of DC Water that have not been disputed in accordance with this Section.

74. Permit actions pursuant to 40 C.F.R. Part 124, including issuance, denials, and modifications, shall not be subject to this Consent Decree, but rather shall continue to be handled through the administrative and judicial procedures set forth in those regulations.

75. Any dispute which arises under or with respect to this Consent Decree shall in the first instance be the subject of informal negotiations between DC Water and the United States. Notice of the dispute shall be transmitted no later than fourteen (14) days from the date of

the circumstances giving rise to the dispute. The period for informal negotiations shall not exceed twenty (20) days from the date of receipt of the original notice of the dispute, unless DC Water and the United States otherwise agree in writing to extend that period.

76. If the informal negotiations are unsuccessful, the position of the United States shall control unless, within twenty (20) days after the conclusion of the informal negotiation period, DC Water invokes the formal dispute resolution procedures of this Section by serving on the United States a written Statement of Position on the matter in dispute, which shall set forth the nature of the dispute with a proposal for its resolution as well as any factual data, analysis or opinion supporting that position and any supporting documentation (including the Long Term Control Plan or portions thereof) relied upon.

77. Within thirty (30) days of the receipt of a Statement of Position, pursuant to this Section, the United States may serve on DC Water its own Statement of Position, which may include an alternate proposal for resolution of the dispute as well as any factual data, analysis, or opinion supporting that position and all supporting documentation (including the Long Term Control Plan or portions thereof) relied upon by the United States. Within 15 days after receipt of such Statement, DC Water may serve on the United States a written Reply.

78. Matters Accorded Record Review: With the exception of modification requests pursuant to Section VII (Modifications to Selected CSO Controls and Schedules), this Paragraph shall pertain to disputes subject to the procedures of this Section that concern the adequacy or nature of the work to be performed under Section VI (Selected CSO Controls and Schedules), or other matters that are accorded review on the administrative record under applicable principles of administrative law. For matters subject to this Paragraph, DC Water shall have the burden of showing that the position of the United States is arbitrary and capricious or otherwise not in

accordance with applicable law or this Consent Decree. Plaintiff shall compile an administrative record, which shall consist of the Statements of Position and supporting documentation relied upon (including the LTCP or portions thereof that the parties incorporated into their Statements) and other documents considered and relied upon by EPA in arriving at its final administrative decision. Where appropriate, EPA may allow DC Water, the District of Columbia, Citizen Plaintiffs, and/or other members of the public to make supplemental submissions. The Director of the Water Protection Division shall issue a written final administrative decision resolving the dispute based on the administrative record. Stipulated penalties for the period from submission of the final Statement of Position or written Reply until issuance of the final administrative decision shall accrue for no more than sixty (60) days, even if EPA issues the final administrative decision after more than 60 days. The final administrative decision shall be effective in ten (10) days, unless DC Water moves for judicial review within ten (10) days of its receipt of the final agency decision.

79. Modification Requests: In the case of requests for modification of the Selected CSO Controls and/or schedules pursuant to Section VII (Modifications to Selected CSO Controls and Schedules), DC Water shall bear the burden of demonstrating that the requested modification should be approved in accordance with Section VII (Modifications to Selected CSO Controls and Schedules). EPA's final decision shall be binding on DC Water, unless within twenty (20) days of its receipt DC Water submits a modification request to the Court. If the Director of the Water Protection Division does not issue a final decision on a request for modification within one hundred twenty (120) days from the date that DC Water submits its Reply to the United States' Statement of Position, DC Water may elect to move in Court to modify the Consent Decree.

80. Other Matters: In the case of other matters not subject to Paragraphs 78 and 79

above, DC Water shall have the burden to demonstrate that its actions or positions were taken in accordance with the terms, conditions, requirements and objectives of this Consent Decree and the Clean Water Act. The Director of the Water Protection Division will issue a final decision resolving the dispute which will be binding on DC Water, unless within twenty (20) days of its receipt DC Water serves on the United States a motion for judicial review of the decision setting forth the matter in dispute, the efforts made to resolve it, the relief requested, and the schedule, if any, within which the dispute must be resolved to ensure orderly implementation of this Consent Decree. Stipulated penalties for the period from submission of the final Statement of Position or written Reply until issuance of the final administrative decision shall accrue for no more than sixty (60) days, even if EPA issues the final administrative decision after more than 60 days.

81. Where the dispute arises from DC Water's request for modification of the Selected CSO Controls and/or schedules pursuant to Section VII (Modifications to Selected CSO Controls and Schedules), the matter shall not be subject to the principles of record review in Paragraph 78. For other matters, if DC Water and the United States disagree as to whether the dispute should proceed under the principles of record review or not, DC Water shall follow the procedures determined by EPA to be applicable. Upon appeal, the Court shall determine which procedures are applicable in accordance with the standards set forth in this Section.

82. Submission of any matter to the Court for resolution shall not extend or stay any of the deadlines set forth in this Consent Decree unless the Parties agree to such extension in writing or the Court grants an order extending such deadline(s). Stipulated penalties with respect to the disputed matter shall continue to accrue but payment shall be stayed pending resolution of the dispute as provided in this Section. Notwithstanding the stay of payment, stipulated penalties shall accrue from the first day of noncompliance with any applicable provision of this Consent

Decree. In the event that DC Water does not prevail on the disputed issue, stipulated penalties shall be assessed and paid as provided in Section XII (Stipulated Penalties).

## XV. RIGHT OF ENTRY

83. Commencing upon the date of lodging of this Consent Decree, U.S. EPA and its representatives, contractors, consultants, and attorneys shall have the right of entry into and upon the premises of DC Water at all reasonable times, upon proper presentation of credentials, for the purposes of:

a. Monitoring the progress of activities required by this Consent Decree;

b. Verifying any data or information required to be submitted pursuant to this Consent Decree;

c. Obtaining samples and, upon request, splits of any samples taken by DC Water or its consultants. Upon request, DC Water will be provided with splits of all samples taken by the United States;

d. Inspecting and evaluating the CSO System;

e. Inspecting and reviewing any record required to be kept under the provisions of this Consent Decree or any NPDES Permit and the Clean Water Act; and

f. Otherwise assessing DC Water's compliance with this Consent Decree.

84. This Section XV (Right of Entry) in no way limits or affects any right of entry and inspection, or any other right otherwise held by the United States, U.S. EPA and any other governmental entity, pursuant to applicable federal or state laws, regulations.

85. DC Water reserves the right to request the laboratory analytical results of samples taken from the CSS by the United States during the term of this Consent Decree, and any non-privileged reports prepared using such results.

## XVI. NOT A PERMIT/COMPLIANCE WITH OTHER STATUTES/REGULATIONS

86. This Consent Decree is not and shall not be interpreted to be a permit or modification of any existing permit issued pursuant to Section 402 of the Act, 33 U.S.C. § 1342. This Consent Decree does not relieve DC Water of any obligation to apply for, obtain and comply with the requirements of any new or existing NPDES permit or to comply with any federal, state or local laws or regulations, including, but not limited to its obligations to obtain a permit for its wastewater treatment and collection system or facilities and to comply with the requirements of any NPDES permit or with any other applicable federal or state law or regulation. Any new permit, or modification of existing permits, must be complied with in accordance with federal and state laws and regulations.

## XVII. FAILURE OF COMPLIANCE

87. The United States does not, by its consent to the entry of this Consent Decree, warrant or aver in any manner that DC Water's complete compliance with this Consent Decree will result in compliance with the provisions of the Clean Water Act, 33 U.S.C. §§ 1251 et seq., or with DC Water's NPDES permit. Notwithstanding EPA's review or approval of any Scope of Work, report, or plans and specifications, pursuant to this Consent Decree, DC Water shall remain solely responsible for any non-compliance with the terms of this Consent Decree, all applicable permits, the Clean Water Act, and regulations promulgated thereunder. The pendency or outcome of any proceeding concerning issuance, reissuance, or modification of any permit shall neither affect nor postpone DC Water's duties and obligations as set forth in this Consent Decree.

## XVIII. EFFECT OF DECREE AND NON-WAIVER PROVISIONS

88. The Parties agree that this Consent Decree resolves the civil claims for violation of water quality standards and for long-term injunctive relief (Claim One) alleged in the Complaint filed by the United States through the date of lodging of this Decree.

89. The Consent Decree in no way affects or relieves Settling Defendants of any responsibility to comply with any federal, state, or local law or regulation.

90. The Parties agree that DC Water is responsible for achieving and maintaining complete compliance with all applicable federal and state laws, regulations, and permits, and that compliance with this Consent Decree shall be no defense to any actions commenced pursuant to said laws, regulations, or permits.

91. The United States reserves the right to file a civil action for statutory penalties or injunctive relief against DC Water for any violations of the Clean Water Act by DC Water which occur after the date of lodging of this Consent Decree and any such violations occurring prior to that date that are not specifically alleged as Claims for Relief in the Complaints.

92. This Consent Decree does not limit or affect the rights of DC Water, the District of Columbia, or the United States as against any third parties which are not parties to this Consent Decree.

93. The Parties reserve any and all legal and equitable remedies available to enforce the provisions of this Consent Decree. This Consent Decree shall not limit any authority of EPA under any applicable statute, including the authority to seek information from DC Water or to seek access to the property of DC Water, nor shall anything in this Consent Decree be construed to limit the authority of the United States to undertake any action against any person, including DC Water, in response to conditions that may present an imminent and substantial endangerment to the environment or the public health or welfare.

94. Obligations of DC Water under the provisions of this Consent Decree to perform duties scheduled to occur after the date of lodging, but prior to the Effective Date of the First Amendment to the Consent Decree, shall be legally enforceable from the date of lodging of this

Consent Decree. Liability for stipulated penalties, if applicable, shall accrue for violation of such obligations as of the date of violation and payment of such stipulated penalties may be demanded by the United States upon or after the Effective Date of the First Amendment to the Consent Decree.

95. The United States reserves the right to file a criminal action for statutory penalties or other criminal relief against DC Water for any violations by DC Water of the Clean Water Act or other applicable federal statutes.

96. It is the intent of the Parties hereto that the clauses hereof are severable, and should any clause(s) be declared by a court of competent jurisdiction to be invalid and unenforceable, the remaining clauses shall remain in full force and effect.

97. The United States reserves all remedies available to it for violations of Federal, State and local law.

## XIX. COSTS OF SUIT

98. The Parties shall bear their own costs and attorney's fees with respect to this action and to matters related to this Consent Decree.

## XX. CERTIFICATION OF SUBMISSIONS

99. DC Water shall maintain copies of any underlying research and data in its possession, custody or control for any and all documents, scope of work, reports, plans and specifications, or permits submitted to EPA pursuant to this Consent Decree for a period of five (5) years, except that DC Water shall not be required to maintain copies of drafts of documents, scope of work, reports, plans and specifications, reports or permits. DC Water shall require any independent contractor implementing this Consent Decree to also retain such materials for a period of five (5) years. DC Water shall submit such supporting documents to EPA upon request. DC Water shall also submit to EPA upon request any other documents that relate to or discuss

the operation, maintenance, repair, or construction of the CSO system (or any portion thereof), or that relate to or discuss the number, frequency, volume, quality or environmental impact of CSO discharges. In all notices, documents or reports submitted to EPA pursuant to this Consent Decree, a senior management official of DC Water shall sign and certify such notices, documents and reports as follows:

> I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to ensure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

## XXI. FORM OF NOTICE

100. Unless otherwise specified within the terms of this Consent Decree, all reports, notices, or any other written communications required to be submitted under this Consent Decree shall be sent to the respective parties at the following addresses:

As to the United States:

Department of Justice

Chief, Environmental Enforcement Section
Environment and Natural Resources Division
U.S. Department of Justice
Post Office Box 7611, Ben Franklin Station
Washington, DC 20044
Reference DOJ Case No. 90-5-1-1-07137

United States Attorney
District of Columbia
Judiciary Center
555 Fifth Street NW
Washington, DC 20530

EPA

Director
Water Enforcement Division
Office of Regulatory Enforcement
U.S. Environmental Protection Agency
OECA-ORE-WED
Ariel Rios Building
12th and Pennsylvania Ave, NW
Mail Code 2243A
Washington, DC 20004

Chief
NPDES Branch (3WP42)
Water Protection Division
U.S. Environmental Protection Agency
Region III
1650 Arch Street
Philadelphia, PA 19103

Yvette Roundtree (3RC20)
Office of Regional Counsel
U.S. Environmental Protection Agency
Region III
1650 Arch Street
Philadelphia, PA 19103

As to DC Water:

George S. Hawkins or his successor
General Manager
District of Columbia Water and Sewer Authority
5000 Overlook Avenue, SW
Washington, D.C. 20032

Deputy General Manager/Chief Enginner
District of Columbia Water and Sewer Authority
5000 Overlook Avenue, SW
Washington, D.C. 20032

As to the District:

The Attorney General of District of Columbia
One Judiciary Square
441 Fourth Street NW
Suite 600 South
Washington, DC 20001

## XXII. MODIFICATION

101. This Consent Decree contains the entire agreement of the Parties and shall not be modified by any prior oral or written agreement, representation or understanding. Prior drafts of this Consent Decree shall not be used in any action involving the interpretation or enforcement of this Consent Decree.

102. The non-material terms of this Consent Decree may be modified by a subsequent written agreement signed by all the Parties. If all the Parties agree to a material modification in writing, they may apply to the Court for approval thereof. If the Parties do not reach agreement on such material modification, the request for modification shall be subject to the dispute resolution procedures of this Decree. All material modifications shall be in writing and approved by the Court before they will be deemed effective.

103. In the event DC Water requests a material modification to the Selected CSO Controls and/or the schedule set forth in Section VI (Selected CSO Controls and Schedules), DC Water shall arrange for additional public participation prior to submitting the modification request to the United States. DC Water shall initially consult with EPA concerning the modification and the scope of public participation to be obtained by DC Water prior to submission of a formal request for modification from DC Water to EPA.

a. The proposed modification package shall be submitted to EPA and shall contain the following:

i. the basis for the modification and the supporting technical and regulatory justification (including if applicable the LTCP or pertinent portions thereof);

ii. any changes to the Selected CSO Controls and/or to the schedule in Section VI (Selected CSO Controls and Schedules), along with any supporting data;

iii. a demonstration of material compliance with any applicable requirements of the 1994 CSO Policy; and

iv. a demonstration that public participation has occurred.

b. If the United States, after consultation with the District of Columbia, agrees to the modification, the proposed changes to the Selected CSO Controls and/or the schedules shall be executed by appropriate officials on behalf of the United States, the District of Columbia, and DC Water and lodged with the Court for a period of public comment prior to entry. If the United States does not agree to the proposed modification, the matter shall be subject to the procedures of Section XIV (Dispute Resolution).

## XXIII. PUBLIC COMMENT

104. The parties agree and acknowledge that final approval by the United States and entry of this Consent Decree is subject to the requirements of 28 C.F.R. § 50.7, which provides for notice of the lodging of this Consent Decree in the Federal Register, an opportunity for public comment, and consideration by the United States of any comments. This Paragraph does not create any rights exercisable by the Settling Defendants, and Settling Defendants shall not withdraw their consent to this Consent Decree between lodging and entry of this Consent Decree and hereby consents to entry of this Decree without further notice.

105. All information and documents submitted by Settling Defendants to U.S. EPA pursuant to this Consent shall be subject to public inspection, unless identified and supported as confidential by DC Water in accordance with 40 C.F.R. Part 2.

## XXIV. CONTINUING JURISDICTION OF THE COURT

106. The Court shall retain jurisdiction to enforce the terms and conditions of this Consent Decree and to resolve disputes arising hereunder as may be necessary or appropriate for the construction, modification or execution of this Consent Decree.

## XXV. APPENDICES

**Appendix A** is the Long Term Control Plan and its Appendices.

**Appendix B** contains DC Water's financial assumptions and projections that it sets forth as its basis for the 20 year implementation schedule in this Consent Decree.

**Appendix C** contains a list of key financial variables to be updated in the event of a request for modification due to changed financial circumstances pursuant to Section VII of the 2005 Consent Decree (Modifications to Selected CSO Controls and Schedules).

**Appendix D** contains the TN/Wet Weather Plan Summary Report.

**Appendix E** contains the Summary of Gray/Green and Green CSO Controls for the Potomac and Rock Creek Sewersheds.

**Appendix F** contains the Green Infrastructure Program for the Potomac and Rock Creek Sewersheds.

## XXVI. TERMINATION

107. This Consent Decree shall terminate upon motion of the United States to the Court after each of the following has occurred:

a. DC Water has Placed in Operation all of the construction projects required under Section VI (Selected CSO Controls and Schedules);

b. DC Water has demonstrated that it has achieved and maintained compliance with the water quality based CSO numerical effluent limitations and the performance standards requiring that the Selected CSO Controls be implemented, operated and maintained as described in DC Water's NPDES Permit for two years after the Selected CSO Controls are Placed in Operation;

c. DC Water has satisfactorily implemented its LIDR projects and programs as required by Section IX (Low Impact Development Retrofit);

d. DC Water has paid all stipulated penalties and any other monetary obligations due hereunder, and no penalties or other monetary obligations due hereunder are outstanding or owed to the United States; and

e. DC Water has certified completion to the United States, and the United States has not contested DC Water's completion or compliance.

108. The Consent Decree shall not terminate if, within 90 days of certification by DC Water to the United States of compliance pursuant to this Section, the United States asserts in writing that full compliance has not been achieved, or seeks further specific information in order to evaluate DC Water's certification. If the United States disputes DC Water's full compliance, this Consent Decree shall remain in effect pending resolution of the dispute by the parties or the Court.

109. Notwithstanding Paragraph 108 above, if DC Water submits a certification to the United States that it has completed all the requirements in Paragraph 107 above, and the United States does not respond on or before 90 days, DC Water may file a motion to the Court seeking termination of this Consent Decree.

## XXVII. SIGNATORIES

110. The Assistant Attorney General on behalf of the United States and the undersigned representatives of the Settling Defendants certify that they are fully authorized to enter into the terms and conditions of this Consent Decree and to execute and legally bind such party to this document.

Entered this 14th day of January, 2016

Thomas F. Hogan

Chief Judge, United States District Court

THE UNDERSIGNED PARTIES enter into this First Amendment to Consent Decree in the matter of *Anacostia Watershed Society, et al., v. District of Columbia Water and Sewer Authority and the District of Columbia; and United States of America v. District of Columbia Water and Sewer Authority and the District of Columbia*

FOR THE UNITED STATES OF AMERICA:

4/22/15
Dated

JOHN C. CRUDEN
Assistant Attorney General
Environment and Natural Resources Division
U.S. Department of Justice

3/27/15
Dated

MARCELLO MOLLO
Senior Attorney
Environmental Enforcement Section
Environment and Natural Resources Division
U.S. Department of Justice
P.O. Box 7611, Ben Franklin Station
Washington, D.C. 20044
601 D Street NW
Washington, D.C. 20004

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[RESERVED]

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FOR THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY:

5/8/15
Dated

SHAWN M. GARVIN
Regional Administrator
U.S. EPA Region III

4/20/15
Dated

MARY COE
Acting Regional Counsel
U.S. EPA Region III

4/21/15
Dated

YVETTE ROUNDTREE
Senior Assistant Regional Counsel
U.S. EPA Region III
1650 Arch Street
Philadelphia, PA 19103

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FOR THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY:

4/7/15
Dated

SUSAN SHINKMAN
Director
Office of Civil Enforcement
Office of Enforcement and Compliance Assurance

4-7-15
Dated

MARK POLLINS
Director, Water Enforcement Division
Office of Civil Enforcement
Office of Enforcement and Compliance Assurance

4-7-15
Dated

SUSHILA NANDA
Senior Attorney Advisor
Office of Civil Enforcement
Office of Enforcement and Compliance Assurance
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

THE UNDERSIGNED PARTIES enter into this First Amendment to Consent Decree in the matter of *Anacostia Watershed Society, et al., v. District of Columbia Water and Sewer Authority and the District of Columbia; and United States of America v. District of Columbia Water and Sewer Authority and the District of Columbia*

FOR THE DISTRICT OF COLUMBIA WATER AND SEWER AUTHORITY:

12/18/14
Dated

GEORGE S. HAWKINS
General Manager
District of Columbia Water and Sewer Authority

12/18/14
Dated

RANDY E. HAYMAN
General Counsel
District of Columbia Water and Sewer Authority
5000 Overlook Avenue, S.W.
Washington, D.C. 20032

Dec. 18, 2014
Dated

DAVID E. EVANS
McGuireWoods LLP
One James Center
901 East Cary Street
Richmond, Virginia 23219
*Counsel to District of Columbia Water and Sewer Authority*

THE UNDERSIGNED PARTIES enter into this First Amendment to Consent Decree in the matter of *Anacostia Watershed Society, et al., v. District of Columbia Water and Sewer Authority and the District of Columbia; and United States of America v. District of Columbia Water and Sewer Authority and the District of Columbia*

FOR THE DISTRICT OF COLUMBIA:

3/24/15
Dated

RASHAD M. YOUNG
City Administrator
District of Columbia
John A. Wilson Building
1350 Pennsylvania Avenue, NW
Washington, DC 20004

KARL A. RACINE
Attorney General for the District of Columbia

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Dated

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# APPENDIX B

## APPENDIX B

Table 1, attached, presents WASA's financial projections for the impact on sewer rates of the 20-year LTCP implementation schedule as specified in the consent decree. Descriptions of the heading columns in Table 1 are presented below:

| Column No. | Heading | Description |
|---|---|---|
| 1 | Year No. | Sequential count of number of years starting in 2004 |
| 2 | Calendar year | Calendar year starting in 2004 |
| 3 | Capital 2001 Dollars ($M) | Estimated capital costs for the CSO LTCP expressed in constant year 2001 dollars |
| 4 | Capital Actual Dollars ($M) | The estimated capital costs for the CSO LTCP expressed in the year of expenditure dollars using 3% per year to escalate the 2001 value estimate. |
| 5 | OM 2001 Dollars ($M) | Estimated operating and maintenance costs for the CSO LTCP expressed in constant year 2001 dollars. |
| 6 | OM Actual Dollars ($M) | The estimated operating and maintenance costs for the CSO LTCP expressed in the year of expenditure dollars using 3% per year to escalate the 2001 value estimate. |
| 7 | Total 2001 Dollars ($M) | The addition of CSO Costs/OM/2001 Dollars ($M) and CSO Costs/Capital/2001 Dollars ($M). |
| 8 | Total Actual Dollars ($M) | The addition of CSO Costs/OM/Actual Dollars ($M) and CSO Costs/Capital/Actual Dollars ($M). |
| 9 | Capital Costs Financed ($M) | The amount of actual capital costs that are debt financed. |
| 10 | Capital Costs PAYGO ($M) | The amount of actual capital costs that are paid from current year revenues on a pay-as-you-go-basis. |
| 11 | Debt Service ($M) | Estimated annual debt service on capital costs that are financed using 30 year term and borrowing costs of 7%. |
| 12 | O&M ($M) | Same as Column 6, OM Actual Dollars ($M) |
| 13 | Total Rate Requirements | The addition of PAYGO, Debt Service, O&M costs. |
| 14 | Other WASA Wastewater Costs Paid by DC Ratepayers | Operating and capital costs for wastewater services that are funded by retail ratepayers before the addition of CSO LTCP costs. |
| 15 | Typical Residential Bill Without CSO LTCP | Estimated annual residential wastewater bill before addition of the CSO LTCP costs. |
| 16 | Bill Increase Without CSO LTCP | Estimated annual change in residential wastewater bill before addition of CSO LTCP costs. |
| 17 | Typical Residential Bill Without CSO LTCP | Estimated annual residential wastewater bill after addition of the CSO LTCP costs. |
| 18 | Bill Increase Without CSO LTCP | Estimated annual change in residential wastewater bill after addition of CSO LTCP costs. |
| 19 | MHI | Estimated median household income (MHI) using 3% annual growth rate |
| 20 | % of MHI | Estimated residential bill as a percent of MHI. |
| 21 | Lower 20% | Household income of the most affluent household of the lower 20th percentile of households in the District. |
| 22 | % of Lower 20% | Estimated residential bill as a percent of the household income for the most affluent household of the lower 20th percentile of households in the District. |

The financial projections are based on certain assumptions, which include, but are not limited to the following:

1. Billed water use is projected to decrease at 1% per year. Residential bill estimates are based on average consumption of 100 ccf per year.

2. Customers are assessed a charge for water and wastewater services based on water consumption. With the exception of certain federal government customers located outside of the District, all customers pay the same rate, regardless of account class, meter size, or size of service connection. The analysis assumes this practice will continue.

3. The analysis assumes a revenue collection rate of 97.7% of billed amounts.

4. Median Household Income in the District of Columbia is projected to increase at 3% per year. The most affluent of the lower 20$^{th}$ percentile of households in the District have a household income in 2004 dollars of $19,669 and this is projected to increase at the rate of inflation, which is assumed to be 3% per year.

5. Projections take into account discounts to low-income customers under the Authority's customer assistance program. The Authority's program covers 6,000 low-income customers and provides discounts of approximately $500,000 each year. Each eligible participant receives an exemption for water service charges in the amount of 4 ccf per month.

6. The financial analysis assumes an all-in borrowing cost assumption of 7 percent including cost of issuance (including bond insurance premiums, premiums for debt service reserve facility and fees and expenses related to bond issuance; approximately 2% on the Authority's 2003 revenue bond issue). The analysis assumes a debt coverage ratio of 1.40 x Term of Debt. The financial analysis utilizes fixed rate financing with a term of 30 years.

7. CSO operating and maintenance and capital costs are escalated at a rate of 3% per year from 2001 cost estimates to the year of expenditure. Non CSO-related wastewater operating and capital costs are projected to increase at approximately 5 percent per year reflecting impacts of inflation and reinvestment in capital facilities.

**Table 1**
**20-Year LTCP Financial Projections**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CSO Costs | | | | | | CSO LTCP Financing | | | | | Other WASA Wastewater Costs | | | Effect on Users | | | | | |
| | | Capital | | Offl | | Total | | | | | | | | | | | | | | | |
| Year No. | Calendar Year | 2001 Dollars ($M) | Actual Dollars ($M) | 2001 Dollars ($M) | Actual Dollars ($M) | 2001 Dollars ($M) | Actual Dollars ($M) | Capital Costs Financed ($M) | Capital Costs PAYGO ($M) | Debt Service ($M) | O & M ($M) | Total Annual Rate Requirements ($M) | Other WASA WW Costs Paid by DC Ratepayers ($M) | Typical Residential Bill w/o CSO LTCP | Bill Increase without CSO LTCP | Typical Residential Bill with CSO LTCP | Bill Increase with CSO LTCP | MHI | % of MHI | Lower 20% | % of Lower 20% |
| 1 | 2004 | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ 120.47 | $ 297 | | $ 297 | | $ 40,616 | 0.7% | $ 19,000 | 1.5% |
| 2 | 2005 | $ 4.07 | $ 4.69 | $ 0.04 | $ 0.04 | $ 4.11 | $ 4.82 | $ 3.86 | $ 0.15 | $ 0.31 | $ 0.64 | $ 0.50 | $ 126.53 | $ 310 | 5% | $ 311 | 5% | $ 41,834 | 0.7% | $ 20,259 | 1.5% |
| 3 | 2006 | $ 4.49 | $ 5.17 | $ 0.06 | $ 0.09 | $ 4.54 | $ 5.26 | $ 1.86 | $ 0.29 | $ 0.46 | $ 0.09 | $ 0.84 | $ 132.80 | $ 323 | 4% | $ 325 | 4% | $ 43,089 | 0.8% | $ 20,867 | 1.6% |
| 4 | 2007 | $ 12.61 | $ 15.06 | $ 0.19 | $ 0.22 | $ 12.80 | $ 15.26 | $ 7.83 | $ 0.97 | $ 1.09 | $ 0.22 | $ 1.90 | $ 139.97 | $ 344 | 6% | $ 346 | 7% | $ 44,382 | 0.8% | $ 21,493 | 1.6% |
| 5 | 2008 | $ 13.45 | $ 16.64 | $ 0.31 | $ 0.37 | $ 13.76 | $ 16.92 | $ 5.36 | $ 0.97 | $ 1.53 | $ 0.37 | $ 2.87 | $ 149.23 | $ 369 | 8% | $ 376 | 8% | $ 45,713 | 0.8% | $ 22,139 | 1.7% |
| 6 | 2009 | $ 16.23 | $ 19.29 | $ 0.45 | $ 0.56 | $ 15.68 | $ 19.85 | $ 14.74 | $ 1.23 | $ 2.71 | $ 0.55 | $ 4.50 | $ 166.06 | $ 397 | 8% | $ 408 | 8% | $ 47,065 | 0.9% | $ 22,802 | 1.8% |
| 7 | 2010 | $ 12.67 | $ 16.52 | $ 0.67 | $ 0.72 | $ 13.23 | $ 17.24 | $ 14.91 | $ 1.62 | $ 3.92 | $ 0.72 | $ 6.26 | $ 196.47 | $ 424 | 7% | $ 439 | 8% | $ 48,497 | 0.9% | $ 23,486 | 1.9% |
| 8 | 2011 | $ 55.90 | $ 75.12 | $ 1.07 | $ 1.40 | $ 56.97 | $ 76.52 | $ 71.13 | $ 3.99 | $ 8.65 | $ 1.40 | $ 15.04 | $ 173.07 | $ 440 | 4% | $ 477 | 8% | $ 49,952 | 1.0% | $ 24,190 | 2.0% |
| 9 | 2012 | $ 60.19 | $ 83.32 | $ 1.62 | $ 2.18 | $ 61.81 | $ 85.49 | $ 76.77 | $ 6.54 | $ 15.83 | $ 2.16 | $ 24.55 | $ 179.02 | $ 459 | 4% | $ 520 | 9% | $ 51,461 | 1.0% | $ 24,916 | 2.1% |
| 10 | 2013 | $ 60.96 | $ 86.91 | $ 2.17 | $ 3.01 | $ 63.13 | $ 89.92 | $ 77.78 | $ 9.14 | $ 22.70 | $ 3.01 | $ 34.24 | $ 177.46 | $ 480 | 5% | $ 545 | 5% | $ 52,994 | 1.0% | $ 25,664 | 2.1% |
| 11 | 2014 | $ 53.65 | $ 78.64 | $ 2.66 | $ 3.79 | $ 56.21 | $ 82.43 | $ 67.26 | $ 11.36 | $ 27.52 | $ 3.79 | $ 42.69 | $ 184.34 | $ 492 | 5% | $ 599 | 5% | $ 54,584 | 1.1% | $ 26,434 | 2.2% |
| 12 | 2015 | $ 57.05 | $ 86.29 | $ 3.17 | $ 4.66 | $ 60.22 | $ 90.96 | $ 72.80 | $ 13.79 | $ 33.37 | $ 4.66 | $ 51.82 | $ 191.51 | $ 505 | 5% | $ 637 | 5% | $ 56,221 | 1.1% | $ 27,227 | 2.3% |
| 13 | 2016 | $ 61.13 | $ 95.24 | $ 3.79 | $ 5.64 | $ 64.86 | $ 100.88 | $ 76.82 | $ 16.42 | $ 39.72 | $ 5.64 | $ 61.77 | $ 198.96 | $ 520 | 5% | $ 686 | 5% | $ 57,908 | 1.2% | $ 28,043 | 2.5% |
| 14 | 2017 | $ 63.43 | $ 101.79 | $ 4.30 | $ 6.71 | $ 67.73 | $ 108.49 | $ 82.82 | $ 19.17 | $ 46.36 | $ 6.71 | $ 72.25 | $ 206.89 | $ 556 | 5% | $ 743 | 5% | $ 59,645 | 1.2% | $ 28,885 | 2.6% |
| 15 | 2018 | $ 69.02 | $ 114.07 | $ 4.93 | $ 7.91 | $ 73.95 | $ 121.98 | $ 91.84 | $ 22.23 | $ 53.78 | $ 7.91 | $ 83.92 | $ 214.78 | $ 582 | 5% | $ 802 | 5% | $ 61,435 | 1.3% | $ 29,751 | 2.7% |
| 16 | 2019 | $ 66.99 | $ 114.04 | $ 5.54 | $ 9.15 | $ 72.52 | $ 123.19 | $ 86.85 | $ 25.19 | $ 60.94 | $ 9.15 | $ 95.28 | $ 223.06 | $ 611 | 5% | $ 863 | 5% | $ 63,278 | 1.4% | $ 30,644 | 2.8% |
| 17 | 2020 | $ 70.36 | $ 123.37 | $ 6.16 | $ 10.61 | $ 76.53 | $ 133.98 | $ 95.02 | $ 28.36 | $ 68.59 | $ 10.51 | $ 107.46 | $ 231.78 | $ 640 | 5% | $ 926 | 5% | $ 65,176 | 1.4% | $ 31,563 | 2.9% |
| 18 | 2021 | $ 116.31 | $ 210.07 | $ 7.28 | $ 12.68 | $ 123.54 | $ 222.75 | $ 175.86 | $ 34.21 | $ 88.77 | $ 12.68 | $ 135.65 | $ 240.78 | $ 671 | 5% | $ 1,021 | 10% | $ 67,191 | 1.5% | $ 32,510 | 3.1% |
| 19 | 2022 | $ 125.00 | $ 232.54 | $ 8.98 | $ 15.11 | $ 133.97 | $ 247.65 | $ 191.94 | $ 40.60 | $ 98.23 | $ 15.11 | $ 153.94 | $ 250.14 | $ 704 | 5% | $ 1,124 | 10% | $ 69,145 | 1.6% | $ 33,485 | 3.4% |
| 20 | 2023 | $ 107.78 | $ 206.48 | $ 9.34 | $ 17.36 | $ 117.10 | $ 223.85 | $ 160.63 | $ 45.95 | $ 111.17 | $ 17.36 | $ 174.50 | $ 259.86 | $ 738 | 5% | $ 1,219 | 8% | $ 71,220 | 1.7% | $ 34,490 | 3.5% |
| 21 | 2024 | $ 106.12 | $ 213.30 | $ 10.32 | $ 19.78 | $ 116.44 | $ 233.17 | $ 162.04 | $ 51.35 | $ 124.23 | $ 19.78 | $ 195.35 | $ 269.99 | $ 774 | 5% | $ 1,318 | 8% | $ 73,366 | 1.8% | $ 35,525 | 3.7% |
| 22 | 2025 | $ - | $ - | $ 10.32 | $ 20.37 | $ 10.32 | $ 20.37 | $ - | $ - | $ 124.23 | $ 20.37 | $ 144.60 | $ 280.50 | $ 812 | 5% | $ 1,218 | -8% | $ 75,567 | 1.6% | $ 36,590 | 3.3% |
| 23 | 2026 | $ - | $ - | $ 10.32 | $ 20.98 | $ 10.32 | $ 20.98 | $ - | $ - | $ 124.23 | $ 20.98 | $ 145.21 | $ 291.42 | $ 851 | 5% | $ 1,264 | 4% | $ 77,824 | 1.6% | $ 37,688 | 3.4% |
| 24 | 2027 | $ - | $ - | $ 10.32 | $ 21.61 | $ 10.32 | $ 21.61 | $ - | $ - | $ 124.23 | $ 21.61 | $ 145.84 | $ 302.77 | $ 893 | 5% | $ 1,311 | 4% | $ 80,158 | 1.6% | $ 38,819 | 3.4% |
| 25 | 2028 | $ - | $ - | $ 10.32 | $ 22.26 | $ 10.32 | $ 22.26 | $ - | $ - | $ 124.23 | $ 22.26 | $ 146.49 | $ 314.56 | $ 936 | 5% | $ 1,361 | 4% | $ 82,663 | 1.6% | $ 39,983 | 3.4% |
| 26 | 2029 | $ - | $ - | $ 10.32 | $ 22.93 | $ 10.32 | $ 22.93 | $ - | $ - | $ 124.23 | $ 22.93 | $ 147.16 | $ 326.61 | $ 982 | 5% | $ 1,413 | 4% | $ 85,040 | 1.7% | $ 41,183 | 3.4% |
| 27 | 2030 | $ - | $ - | $ 10.32 | $ 23.61 | $ 10.32 | $ 23.61 | $ - | $ - | $ 124.23 | $ 23.61 | $ 147.84 | $ 339.53 | $ 1,030 | 5% | $ 1,467 | 4% | $ 87,591 | 1.7% | $ 42,418 | 3.5% |
| 28 | 2031 | $ - | $ - | $ 10.32 | $ 24.32 | $ 10.32 | $ 24.32 | $ - | $ - | $ 124.23 | $ 24.32 | $ 148.55 | $ 352.78 | $ 1,080 | 5% | $ 1,524 | 4% | $ 90,219 | 1.7% | $ 43,691 | 3.5% |
| 29 | 2032 | $ - | $ - | $ 10.32 | $ 25.05 | $ 10.32 | $ 25.05 | $ - | $ - | $ 124.23 | $ 25.05 | $ 149.28 | $ 366.50 | $ 1,133 | 5% | $ 1,583 | 4% | $ 92,925 | 1.7% | $ 45,001 | 3.5% |
| 30 | 2033 | $ - | $ - | $ 10.32 | $ 25.80 | $ 10.32 | $ 25.80 | $ - | $ - | $ 124.23 | $ 25.80 | $ 150.03 | $ 380.76 | $ 1,188 | 5% | $ 1,645 | 4% | $ 95,713 | 1.7% | $ 46,351 | 3.5% |
| 31 | 2034 | $ - | $ - | $ 10.32 | $ 26.58 | $ 10.32 | $ 26.58 | $ - | $ - | $ 124.23 | $ 26.58 | $ 150.81 | $ 395.52 | $ 1,246 | 5% | $ 1,710 | 4% | $ 98,585 | 1.7% | $ 47,742 | 3.6% |
| 32 | 2035 | $ - | $ - | $ 10.32 | $ 27.37 | $ 10.32 | $ 27.37 | $ - | $ - | $ 123.92 | $ 27.37 | $ 151.29 | $ 411.04 | $ 1,307 | 5% | $ 1,777 | 4% | $ 101,542 | 1.8% | $ 49,174 | 3.6% |
| 33 | 2036 | $ - | $ - | $ 10.32 | $ 28.20 | $ 10.32 | $ 28.20 | $ - | $ - | $ 123.77 | $ 28.20 | $ 151.96 | $ 427.06 | $ 1,371 | 5% | $ 1,848 | 4% | $ 104,588 | 1.8% | $ 50,650 | 3.6% |
| 34 | 2037 | $ - | $ - | $ 10.32 | $ 29.04 | $ 10.32 | $ 29.04 | $ - | $ - | $ 123.13 | $ 29.04 | $ 152.16 | $ 443.70 | $ 1,438 | 5% | $ 1,921 | 4% | $ 107,726 | 1.8% | $ 52,169 | 3.7% |
| 35 | 2038 | $ - | $ - | $ 10.32 | $ 29.91 | $ 10.32 | $ 29.91 | $ - | $ - | $ 122.70 | $ 29.91 | $ 152.62 | $ 461.00 | $ 1,509 | 5% | $ 1,997 | 4% | $ 110,958 | 1.8% | $ 53,734 | 3.7% |
| | Total | $ 1,138.24 | $ 1,888.43 | $ 216.76 | $ 466.93 | $ 1,355.00 | $ 2,355.36 | $ 1,641.56 | $ 333.22 | $ 2,846.99 | $ 469.83 | $ 3,343.04 | | | | | | | | | |

J:\1165\Litigation\Financial Inspection\[20 YR CSO LTCP Case V10292804 scenario Late]Vertical Table

# APPENDIX C

**APPENDIX C**
Certain Financial Information to Perform Financial Analysis
Pursuant to Section VII

In the event that WASA seeks a modification of the Schedule pursuant to Section VII of the Consent Decree due to cost overruns or changed financial circumstances, WASA shall update its financial information. Information that may be relevant includes the following list or categories of information, and WASA agrees to provide such information in the event the United States requests it. Nothing in this Appendix in any way limits or narrows the United States' right to obtain or request other information in order to review and respond to WASA's request for a modification.

1. DC population, current and projected

2. Number of households, current and projected
   - Single-family residence
   - Multi-family buildings

3. Median household income

4. Wastewater billings and volume billed for past three years, broken out for all user classes

5. Wastewater revenues and expenditures for past three years.

6. WASA financial statements for past three years.

7. Prospectuses issued within the past three years.

8. Rate studies prepared within the past three years related to wastewater or stormwater programs.

9. Per household wastewater metering fee and ROW fee

10. Average per household volume billed for
    - Single-family residence
    - Multi-family residence

11. Current baseline revenues and expenditures.

12. LTCP costs
    - Capital costs incurred to date
    - Capital costs projected by year
    - Additional operations and maintenance costs projected by year
    - Costs to date financed with grants (amount and interest rate by year)
    - Costs to date financed with low interest, non-market loans (amount and interest rate by

year)

13. Projected costs other than those required by this consent decree that should be considered in addition to baseline costs. Identify and project by year.
- Costs necessary to comply with regulations or other legal requirements.
- Projected sewer system assessment and rehabilitation costs
- Other increases that would cause total annual expenditures to rise at a rate greater than inflation

14. Debt coverage ratio

15. Bond interest rate and term

16. Rate of inflation

17. PAYGO assumption

18. Current wastewater rate per ccf for single-family residential customers.

19. History of rate adjustments or rate recovery approach during the past five years. Identify the current basis for recovery of LTCP costs and any expected changes in the basis for the recovery of these costs. If rates are recovered through other than the wastewater rate, identify the mechanism, and the amount of costs born by each user class.

20. Projection over twenty years estimating per household impact of LTCP.

21. Current programs to provide relief to low-income residents.

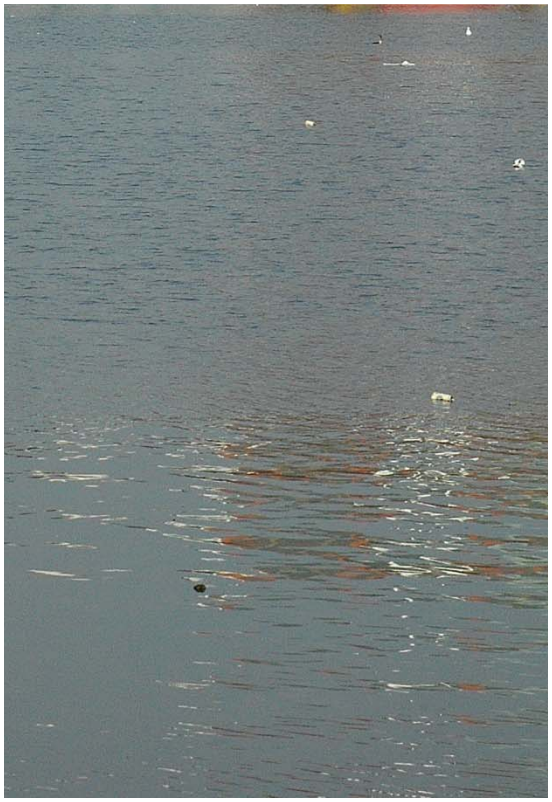
22. Other documentation or analysis that EPA and/or WASA deems relevant for the particular circumstances.

# APPENDIX D

DISTRICT OF COLUMBIA WATER AND SEWER AUTHORITY

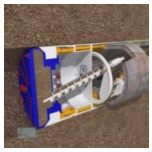
LONG TERM CSO CONTROL PLAN

**ANACOSTIA RIVER PROJECTS**



# DOCUMENT II-3:5-FI

# FACILITY PLAN



## SUMMARY REPORT AND DETAILED IMPLEMENTATION SCHEDULE

SEPTEMBER 23, 2008

CDM/HMM, A JOINT VENTURE – FACILITY PLAN, DCFA #399-WSA

GREELEY AND HANSEN LLC - OPERATIONAL PLAN, EPMC-III

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# Summary Report and Detailed Implementation Schedule

This report is a summary of findings and recommendations based on the Facility Plan developed for the District of Columbia Water and Sewer Authority's (Authority or WASA) Anacostia River Projects which are part of WASA's Long Term Control Plan for Combined Sewer Overflows. It has been prepared to satisfy the requirement for the Authority to submit to the United States Environmental Protection Agency (EPA), no later than September 23, 2008, a summary report and detailed implementation schedule for the Anacostia River Projects as described at Section VI, paragraph A.9. of the Consent Decree entered into by the Authority, the United States and the District of Columbia, effective March 23, 2005. Detailed information regarding the Facility Plan for the Anacostia River Projects, is provided in Document II-3:4 FD, Facility Plan, which includes a main document volume and four Appendix volumes of supporting and reference information.

When completed, the Anacostia River Projects are expected to reduce the average year volume of combined sewer overflows to the Anacostia River by 98 percent, and number of overflows from 82 to 2 in the average year.

## 1. Background and Introduction

Communities with combined sewer systems are required to prepare long term plans for control of combined sewer overflows (CSOs) in accordance with the CSO Policy at Section 402 (q) of the Clean Water Act. The Authority, after extensive stakeholder and public participation, completed its Long Term Control Plan (LTCP) for the District's combined sewer system in July 2002. The LTCP provides for control of CSOs to the Anacostia River, Rock Creek and Potomac River and was submitted for approval to the District Department of Health (DOH) and EPA.

The LTCP was approved by DOH on August 28, 2003, and on December 16, 2004 EPA reissued the Authority's National Pollutant Discharge Elimination System (NPDES) permit to include the CSO control provisions of the DOH approved LTCP. Subsequently, the Authority, the District of Columbia and the United States entered into a Consent Decree to implement the LTCP. The Consent Decree includes the schedule for the facilities included in the LTCP and was entered by the Federal Court on March 23, 2005.

Projects to control CSOs to the Anacostia River are at the top of the court ordered schedule, and the Authority is required to prepare a Facility Plan for these projects. The Facility Plan for the Anacostia River CSOs comprises engineering studies to advance the LTCP conceptual plan to a level sufficient to proceed into detailed design and construction.

The Consent Decree schedule for the Anacostia River Projects, including milestone dates, is summarized in Table 1.

**Table 1**
**Anacostia River Projects**
**Consent Decree Milestone Dates**
**(not later than dates)**

| Project | Award Contract for Design | Award Contract for Construction | Place in Operation |
|---|---|---|---|
| Anacostia River Projects Facility Plan | Sep 23, 2005 | n/a | Sep 23, 2008 (1) |
| Storage/Conveyance Tunnel From Poplar Point to Northeast Boundary | Mar 23, 2009 | Mar 23, 2012 | Mar 23, 2018 |
| Anacostia Outfall Consolidation | Mar 23, 2013 | Mar 23, 2016 | Mar 23, 2018 |
| Storage/Conveyance Tunnel Parallel to Northeast Boundary Sewer | Mar 23, 2015 | Mar 23, 2018 | Mar 23, 2025 |
| Northeast Boundary Side Tunnels | Mar 23, 2019 | Mar 23, 2022 | Mar 23, 2025 |
| Poplar Point Pumping Station | Mar 23, 2012 | Mar 23, 2015 | Mar 23, 2018 |
| Separate Fort Stanton Drainage Area (Outfall 006) | Mar 23, 2006 | Mar 23, 2008 | Mar 23, 2010 |
| Fort Stanton Interceptor | Mar 23, 2013 | Mar 23, 2016 | Mar 23, 2018 |

(1) Requires WASA to submit a summary report and detailed implementation schedule to EPA.

There are fourteen existing CSO outfalls along the Anacostia River as shown on Figure 1. Under the LTCP, the area tributary to Outfall 006 is being separated. That project is under construction and scheduled to be placed in operation by March 23, 2010. The remainder of the CSOs, shown on Figure 1, are included in the facilities that comprise the Facility Plan for the Anacostia River Projects (ARP) program. The ARP program comprises a tunnels system together with diversion and overflow facilities to capture, store and convey combined sewer flow. In addition to providing CSO control, the tunnels system is designed to control chronic surface flooding on the combined sewer system in the Northeast Boundary Area. The chronic surface flooding is the result of a lack of adequate capacity in the existing Northeast Boundary Trunk Sewer. The tunnels system, CSO locations and the Northeast Boundary areas prone to surface flooding are shown on Figure 2.


**Figure 1: Locations of Combined Sewer Overflows along the Anacostia River**

As shown on Figure 2, the tunnels system extends from the Authority's Blue Plains Advanced Wastewater Treatment Plant (Blue Plains or BPAWWTP), along the Potomac and Anacostia Rivers and into the Northeast Boundary Area. Existing CSOs will be conveyed into the tunnels system through a system of diversion sewers and drop shafts. Similar diversion facilities will be used to provide relief for the existing Northeast Boundary Trunk Sewer. Flow captured in the tunnels will be treated at Blue Plains. Flows in excess of the tunnels storage capacity and Blue Plains treatment capacity will overflow to the Potomac and Anacostia Rivers at locations shown on Figure 2.


**Figure 2: Location of Tunnels System Relative to CSOs and Flooding Areas**

The tunnels system shown on Figure 2, is a result of the following:

- The LTCP approved by DOH on August 28, 2003, which provided for the tunnel's system to terminate at its south end on Poplar Point and;
- Supplement No.1 to the LTCP, which comprises the Blue Plains Total Nitrogen Removal/Wet Weather Plan submitted to EPA on October 12, 2007. This plan provides for modifying the LTCP Consent Decree to blend the new nitrogen limit for Blue Plains and wet weather treatment. The principal provisions of the plan include the addition of enhanced nitrogen removal (ENR) at Blue Plains and extension of the tunnels system from Poplar Point to Blue Plains, including tunnel dewatering and enhanced clarification facilities at the tunnels system terminus.

# 2. Project Scope & Description of Facilities

Principal facilities included in the Anacostia River Projects are shown on Figure 3 and include approximately 12.9 miles of tunnels, 17 shafts for conveyance of flows into the tunnels system, overflow structures, air venting and management, and maintenance and inspection access. In addition to the underground works, diversion chambers and sewers will be constructed to capture and divert flows from the existing combined sewer system into drop shafts that will convey the flows to the tunnels system. The tunnels will be constructed using pressurized-face soft ground tunnel boring machines (TBMs). The tunnels and shafts will be constructed at depths to invert between 70 and 200 below existing ground elevation.

The principal elements that comprise the ARP are described briefly as follows:

- Blue Plains Tunnel (BPT) –The BPT follows an alignment that starts at Blue Plains, traverses west of Interstate 295 along the Potomac River through Bolling Air Force Base (BAFB) and the Anacostia Naval Annex, then crosses under the Anacostia River north of the existing WASA Main Outfall Sewers (which extend from WASA's Main Pumping Station to Poplar Point), and terminates in the north yard area of WASA's Main Pumping Station. The BPT will have an inside diameter of 23 feet and a permanent lining of precast concrete segments connected by bolts and gaskets. This lining system will be used for all tunnel reaches on the ARP for bored tunnels. Shafts located along the BPT include a dewatering pumping station shaft at Blue Plains; a tunnel overflow shaft within BAFB downstream of a new connection to the Potomac Outfall Sewers; a combination drop and junction shaft with the Anacostia River Tunnel near Poplar Point; and a drop shaft at WASA's Main Pumping Station.
- Anacostia River Tunnel (ART) – The ART begins at the junction shaft with the BPT at a location approximately 750 feet south of the existing Poplar Point Pumping Station. It then traverses under the Washington Metropolitan Area Transit Authority (WMATA) Green Line at Poplar Point, follows Anacostia Park to a point east of the 11th Street Bridges where it crosses the Anacostia River, and then follows the north (west) shore of the river from Water Street to an interface with the Northeast Boundary Tunnel immediately north of the planned CSO 019 facilities. The ART is planned to be constructed from the CSO 019 area southward to the junction shaft with the BPT, with all

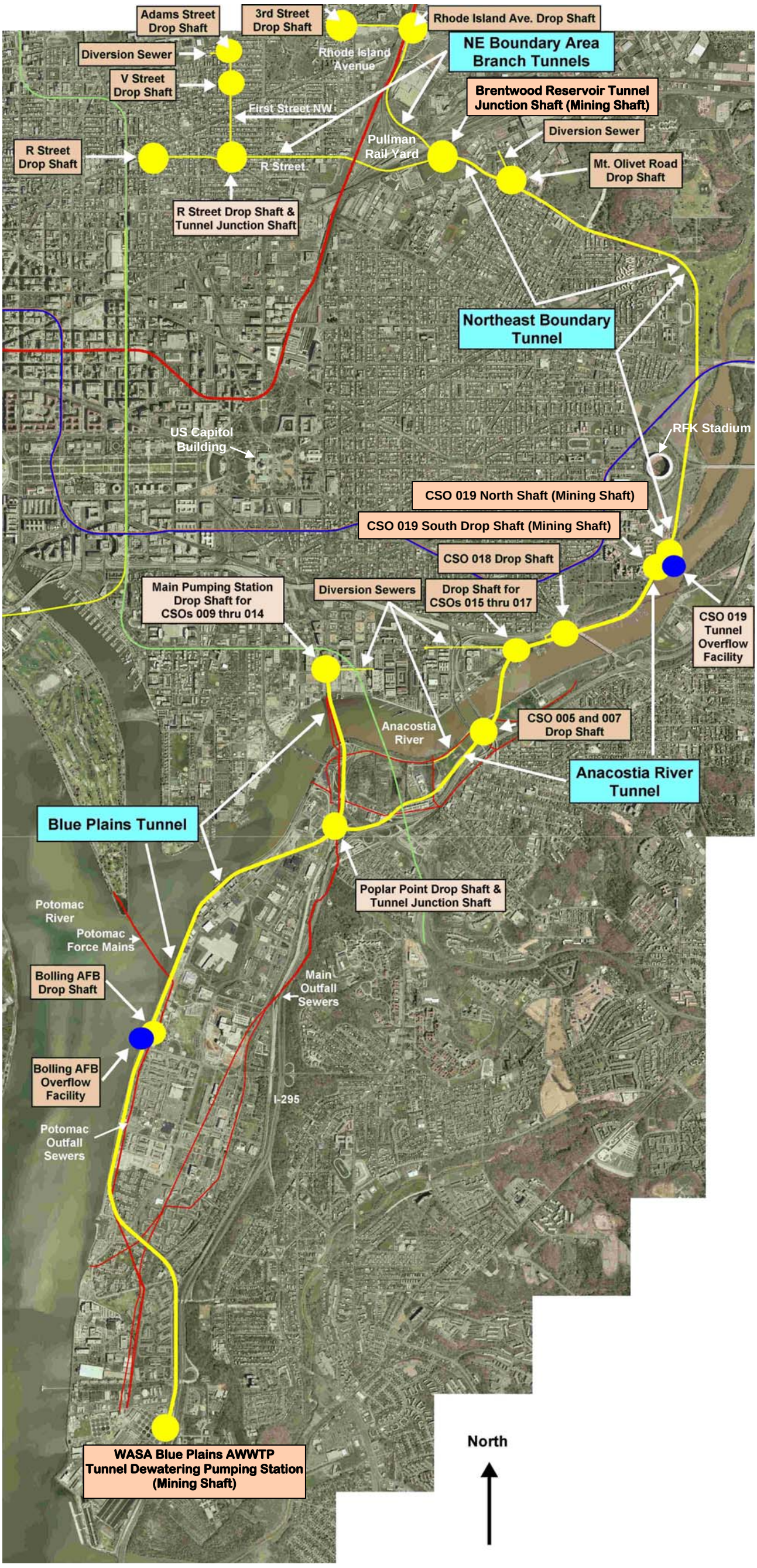



**Figure 3: Principal Anacostia River Projects Facilities**

tunnel construction staging from the south parking lot area of RFK Stadium. Flows from CSOs 005 and 007 on the south side of the river will be captured in a new diversion sewer and conveyed into the tunnel at a drop shaft located between the approach roadways for the 11th Street Bridges. Flows from CSOs 015, 016 and 017 on the north (west) side of the river also will be captured in a new diversion sewer and conveyed to a drop shaft located at the intersection of Water Street SE and M Street SE. Flows from CSO 018 on the north (west) side of the river will be conveyed to a drop shaft somewhat to the east along M Street near Barney Circle. At the CSO 019 area, a drop shaft will accept flows from the existing Northeast Boundary Trunk Sewer above CSO 019. In addition, the drop shaft will serve as a tunnel overflow shaft, and a second tunnel overflow shaft will also be constructed. The CSO 019 area is the limit of the first phase of facilities construction and facilities system operation. The Consent Decree requires the new ARP facilities from Blue Plains to the CSO 019 area to be placed in operation by March 23, 2018.

- Northeast Boundary Tunnel (NEBT) – The NEBT will be excavated north from the CSO 019 area under the RFK Stadium parking lots along the Anacostia River, Langston Golf Course and under the National Arboretum. It will then continue west along Mount Olivet Road NE and terminate at WASA's Brentwood Reservoir site adjacent to New York Avenue. Since the ART will be operating while the NEBT is under construction, a temporary isolation plug or physical separation (bulkhead) between the ART and NEBT tunnels must be in place to provide for the safety of the workers constructing the NEBT. This separating plug or bulkhead will be constructed by the ART construction contractor. Along the NEBT there will be a drop shaft near the intersection of Mount Olivet Road NE and West Virginia Avenue NE to receive flows from this flooding area. The tunnel terminus at the Brentwood Reservoir will be at a shaft for extraction of the TBM. This shaft will also serve as a junction shaft for connecting the Northeast Boundary Area branch tunnels to the NEBT, and as the mining shaft for the R Street and Rhode Island Avenue branch tunnels.
- Northeast Boundary Area Branch Tunnels – Three branch tunnels will convey flows from flooding areas west of the Pullman Rail Yard: the R Street Branch Tunnel (RSBT), the Rhode Island Avenue Branch Tunnel (RIBT), and the First Street NW Branch Tunnel (FSNWBT). These tunnels have been planned with inside diameters of 12 feet. Drop shafts are planned at the upstream ends of the respective tunnels. The RSBT and FSNWBT will join at an intermediate, combination drop and junction shaft. As for other drop shafts, these will connect to the existing combined sewer system via diversion chambers and sewers.

  Diversion Chambers and Sewers – In order to capture and convey flows from the existing combined sewer system to the respective drop shaft facilities, diversion chambers will be constructed at the points of diversion, and diversion sewers will be constructed from those points to the nearest drop shafts. These will involve surface construction at the diversion points and potentially at intermediate locations along the diversion sewer alignments, depending on the construction technology applied. Microtunneling and pipe-jacking applications are being considered for construction of diversion sewers, depending

on the feasibility of the respective technologies with respect to the site conditions. The most significant diversion sewer alignments include:

- Tingey Street SE, connecting to drop shaft facilities at the Main Pumping Station
- M Street SE and Water Street SE areas, connecting to drop shaft facilities along Water Street SE and M Street SE
- Mount Olivet Road neighborhood area diversions
- Northeast Boundary Area diversions connecting to the branch tunnels described above

# 3. Project Setting

Facilities to be constructed and operated will be located in a variety of settings ranging from open space and public lands to well developed residential and commercial neighborhoods. Several areas are also being planned to undergo substantial development and infrastructure improvements prior to and during construction of the ARP facilities. Therefore, the siting of facilities and planning for construction and facilities operations has involved a substantial degree of coordination and collaboration with numerous government agencies, citizen groups and neighborhoods, military commands, railroad entities, utility companies and other interested parties. Planning has been designed to minimize disturbance to neighborhoods as well as physical and construction staging interfaces with planned property development and major infrastructure projects.

The storage and conveyance tunnels are predominantly located in soil strata, and therefore soft ground tunneling technologies will be employed. Tunnel construction will be performed by Tunnel Boring Machines (TBMs) that will be driven from mining shafts at locations shown on Figure 3. The majority of tunnel construction activities will be concentrated at the mining shaft locations. Consequently, the mining shaft areas require substantial staging areas for material handling, construction logistics, and utility support. The recommended plan is based on the use of two sites for the majority of tunnel construction: WASA's Blue Plains site for construction of the BPT to Main Pumping Station and the southern parking lot area of RFK Stadium for construction of the ART to its junction with the BPT; and the NEBT to its terminal shaft at Brentwood Reservoir in the vicinity of New York Avenue NE. The Brentwood Reservoir site will also be a construction work site for mining and construction of approximately 2.6 miles of the branch tunnels.

Improvements in tunneling technology during the past couple of decades will result in fewer impacts on the surrounding neighborhoods and environment than in the past and provides the ability to construct tunnels within more variable and difficult ground conditions than in the past. However, the minimization of risks associated with the ARP tunnels program is a key consideration as for any other underground construction program. Such risks could involve, but are not limited to:

- Ability to perform the work under varying or adverse geological conditions
- Protection of structures and utilities from settlement or other adverse impacts
- Encountering unknown subsurface obstructions that impede tunnel advance

- Major mechanical failures of the TBM that may require construction of an unplanned access from the surface or extensive ground improvement to rescue and repair the TBM

These risks are particularly important considerations for the design and construction of soft ground tunnels compared to tunnels constructed in intact rock, as has been the case for many CSO tunnels that have been constructed prior to the introduction of modern soft-ground tunneling technology.

In consideration of the risks above, as well as in the interest of minimizing the need to acquire private property or easements, the tunnel alignments have been located to be predominantly in open land within public space and to not pass directly below existing surface structures. These public lands include D.C. streets and properties occupied by WASA, development land, park land, BAFB, the Anacostia Naval Annex, the RFK Stadium site, and the National Arboretum. Rights are required for construction and operation of the tunnels underneath private properties, including CSX and WMATA properties at five locations and several small privately owned parcels for subsurface easements along the tunnels alignments. Easements for small privately owned parcels along sections of the alignments are required because of the minimum turning radii needed for the TBMs to facilitate excavation and construction of the pre-cast concrete tunnel lining.

To avoid subsurface obstructions and to protect structures and utilities from settlement-induced damage, the Facility Plan development included a limited subsurface geotechnical exploration program to investigate geological conditions along the planned tunnel alignments and research of the major infrastructure and structures in proximity to the alignments. The alignment of the ART is greatly influenced by avoidance of past, present, and future bridge piers and piles while maintaining a minimum radius of curvature for tunnel construction. Protection and avoidance of damage to WMATA transit structures is also a consideration. The tunnel alignments cross under the subsurface Green Line just west of Anacostia Station, the aerial section of the Blue Line in the northern parking area of RFK Stadium, and the surface Red Line track south and north of the Rhode Island Avenue Station. Additionally, the Tingey Street Diversion Sewer will cross above the WMATA Green Line. Traversal of the Bolling AFB and Anacostia Naval Annex also include consideration of not only protection of existing structures and infrastructure, but also security considerations during construction and systems operations.

For the branch tunnels west and north of the NEBT terminus shaft, the local area along the tunnel alignments is predominantly residential with some commercial properties and small public parks. Tunnels in this area will be primarily to provide conveyance of storm flows rather than provide storage during a storm event. Consequently, they are planned to be smaller than the main storage / conveyance tunnels, which lessens the potential for surface or structural settlement. At the currently planned diameters, these tunnels will be constructed using the same methodology as the main storage / conveyance tunnels. If it is determined, as the design proceeds, that these can be smaller tunnels, alternative tunnel construction technologies may be applied, such as pipe jacking or micro-tunneling. The determination of the appropriate technology will likely occur during the design phase of the program based on a more extensive site characterization and geotechnical investigation program.

Coordination with other planned development and infrastructure projects also had a significant influence on the siting of the facilities. The Principal projects include those shown on Figure 4 and are:

- The planned development of residential and commercial properties and public lands at Poplar Point and the planned replacement of the South Capitol Street Bridge with associated modifications to the I-295 interchange in this area.
- The planned development of Diamond Teague Park, currently under construction, located along the north bank of the Anacostia River immediately to the south and east of Nationals Stadium and to the south and west of WASA's O Street Pumping Station.


**Figure 4: Principal Planned Development and Infrastructure Projects in ARP Area**

- On the north (west) shore of the Anacostia River, planned property development at the Southeast Federal Center near WASA's Main Pumping Station, Maritime Plaza and Boathouse Row developments near Water Street, and the Hill East development project near CSO 019 have to be considered relative to the siting of facilities.
- Another major infrastructure project that impacts the design and construction of facilities on both sides of the Anacostia River is the replacement of the 11th Street Bridges by the District Department of Transportation (DDOT). Coordination is required for diversion chambers and sewers as well as the drop shaft facility for CSO 005 and CSO 007.
- In the Northeast Boundary Area, extensive development has been accomplished near New York and Florida Avenues, with more planned to be completed over the next 20+ years while the ARP is under design and construction. Much of this development will be accomplished under the District's NoMA project (North of Massachusetts Avenue).

# 4. Investigation and Evaluation of Alternatives

During development of the recommended plan, a number of alternatives and variations of alternatives for the configuration of facilities were investigated and evaluated in an organized and systematic manner. The major alternative alignment corridors which were investigated are presented on Figure 5. These alternatives were evaluated relative to their ability to achieve the required system hydraulic operational performance, as well as their respective programmatic profiles (e.g., estimated cost, schedule, risks, real estate needs, permitting, and degree of required coordination with other agencies and projects and community impacts, if any).

Overall, 12 alternative tunnel horizontal alignments, with some associated variations for localized conditions, were investigated for the tunnels between Poplar Point and the Northeast Boundary Area. For the BPT, three alternative alignments were investigated to varying degrees.

Alternative configurations were also investigated for construction and operation of deaeration facilities and drop shafts. Where such facilities have been constructed in rock as part of CSO storage and conveyance systems in major cities such as Milwaukee and Atlanta, deaeration facilities were constructed in horizontal chambers at the terminus of tunnel segments or adjacent to the tunnel with a small-diameter connecting tunnel or adit between the drop shaft and the tunnel. In those cases, the deaeration chambers were also typically of similar or larger cross-section than the tunnel. For the soil conditions anticipated for the ARP, construction of that same type of configuration could prove difficult and risky. Accordingly, an alternative configuration for locating the deaeration facility within a construction shaft in line with the tunnel has been developed for the ARP program. For this configuration, flows will enter the drop shaft through a tangential approach ramp and vortex generator, which is typical for many CSO facilities. However, at the base of the drop shaft the flow would transition to a circular channel to allow deaeration of the flow before the flow enters the tunnels system.

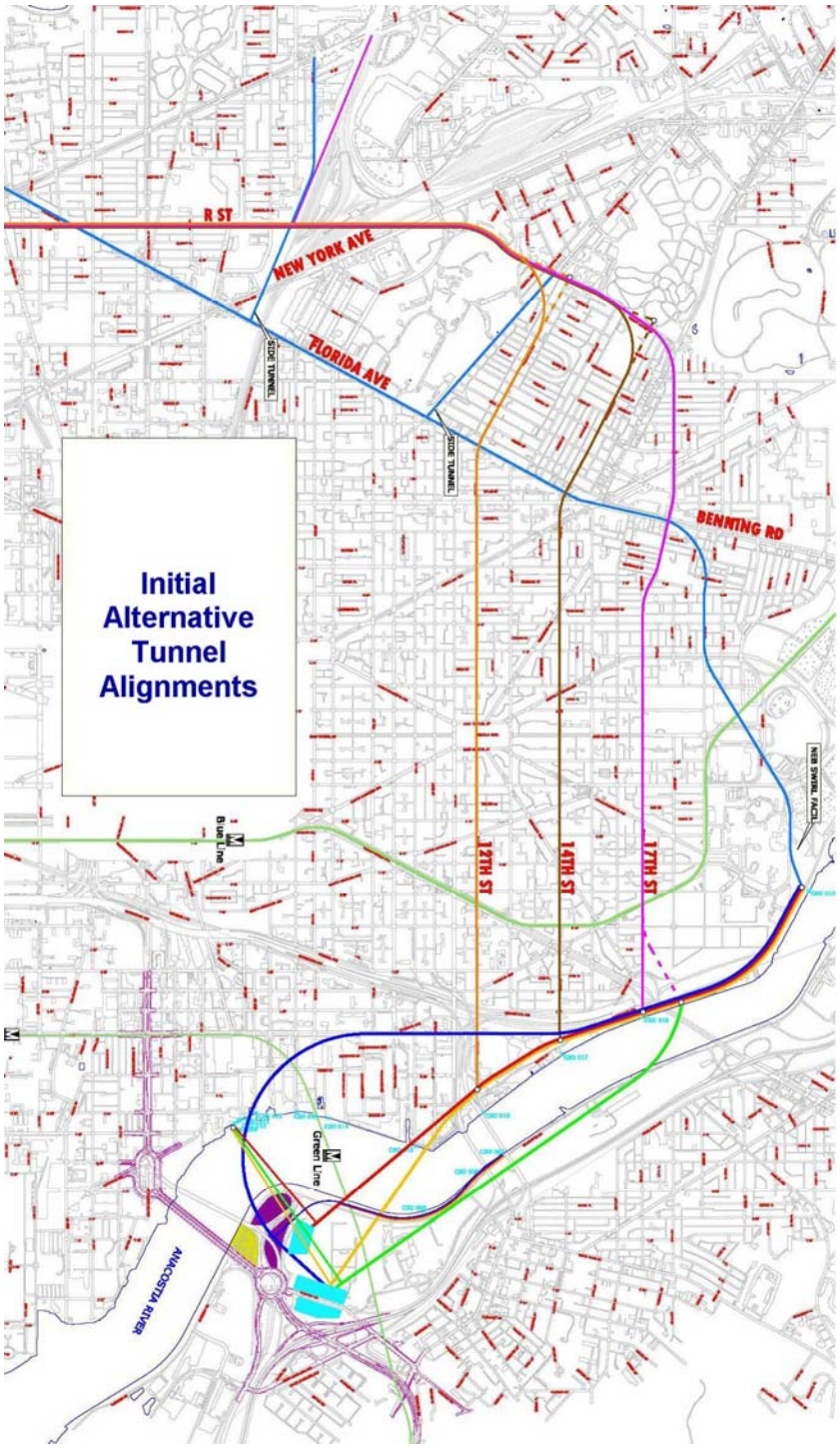



**Figure 5: Alternative Tunnel Alignment Corridors**

# 5. Recommended Implementation Schedule for Anacostia River Projects

The Facility Plan documents provide an expanded description of the facilities to be designed, constructed and placed in operation for the Anacostia River Projects, together with an associated schedule, estimated costs and other program related activities and issues.

The implementation schedule for the ARP has been developed to provide for construction through a number of individual contracts or contract divisions based on principal consideration as follows:

- Limit the value of construction contracts to the availability of bonding capacity and contractor resources in the tunneling industry.
- Separate work by degree of risk, contractor specialty and availability of local resources. Basically, this means separating the deep tunnel work from the near surface work such as diversion structures and sewers.
- Sequencing and interfacing requirements for the individual contract divisions
- Ability to meet and exceed goals for MBE/WBE participation.
- Timeframes required for the various construction activities such as time for procurement and delivery of the large tunnel boring machines and anticipated tunnel mining rates.

Construction contract divisions developed for implementation of the ARP are summarized in Table 2 and shown on Figure 6.

A comparison between the projects developed in the Facility Plan and those in the Consent Decree is summarized in Table 3. This comparison relates compliance dates for the Consent Decree projects to the Facility Plan Contract Divisions.

A detailed implementation schedule for the Facility Plan Contract Divisions is shown on Figure 7. Also shown on Figure 7 are the proposed projects and milestone dates for a modification of the Consent Decree that reflects facility planning. Additionally, the schedule shows permitting timeframes related to the proposed construction. The modified Consent Decree projects milestones match the milestones for the projects in the existing Consent Decree.

Principal features included in the detailed implementation schedule shown on Figure 7 are summarized as follows:

- An 18-month period from award of construction contract, for manufacture, delivery, assembly and start-up of a TBM. This means that actual tunnel mining starts 18 months after construction contract award.
- Tunnels shafts construction starts upon award of construction contract.
- Tunnels mining derived from the available geotechnical information and other experience has been based on an average rate of 40 feet per day.

- Contract Divisions C, E, F and G, which interface with Contract Division H, the Anacostia River Tunnel, will be completed to a "Ready to be Placed in Operation" stage before the Division H contract is awarded.
- The construction contract award date for Contract Division K, the Northeast Boundary Branch Tunnels, occurs on the "Place in Operation" date for Contract Division H, the Anacostia River Tunnel.
- The construction contract award date for Contract Division J, the Northeast Boundary Tunnel occurs at a point when there should be sufficient time for Contract Division K to vacate the Brentwood shaft site, which is the recovery shaft for Contract Division J.
- Contract Division H, Anacostia River Tunnel has the responsibility for activating connections, constructed under other contracts, to place the system between Blue Plains and CSO 019 in operation.
- Contract Division J, Northeast Boundary Tunnel has the responsibility for activating connections, constructed under other contracts, to place the system between CSO 019 and the Northeast Boundary area in operation.

**Table 2**
**Construction Contract Divisions for Anacostia River Projects**

| CONTRACT DIVISION | DESCRIPTION |
|---|---|
| A | Blue Plains Tunnel and Main Outfall Sewers Diversion |
| B | Tingey Street Diversion Sewer for CSOs 013 and 014 |
| C | CSO 019 Overflows and Diversion Structures |
| D | Bolling AFB Overflow and Potomac Outfall Sewer Diversion |
| E | M Street Diversion Sewer for CSOs 015, 016, and 017 |
| F | CSO 018 Diversion Sewer |
| G | CSO 005 and 007 Diversion Sewer |
| H | Anacostia River Tunnel |
| I | Main Pumping Station Diversions |
| J | Northeast Boundary Tunnel |
| K | Northeast Boundary Branch Tunnels |
| L | Northeast Boundary Diversions |
| M | Mt. Olivet Road Diversions |
| Y | Blue Plains Tunnel Dewatering Pumping Station and Enhanced Clarification Facility |
| Z | Poplar Point Pumping Station Replacement |

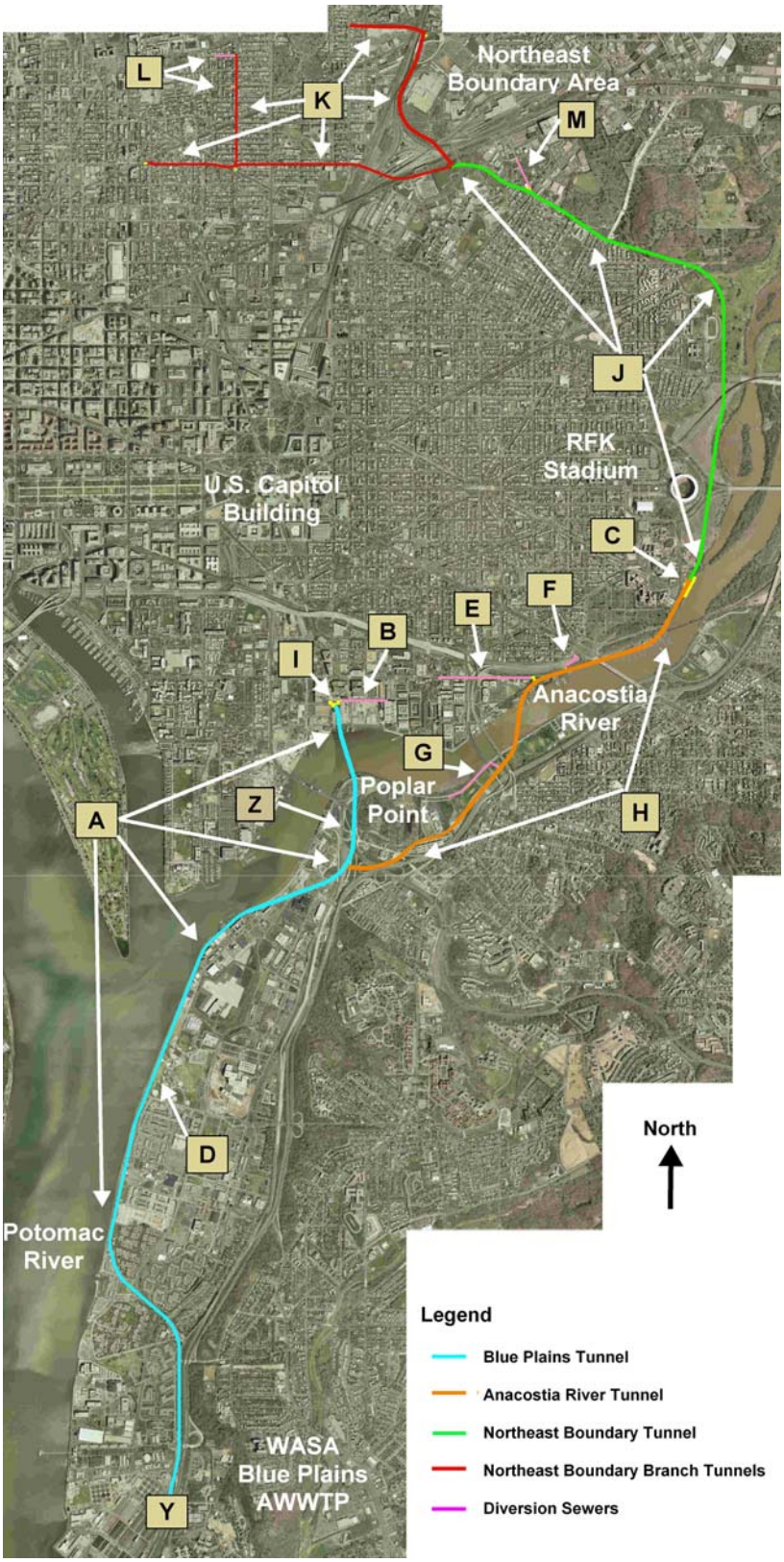


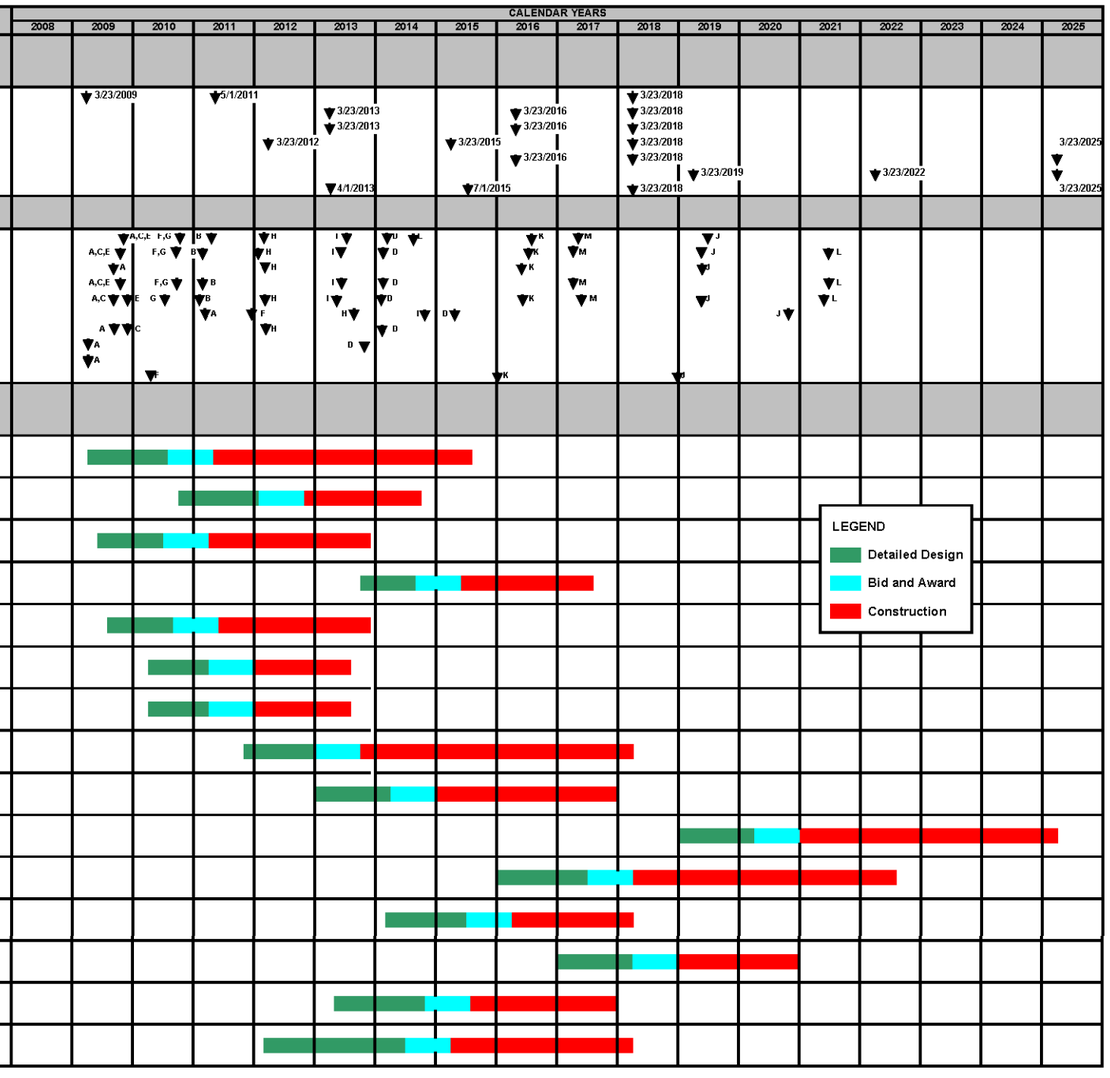

**Figure 6: Locations of Contract Divisions**

**Table 3**
**Anacostia River Projects**
**Comparison of Facility Plan and Consent Decree Projects**

| FACILITY PLAN CONTRACT DIVISION | FACILITY PLAN PROJECT | MATCHING CONSENT DECREE PROJECT | CONSENT DECREE COMPLIANCE DATES RELATED TO FACILITY PLAN PROJECT |
|---|---|---|---|
| A | Blue Plains Tunnel and Main Outfall Sewers Diversion | Storage/Conveyance Tunnel from Poplar Point to Northeast Boundary | Contract Division A award dates for detailed design and contract for construction to be used to determine compliance for Consent Decree project dates |
| E<br><br>F | M Street Diversion Sewer for CSOs 015, 016, and 017<br><br>CSO 018 Diversion Sewer | Anacostia Outfall Consolidation | Contract Divisions E and F award dates for detailed design and contract for construction to be used to determine compliance for Consent Decree project dates |
| H | Anacostia River Tunnel | Storage/Conveyance Tunnel from Poplar Point to Northeast Boundary | Contract Division H Place in Operation Date to be used to determine compliance for Consent Decree project date |
| G | CSO 005 and 007 Diversion Sewer | Fort Stanton Interceptor | Contract Division G replaces function of Consent Decree project; Fort Stanton Interceptor to be deleted. |
| Z | Poplar Point Pumping Station Replacement | Poplar Point Pumping Station | Contract Division Z has same compliance dates as Consent Decree project |
| J | Northeast Boundary Tunnel | Storage/Conveyance Tunnel Parallel to Northeast Boundary Sewer | Contract Division J Place in Operation date to be used to determine compliance for Consent Decree projects date |
| K | Northeast Boundary Branch Tunnels | Storage/Conveyance Tunnel Parallel to Northeast Boundary Sewer | Contract Division K award dates for detailed design and contract for construction to be used to determine compliance for Consent Decree project dates |
| K | Northeast Boundary Branch Tunnels | Northeast Boundary Side Tunnels | Contract Division K award dates for detailed design and contract for construction and Place in Operation date to be used to determine compliance for Consent Decree project dates |
| Y | Blue Plains Tunnel Dewatering Pumping Station and Enhanced Clarification Facility (ECF) | Poplar Point Pumping Station and Excess Flow Improvements | Contract Division Y Place in Operation date to be used to determine compliance for Consent Decree project date; ECF replaces Excess Flow Improvements |

| | FACILITY PLAN PROJECTS RELATED TO MODIFIED CONSENT DECREE PROJECTS AND ASSOCIATED MODIFIED CONSENT DECREE MILESTONES [1] | Award Contract for Detailed Design | Award Contract for Construction | Place in Operation | |
|---|---|---|---|---|---|
| | *Storage/Conveyance Tunnel from Blue Plains to CSO 019* | *March 23, 2009* | *May 1, 2011* | *March 23, 2018* | |
| | *M Street Diversion Sewer and CSO 018 Diversion Sewer* | *March 23, 2013* | *March 23, 2016* | *March 23, 2018* | |
| | *CSO 005 and 007 Diversion Sewer* | *March 23, 2013* | *March 23, 2016* | *March 23, 2018* | |
| | *Poplar Point Pumping Station Replacement* | *March 23, 2012* | *March 23, 2015* | *March 23, 2018* | |
| | *Northeast Boundary Storage/Conveyance Tunnel* | *March 23, 2016* | *March 23, 2018* | *March 23, 2025* | |
| | *Northeast Boundary Branch Tunnels* | *March 23, 2019* | *March 23, 2022* | *March 23, 2025* | |
| | *Blue Plains Tunnel Dewatering Pumping Station and Enhanced Clarification Facilities* | *April 1, 2013* | *July 1, 2014* | *March 23, 2018* | |
| | GENERAL TIME FRAMES FOR PERMIT APPLICATIONS BY CONTRACT DIVISION | | | | |
| | *DC Water and Sewer Authority* | *2 months prior to 60% design* | | | |
| | *Department of Consumer & Regulatory Affairs* | *3 months prior to 60% design* | | | |
| | *Department of Health, DC Fire & Emergency Medical Services* | *30% design* | | | |
| | *DC Department of Environment* | *3 months prior to 60% design* | | | |
| | *DC Department of Public Works* | *30% design* | | | |
| | *DC Department of Parks & Recreation* | *2 months prior to Construction NTP* | | | |
| | *US Army Corps of Engineers* | *30% design* | | | |
| | *Bolling AFB (DOD), Department of the Air Force* | *Design NTP* | | | |
| | *US Navy* | *Design NTP* | | | |
| | *CSX Corporation* | *Design NTP* | | | |

| CONTRACT DIVISION | DESCRIPTION | AWARD CONTRACT FOR DETAILED DESIGN | AWARD CONTRACT FOR CONSTRUCTION | READY TO BE PLACED IN OPERATION [2] | PLACE IN OPERATION |
|---|---|---|---|---|---|
| A | *Blue Plains Tunnel and Main Outfall Sewers Diversion* | *March 23, 2009* | *May 1, 2011* | *July 1, 2015* | *(3)* |
| B | *Tingey Street Diversion Sewer for CSOs 013 and 014* | *October 1, 2010* | *October 1, 2012* | *October 1, 2014* | *(3)* |
| C | *CSO 019 Overflows and Diversion Structure* | *June 1, 2009* | *March 1, 2011* | *November 1, 2013* | *(3)* |
| D | *Bolling AFB Overflow and Potomac Outfall Sewer Diversion* | *October 1, 2013* | *July 1, 2015* | *July 1, 2017* | *(3)* |
| E | *M Street Diversion Sewer for CSOs 015, 016, and 017* | *August 1, 2009* | *May 1, 2011* | *November 1, 2013* | *(3)* |
| F | *CSO 018 Diversion Sewer* | *April 1, 2010* | *January 2, 2012* | *July 1, 2013* | *(3)* |
| G | *CSO 005 and 007 Diversion Sewer* | *April 1, 2010* | *January 2, 2012* | *July 1, 2013* | *(3)* |
| H | *Anacostia River Tunnel* | *November 1, 2011* | *November 1, 2013* | *March 23, 2018* | *March 23, 2018* |
| I | *Main Pumping Station Diversions* | *January 2, 2013* | *January 2, 2015* | *December 31, 2017* | *(3)* |
| J | *Northeast Boundary Tunnel* | *January 2, 2019* | *January 2, 2021* | *March 23, 2025* | *March 23, 2025* |
| K | *Northeast Boundary Branch Tunnels* | *January 2, 2016* | *March 23, 2018* | *July 1, 2022* | *(4)* |
| L | *Northeast Boundary Diversions* | *March 23, 2014* | *March 23, 2016* | *March 23, 2018* | *(4)* |
| M | *Mt. Olivet Road Diversions* | *January 2, 2017* | *January 2, 2019* | *December 31, 2020* | *(4)* |
| Y | *Blue Plains Tunnel Dewatering Pumping Station and Enhanced Clarification Facility (ECF)* | *April 1, 2013* | *July 1, 2015* | *December 31, 2017* | *(3)* |
| Z | *Poplar Point Pumping Station Replacement* | *March 23, 2012* | *March 23, 2015* | *March 23, 2018* | *March 23, 2018* |




Note:
1 See Table 3 for comparison of Facility Plan and Consent Decree Projects
2 Means that facilities included in contract can be placed in operation when a subsequent contract is placed in operation.
3 Will be placed in operation when Contract Division H is placed in operation.
4 Will be placed in operation when Contract Division J is placed in operation.

**Figure 7: Anacostia River Projects Detailed Facility Plan Contract Divisions Implementation Schedule**

# 6. Program Implementation

The Authority and its consultants have developed the Facility Plan and implementation schedule. This work has been frequently reviewed by the Authority's Project Review Board (PRB). The PRB is comprised of nine individuals with a high level of experience and expertise in planning, engineering, construction and management of projects of similar type and scope to those in the ARP program. The Project Review Board has endorsed the Facility Plan and contributed suggestions and recommendations for its implementation.

The following subsections describe findings to-date regarding issues and other factors associated with the implementation of the Anacostia River Projects together with discussion of various aspects that are pertinent to its successful and timely completion.

## Operational Plan and Hydraulic Design

The following criteria were selected by WASA for the operational plan and hydraulic design of the Anacostia River Projects.

- Comply with the LTCP Consent Decree, as modified to accommodate the Total Nitrogen Removal / Wet Weather (TN/WW) Plan.
- Reduce CSO overflows on the Anacostia River to the level identified in the approved LTCP: two CSO overflows and 54 million gallons (mg) of overflow per average year.
- Provide flood relief to the Northeast Boundary (NEB) Drainage Area up to a 6-hour 15-year design storm.
- Provide solids and floatables control for remaining overflows.
- Consolidate CSO's 016, 017 and 018 in the Anacostia Marina area such that all overflows are either stored in the tunnel or conveyed by the tunnel for overflow at another location.
- Configure the system to operate passively by gravity, without use of active operation gates or other such controls.
- Configure the system to prevent flooding of basements and flooding to grade. Where existing conditions in the collection system cause these conditions, arrange the tunnel system to improve hydraulic performance to the extent practicable.

The hydraulic design of the tunnels system was performed using the model prepared to develop the LTCP: the Danish Hydraulic Institute's MOUSE Model. The model was updated to reflect changes to the collection system since the development of the LTCP. The following summarizes key elements of the hydraulic design and operational plan:

- System operation: The tunnels system is designed to fill by gravity. If storms produce volumes that exceed the capacity of the system, the tunnels system has been configured to overflow to the receiving waters by gravity. The only facility that requires active operation during storms is the tunnel dewatering pumping station. The facilities that control diversions into and overflows from the tunnel typically comprise weirs, orifices and other static hydraulic controls.

- Extent of Northeast Boundary Flooding Protection: The tunnels system is designed to provide flooding protection to the Northeast Boundary area up to a 15-year, 6-hour design storm. It has been determined that most existing trunk and local street sewers in the drainage area do not have adequate capacity to convey the design storm. This is not unexpected since the sewers were constructed prior to the adoption of the 15-year storm as the bases for design. Since most of the existing sewers in the Northeast Boundary area do not have the capacity to convey the design storm, evaluations were made to determine the extent of flooding relief that would be provided by the ARP. These evaluations showed that it was cost prohibitive to bring all sewers in the Northeast Boundary area up to the 15-year design standard. Instead, the following design criteria were adopted for the program:
  - Provide flooding relief for the Northeast Boundary Trunk Sewer from it's outlet at CSO 019 to 1st Street NW
  - Provide relief to the following chronic flood areas and to the trunk sewers serving the areas listed below that are located between the Northeast Boundary Trunk Sewer and the flood areas:
    - Area 1 - Rhode Island Avenue N.E. between 4th and 6th Streets
    - Area 2 - West Virginia Avenue N.E. near Mt. Olivet Road
    - Area 3 - P Street and 1st Street N.W.
    - Area 5 - Rhode Island Avenue N.W., near 6th and R Streets
    - Area 6 – Thomas and Flagler Streets, NW
  - Size the tunnel and its appurtenances so they are large enough to accommodate future relief in the Northeast Boundary Area.

  These criteria will provide relief for the identified flooding in the drainage area up to the design storm. In addition, the tunnel is sized large enough to allow future relief of other sub-sewer sheds in the Northeast Boundary area if relief is required in other areas in the future.
- Storage Volume: The tunnels system is designed to provide 157 million gallons of storage at a tunnel fill elevation of -24.0 (DC DPW Datum).
- Tunnel Overflow Facilities: Tunnel overflow facilities have been sited at Bolling Air Force Base (BAFB) and at CSO 019 which serves the Northeast Boundary area. After the tunnel is full, the BAFB overflow facility will typically convey flow from CSOs 005, 007, 009, and 011 through 018, while the overflow facility at CS0 019 will provide relief for the Northeast Boundary area combined sewer flow and relief flow for the flood prone locations in the Northeast Boundary area.
- Tunnel Dewatering Pumping Station – In accordance with the TN/WW Plan, the facility will have an installed firm capacity of 225 mgd. To provide for future expansion, the facility will be designed to be expandable.
- Other Aspects: Analyses have been conducted during the facility planning regarding odor control, venting, hydraulic transients, access, isolation of the tunnel, monitoring and keeping the tunnel clean. These are described in detail in the Facility Plan document.

## Risk Management and Construction Planning

Underground construction for shafts and tunnels is a highly specialized field with inherent risks. Design and construction efforts and activities should, therefore, progress in concert with an appropriate risk management program. Section 8 of the Facility Plan discusses the risk management efforts accomplished to date and outlines a risk management program considered as part of facility planning efforts. Figure 8 below illustrates the relationship between the implementation elements of the projects and the risk management program as suggested in the Facility Plan.

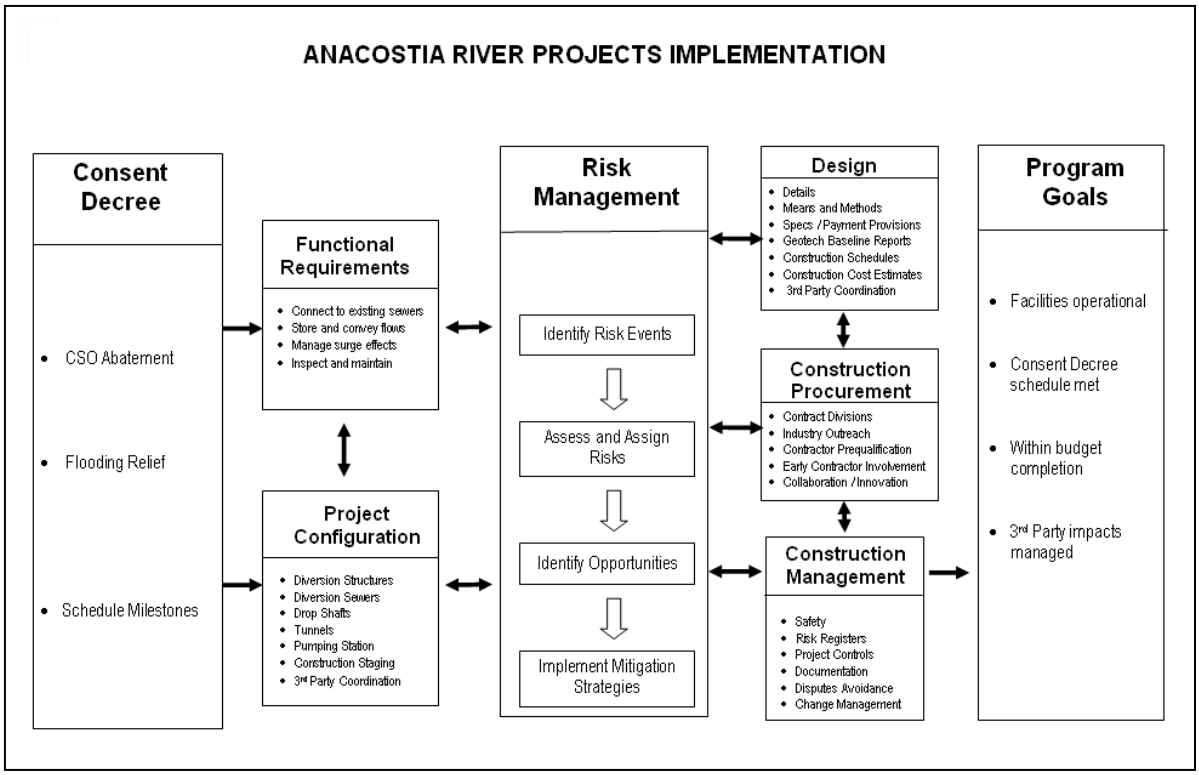



**Figure 8: Program Implementation and Risk Management**

The general risk management considerations diagrammed in Figure 8 will be evaluated further to develop a comprehensive approach in the future phases of the ARP implantation.

Additionally, the risk management program will need to include provisions to mitigate construction impacts on areas and neighborhoods during construction. Such provisions include by may not be limited to impacts to residences and businesses, traffic routes, noise, dust, utilities and other public concerns. The design and construction phases of the ARP program will, therefore, include outreach elements to accommodate public and institutional needs

## Geotechnical Investigations

Planning level geotechnical investigations have been made for the development of the Facility Plan. Most of these investigations have been completed, but some will continue through the end of 2008. Data from the latter investigations will be included in subsequent phases of project implementation. The geotechnical investigations have included research of existing information; geophysical surveys; borings by conventional rotary and sonic drilling methods; field instrumentation and testing programs; laboratory testing of recovered soil and rock samples; and groundwater monitoring. The Facility Plan includes a Preliminary Geotechnical Data Report as Appendix Volume III.

Figure 9 shows the locations of borings and geophysical surveys performed as part of the Facility Plan development. Figure 10 presents a general composite of the geological profile of the currently anticipated ground conditions along the tunnels alignments. Geotechnical investigations during design will provide more detailed information regarding the conditions which may be expected at specific shaft and structure locations as well as along the diversion sewers and tunnels alignments.

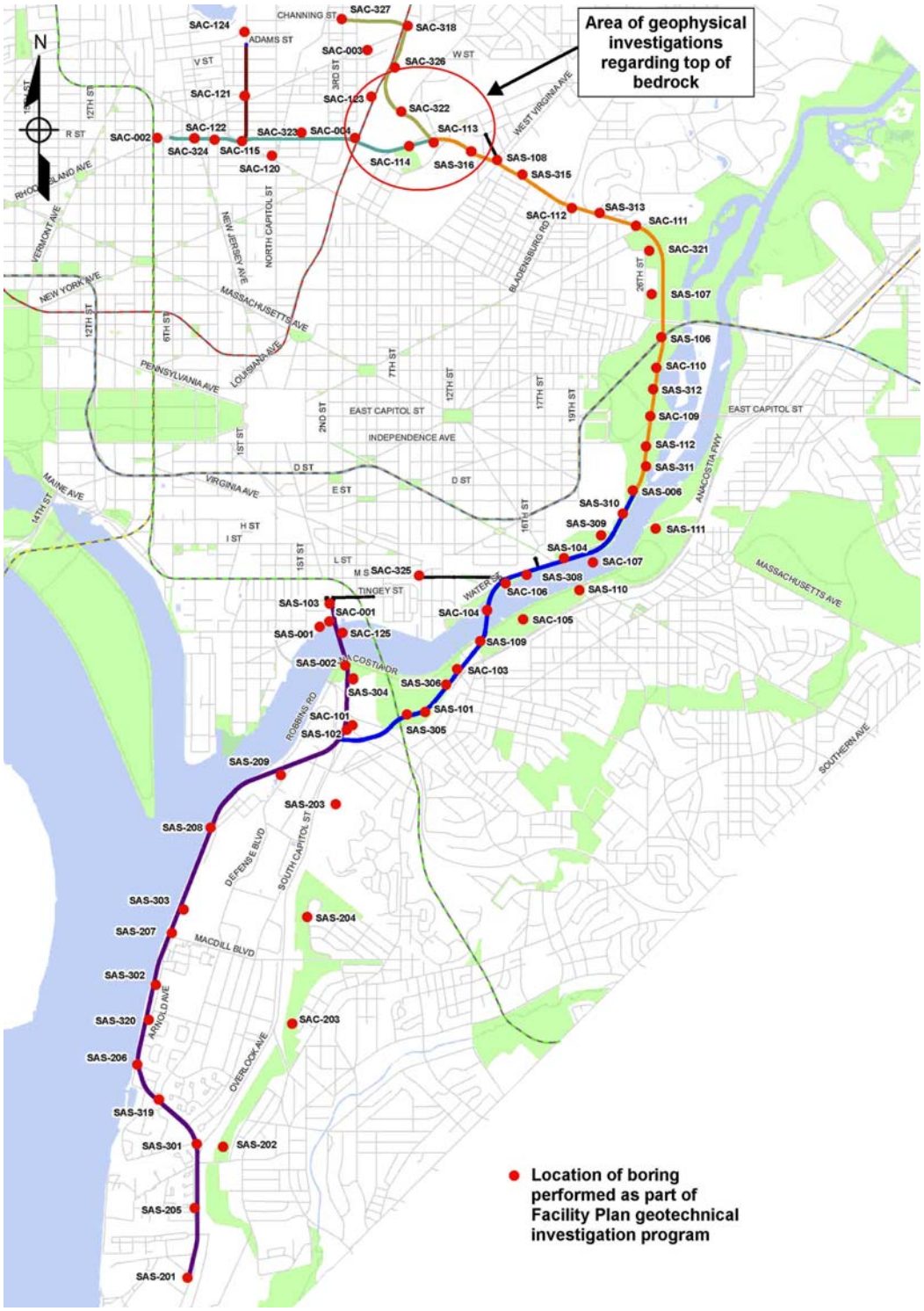



**Figure 9: Locations of Borings and Geophysical Survey**

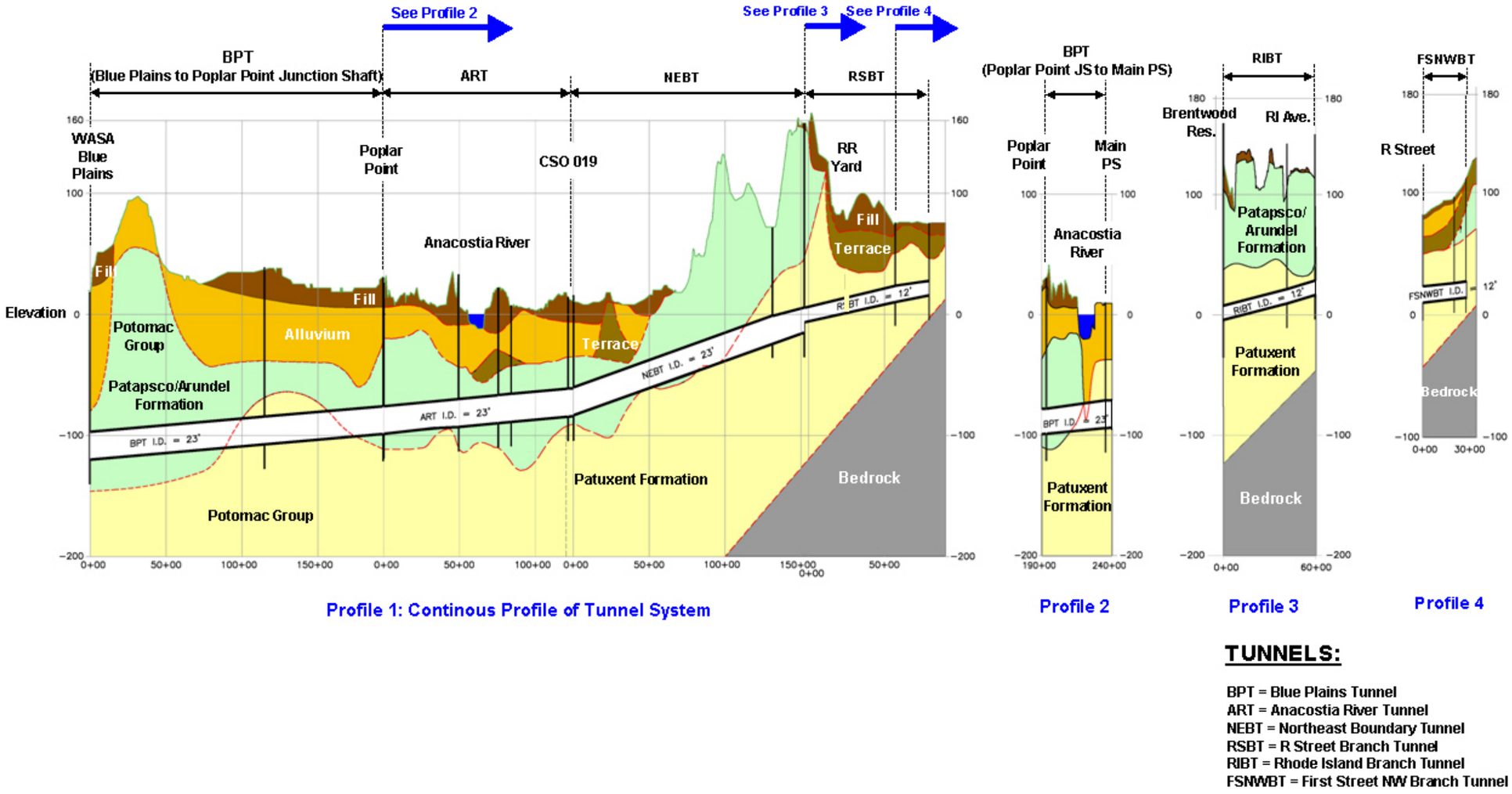



**Figure 10: Summary Geologic Profiles**

## Project Permitting

The Consent Decree includes requirements relative to acquisition of permits and approvals associated with the ARP. These requirements include identification of the permits required for the ARP as well as the timing for submittals applications. Table 4 identifies the agencies and organizations that will require some type of permit or approval for construction of the facilities defined for the project. The detailed implementation schedule shown on Figure 7 also includes a graphical summary of the permits process timeline.

The permitting agencies and organizations presented in Table 4 have been divided into the following categories:

- Utility agencies
- District of Columbia (D.C.) agencies
- Regional agencies
- Federal agencies, including applicable military commands
- Private organizations/property owners

The permit requirements vary among the different agencies. Section 11 of the Facility Plan identifies, to the extent identified as being applicable, all of the agencies that will have jurisdiction over the planned alignments, and appurtenant facilities sites, and it outlines the requirements and procedures for obtaining a permit from each respective agency. Section 14 of the Facility Plan provides additional information relative to those agencies and other entities that will require on-going coordination beyond the formal permitting process throughout the design and construction periods.

## Land Acquisition and Approvals

Section 12 of the Facility Plan provides a detailed listing of the property acquisitions, easements and agreements required for the project. The scope of the respective property acquisitions relative to the planned facilities and tunnels alignments are also shown on several figures included within Section 12. The evaluations of alternative tunnel alignments were based on locations that would minimize impacts on private property owners and establish the locations of tunnels corridors in public owned areas. Approximately 10 percent of the tunnels alignments and facilities defined in the Facility Plan are located on privately owned locations.

A summary of property owners identified on Figures 12-1 through 12-23 of the Facility Plan is presented in Table 5. More than 90 percent of the tunnels length is located below land owned by the United States Government and controlled by the military (Bolling Air Force Base and Anacostia Naval Annex) or the National Park Service, or below the public right-of-way. Various railroad companies, including CSX Railroad and WMATA own or control the land above approximately 6 percent of the tunnels length and private entities own the land above approximately 3 percent of the tunnels length.

**Table 4, Sheet 1 of 3**
**Project Permitting and Submittal Deadline Requirements**
**Based on Information Available During Facility Planning**

| Contract Division Designation and Major Components | Agency/Organization | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Utilities | | | | | DC Agencies | | | | | | | | | | Federal Agencies | | | | | | | | | Other Agencies/Private | | | |
| | Potomac Electric Power Company | | Washington Gas Company | Telephone (Comcast/Verizon) | DC Water and Sewer Authority | District Department of Transportation | DC Office of Planning | Department of Consumer & Regulatory Affairs | Department of Health / D.C. Fire & Emergency Medical Services | District Department of Environment | Navy Research Laboratory | Deputy Mayor for Planning and Economic Development | Various Advisory Neighborhood Commissions | DC Department of Public Works | DC Department of Parks & Recreation | National Mall and Memorial Parks | U.S. Army Corps of Engineers | Department of the Interior (Marinas) | National Park Service - East | Bolling AFB (DoD) or Department of the Air Force | U.S. Navy | National Arboretum | National Capitol Planning Commission | U.S. Coast Guard (Sector Baltimore) | Washington Metropolitan Area Transit Authority | CSX Corporation | Private Property Owners | U.S. Postal Service |
| | Request for New Service | Utility Relocation Review | Utility Relocation Request | Utility Relocation Request | Construction Site Permit | Maintenance of Traffic Schemes | Document Review | Public Space Application/PSMA-WOSE/Others | Tunnel Ventilation/Other Permit Approvals through DCRA & DDOT | ESC/SMP/NPDES | Property Access | Site Acquisition | Letter Notification | Site Layout Permit | Tree Protection Permit | RFK Stadium Access | 404 Permit (s) | Document Review | Site Acquisition /Document Review | Document Review/Site Access Permit | Document Review/Site Access Permit | Document Review | Document Review | River Crossing | Real Estate Application | Document Review/Right of Entry Permit | Letter of Notification | Document Review |
| A<br>BPT, BPTDS, BAFB-DS, PP-JS (excavation & support), MPS-DS, MOS-DC, and approach channel | At 30% design | At 30% design | — | — | 2 mo. prior to 60% design | At 60% design | At NTP design | 3 mo. prior to 60% design | At 30% design | 3 mo. prior to 60% design | At NTP for design | At NTP for design | At 30% design | At 30% design | — | — | 2 mo. Prior to 30% | — | 2 mo. prior to 30% design | At NTP design | At NTP design | — | 3 mo. prior to 60% design | At NTP design | — | — | — | — |
| B<br>CSO 013-DC, CSO 014-DC and microtunnel | At 60% design | At 30% design | 2 mo. prior to 60% design | At 30% design | 2 mo. prior to 60% design | At 60% design | At NTP design | 3 mo. prior to 60% design | — | 3 mo. prior to 60% design | — | At NTP for design | At 30% design | At 30% design | — | — | — | — | — | — | — | — | 3 mo. prior to 60% design | — | — | — | — | — |
| C<br>CSO 019-S, CSO 019-N, CSO 019-JC-2 and approach channel | At 60% design | At 30% design | 2 mo. prior to 60% design | — | 2 mo. prior to 60% design | At 60% design | At NTP design | 3 mo. prior to 60% design | — | 3 mo. prior to 60% design | — | At NTP for design | At 30% design | At 30% design | 2 mo. prior to const. NTP | At 30% design | — | — | 2 mo. prior to 30% design | — | — | — | 3 mo. prior to 60% design | — | — | — | — | — |
| D<br>BAFB-OF, BPOS-DC and approach channel | At 60% design | At 30% design | 2 mo. prior to 60% design | At 30% design | 30% design | At 60% design | At NTP design | 3 mo. prior to 60% design | — | 3 mo. prior to 60% design | — | — | At 30% design | At 30% design | 2 mo. prior to const. NTP | — | At 30% design | — | 2 mo. prior to 30% design | At NTP design | — | — | 3 mo. prior to 60% design | At NTP design | — | — | — | — |
| E<br>CSO 015-DC, CSO 016-DC, CSO 017-DC, microtunnel and approach channel | At 60% design | At 30% design | 2 mo. prior to 60% design | At 30% design | 2 mo. prior to 60% design | At 60% design | At NTP design | 3 mo. prior to 60% design | — | 3 mo. prior to 60% design | — | At NTP for design | At 30% design | At 30% design | 2 mo. prior to const. NTP | — | — | At 30% design | — | — | — | — | 3 mo. prior to 60% design | — | — | — | — | — |

**Table 4, Sheet 2 of 3**
**Project Permitting and Submittal Deadline Requirements**
**Based on Information Available During Facility Planning**

| Contract Division Designation and Major Components | Agency/Organization | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Utilities | | | | | DC Agencies | | | | | | | | | | Federal Agencies | | | | | | | | | Other Agencies/Private | | | |
| | Potomac Electric Power Company | | Washington Gas Company | Telephone (Comcast/Verizon) | DC Water and Sewer Authority | District Department of Transportation | DC Office of Planning | Department of Consumer & Regulatory Affairs | Department of Health / D.C. Fire & Emergency Medical Services | District Department of Environment | Navy Research Laboratory | Deputy Mayor for Planning and Economic Development | Various Advisory Neighborhood Commissions | DC Department of Public Works | DC Department of Parks & Recreation | National Mall and Memorial Parks | U.S. Army Corps of Engineers | Department of the Interior (Marinas) | National Park Service - East | Bolling AFB (DoD) or Department of the Air Force | U.S. Navy | National Arboretum | National Capitol Planning Commission | U.S. Coast Guard (Sector Baltimore) | Washington Metropolitan Area Transit Authority | CSX Corporation | Private Property Owners | U.S. Postal Service |
| | Request for New Service | Utility Relocation Review | Utility Relocation Request | Utility Relocation Request | Construction Site Permit | Maintenance of Traffic Schemes | Document Review | Public Space Application/PSMA-WOSE/Others | Tunnel Ventilation/Other Permit Approvals through DCRA & DDOT | ESC/SMP/NPDES | Property Access | Site Acquisition | Letter Notification | Site Layout Permit | Tree Protection Permit | RFK Stadium Access | 404 Permit (s) | Document Review | Site Acquisition /Document Review | Document Review/Site Access Permit | Document Review/Site Access Permit | Document Review | Document Review | River Crossing | Real Estate Application | Document Review/Right of Entry Permit | Letter of Notification | Document Review |
| A<br>BPT, BPTDS, BAFB-DS, PP-JS (excavation & support), MPS-DS, MOS-DC, and approach channel | At 30% design | At 30% design | — | — | 2 mo. prior to 60% design | At 60% design | At NTP design | 3 mo. prior to 60% design | At 30% design | 3 mo. prior to 60% design | At NTP for design | At NTP for design | At 30% design | At 30% design | — | — | 2 mo. Prior to 30% | — | 2 mo. prior to 30% design | At NTP design | At NTP design | — | 3 mo. prior to 60% design | At NTP design | — | — | — | — |
| B<br>CSO 013-DC, CSO 014-DC and microtunnel | At 60% design | At 30% design | 2 mo. prior to 60% design | At 30% design | 2 mo. prior to 60% design | At 60% design | At NTP design | 3 mo. prior to 60% design | — | 3 mo. prior to 60% design | — | At NTP for design | At 30% design | At 30% design | — | — | — | — | — | — | — | — | 3 mo. prior to 60% design | — | — | — | — | — |
| C<br>CSO 019-S, CSO 019-N, CSO 019-JC-2 and approach channel | At 60% design | At 30% design | 2 mo. prior to 60% design | — | 2 mo. prior to 60% design | At 60% design | At NTP design | 3 mo. prior to 60% design | — | 3 mo. prior to 60% design | — | At NTP for design | At 30% design | At 30% design | 2 mo. prior to const. NTP | At 30% design | — | — | 2 mo. prior to 30% design | — | — | — | 3 mo. prior to 60% design | — | — | — | — | — |
| D<br>BAFB-OF, BPOS-DC and approach channel | At 60% design | At 30% design | 2 mo. prior to 60% design | At 30% design | 30% design | At 60% design | At NTP design | 3 mo. prior to 60% design | — | 3 mo. prior to 60% design | — | — | At 30% design | At 30% design | 2 mo. prior to const. NTP | — | At 30% design | — | 2 mo. prior to 30% design | At NTP design | — | — | 3 mo. prior to 60% design | At NTP design | — | — | — | — |
| E<br>CSO 015-DC, CSO 016-DC, CSO 017-DC, microtunnel and approach channel | At 60% design | At 30% design | 2 mo. prior to 60% design | At 30% design | 2 mo. prior to 60% design | At 60% design | At NTP design | 3 mo. prior to 60% design | — | 3 mo. prior to 60% design | — | At NTP for design | At 30% design | At 30% design | 2 mo. prior to const. NTP | — | — | At 30% design | — | — | — | — | 3 mo. prior to 60% design | — | — | — | — | — |

**Table 4, Sheet 3 of 3**
**Project Permitting and Submittal Deadline Requirements**
**Based on Information Available During Facility Planning**

| Contract Division Designation and Major Components | Agency/Organization | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Utilities | | | | | DC Agencies | | | | | | | | | | Federal Agencies | | | | | | | | | Other Agencies/Private | | | |
| | Potomac Electric Power Company | | Washington Gas Company | Telephone (Comcast/Verizon) | DC Water and Sewer Authority | District Department of Transportation | DC Office of Planning | Department of Consumer & Regulatory Affairs | Department of Health / D.C. Fire & Emergency Medical Services | District Department of Environment | Navy Research Laboratory | Deputy Mayor for Planning and Economic Development | Various Advisory Neighborhood Commissions | DC Department of Public Works | DC Department of Parks & Recreation | National Mall and Memorial Parks | U.S. Army Corps of Engineers | Department of the Interior (Marinas) | National Park Service - East | Bolling AFB (DoD) or Department of the Air Force | U.S. Navy | National Arboretum | National Capitol Planning Commission | U.S. Coast Guard (Sector Baltimore) | Washington Metropolitan Area Transit Authority | CSX Corporation | Private Property Owners | U.S. Postal Service |
| | Request for New Service | Utility Relocation Review | Utility Relocation Request | Utility Relocation Request | Construction Site Permit | Maintenance of Traffic Schemes | Document Review | Public Space Application/PSMA-WOSE/Others | Tunnel Ventilation/Other Permit Approvals through DCRA & DDOT | ESC/SMP/NPDES | Property Access | Site Acquisition | Letter Notification | Site Layout Permit | Tree Protection Permit | RFK Stadium Access | 404 Permit (s) | Document Review | Site Acquisition /Document Review | Document Review/Site Access Permit | Document Review/Site Access Permit | Document Review | Document Review | River Crossing | Real Estate Application | Document Review/Right of Entry Permit | Letter of Notification | Document Review |
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| B<br>CSO 013-DC, CSO 014-DC and microtunnel | At 60% design | At 30% design | 2 mo. prior to 60% design | At 30% design | 2 mo. prior to 60% design | At 60% design | At NTP design | 3 mo. prior to 60% design | — | 3 mo. prior to 60% design | — | At NTP for design | At 30% design | At 30% design | — | — | — | — | — | — | — | — | 3 mo. prior to 60% design | — | — | — | — | — |
| C<br>CSO 019-S, CSO 019-N, CSO 019-JC-2 and approach channel | At 60% design | At 30% design | 2 mo. prior to 60% design | — | 2 mo. prior to 60% design | At 60% design | At NTP design | 3 mo. prior to 60% design | — | 3 mo. prior to 60% design | — | At NTP for design | At 30% design | At 30% design | 2 mo. prior to const. NTP | At 30% design | — | — | 2 mo. prior to 30% design | — | — | — | 3 mo. prior to 60% design | — | — | — | — | — |
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**Table 5**
**Summary of Property Owners along the Proposed Tunnels System Alignments**

| Property Owners | Approximate Length of Tunnel (Ft) | % of Total Length |
|---|---|---|
| Public Right-of-Way | 20,775 | 32.9% |
| National Park Service (USA) | 18,260 | 28.9% |
| Military (BAFB and Navy) | 15,390 | 24.4% |
| Railroad Entities | 4,025 | 6.4% |
| US Army Corps of Engineers (USA) | 2,300 | 3.6% |
| Private Property | 1,915 | 3.0% |
| USA (other) | 1,725 | 2.7% |
| National Arboretum (USDA) | 1,660 | 2.6% |
| District of Columbia | 1,370 | 2.2% |
| WASA controlled (owned by DC and/or USA) | 510 | 0.8% |
| PEPCO | 105 | 0.2% |
| **Total** | **68,035** | **100%** |

# Public Notification

A visual CSO notification system has been installed and is in operation on the Anacostia River as shown on Figure 11. Under the Consent Decree, at least three additional systems are required. Because extensive redevelopment planning and new bridge construction planning is underway all along the Anacostia River in the area of all the CSO outfalls, it is not practicable, at this time, to finalize the details of the public notification system. For example, some of the redevelopment plans are considering new public access to the river, but the locations and other details are only conceptual. In view of the circumstance associated with the redevelopment and bridge construction, the Authority proposes to include the visual notification systems under Contract Division H, Anacostia River Tunnel, which is scheduled for award of design by November 1, 2011.

**Figure 11: CSO Warning Lights on Anacostia River**

## Other ARP Implementation Factors

The ARP have been developed at this stage to a level sufficient to proceed to detailed design and construction. However, uncertainties remain, and these uncertainties could impact the design and schedule of the facilities included in the Facility Plan. In addition to uncertainties discussed under project setting, risk management and construction planning, geotechnical information, permitting and land acquisition, there are those criteria, standards, regulations, laws, guidelines and assumptions upon which the ARP and schedule are based. The following list includes, but may not be limited to, factors for which changes from the bases upon which the Facility Plan has been prepared, could require changes to the ARP and the implementation schedule:

- Those items listed in subsection 13.7 of the LTCP, Final Report, July 2002
- EPA's approval and approval conditions of the Authority's Blue Plains Total Nitrogen Removal/Wet Weather Plan, LTCP Supplement No. 1, Final, October 2007
- The terms and conditions related to nitrogen removal and the combined sewer system in the proposed and final reissued NPDES permit for Blue Plains
- The terms and conditions in a modified Consent Decree necessary to incorporate LTCP Supplement No. 1 and the Facility Plan
- Actions, decision, conditions and delays created, caused or contributed by third parties that impact the design and schedule bases of the ARP included in the Facility Plan. Third parties include, but may not be limited to, the parties to the Consent Decree, other than the Authority, and all their branches, departments and agencies; utility agencies, transportation agencies, the affected public, special interest groups, suppliers, and contractors.

# APPENDIX E

DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY

DC CLEAN RIVERS PROJECT

# APPENDIX E

# SUMMARY OF GREEN/GRAY AND GREEN CONTROLS FOR THE POTOMAC AND ROCK CREEK SEWERSHEDS

December 2014

Prepared for:

Prepared by:

Program Consultants Organization
Blue Plains Advanced Wastewater Treatment Plant
5000 Overlook Avenue, SW
Washington, DC 20032

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# Table of Contents



# List of Tables



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# 1 Introduction

## 1.1 Purpose

The District of Columbia Water and Sewer Authority (DC Water) is implementing a Long Term Control Plan (LTCP or DC Clean Rivers Project, DCCR) to control combined sewer overflows (CSOs) to the District's waterways. The DCCR is comprised of a variety of projects including pumping station rehabilitations, targeted sewer separation, green infrastructure (GI) at DC Water facilities and a system of underground storage/conveyance tunnels to control CSOs. The DCCR is being implemented in accordance with a Consent Decree (LTCP Decree) signed by DC Water, the District, and the U.S Government, that specifies the schedule for implementation. Projects on the Anacostia River are first in the schedule and DC Water is implementing those projects in accordance with the Decree.

Unlike single-purpose gray infrastructure which uses tanks, tunnels and pipes to store and convey CSO, GI uses vegetation and soil to manage stormwater where it falls. GI has the ability to reduce stormwater and CSOs, and provide multiple environmental, social and economic benefits. Examples of these benefits include improved air quality, reduced heat island effects, improved property values and creation of local jobs. In addition, GI consists of many small projects which can be brought on line as soon as individual projects are completed. In contrast, gray CSO projects can typically only be brought on line when all the elements are completed. Because of this, GI projects can provide earlier CSO reduction than all-gray projects.

Based on an assessment of the sewersheds, DC Water is proposing hybrid CSO controls for the Potomac and Rock Creek as follows:

- In Rock Creek, construct GI instead of the Piney Branch tunnel to control the Piney Branch CSO
- On the Potomac, construct a hybrid green and gray control system for the Potomac River CSOs

This document provides a summary of the green/gray and green controls for the Potomac and Rock Creek sewersheds.

DC Water has public noticed a detailed summary of the analysis supporting the green and green/gray controls in the following document: *Long Term Control Plan Modification for Green Infrastructure*, January 2014, DC Water.

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# 2 Collection System Modeling

This section describes the use of DC Water's hydrologic and hydraulic model to predict sewer system response to the proposed green and green/gray CSO controls. This section presents a brief background on the models employed followed by discussions of the model development and the model application.

## 2.1 Background

Hydrologic and hydraulic models are computer simulation tools used by planners and engineers to evaluate rainfall and runoff relationships in urban areas. The hydrologic model simulates the major components of the hydrologic cycle; that is, the physical processes of rainfall, evapotranspiration, storage, and runoff. The response of urban neighborhoods to rainfall is determined by the relative degree of imperviousness of surface features (e.g., rooftops, parking lots, roads, etc.) and the infiltration capabilities of the soils. The hydraulic model simulates the movement of runoff and sewer flows through the below-ground network of pipes and other infrastructure that make up the sewer system. Flow through the sewer system is determined by the capacity of pipes, pumps, and other hydraulic control structures, and by backwater conditions.

Hydrologic and hydraulic models are calibrated based on observed rainfall and flow data. The model parameters (e.g., infiltration rate, slope, roughness coefficient, etc.) are adjusted in calibration to an optimal point where the ability of the model to simulate the volume and timing of runoff events is maximized. Independent validation of models is done by gauging the ability of the model to simulate a separate group of rainfall/runoff events without adjustment of the model parameters. Model calibration and validation provide confidence in the ability of the models to "predict" the response of the system under a variety of conditions. This is particularly true when the calibration and validation data sets include a wide variety of rainfall and flow conditions.

Identifying a dataset that represents average rainfall conditions for use in the hydrologic model is a fundamental first step in model development. As part of the evaluation of the original LTCP, DC Water analyzed over 50 years of hourly rainfall data at Ronald Reagan National Airport to identify an average rainfall period. The years from 1988 to 1990 were selected as the average rainfall period. This period was chosen because annual precipitation from these three years represent dryer conditions, wetter conditions, and average conditions compared to the long term average for the District. Table 2-1 compares the rainfall for these three years to the long term average.

**Table 2-1. Annual Average Rainfall Conditions in the District**

| Statistic | 1988 | 1989 | 1990 | 1988-1990 Avg | Long Term Avg[1] |
|---|---|---|---|---|---|
| Annual Rainfall (inches) | 31.74 | 50.32 | 40.84 | 40.97 | 38.95 |
| No. Events > 0.05 inches[2] | 61 | 79 | 74 | 71 | 74 |
| Average Storm Duration (hours)[2] | 9.6 | 11.2 | 9.6 | 10.1 | 9.9 |
| Average Maximum Intensity (in/hr) | 0.15 | 0.18 | 0.15 | 0.16 | 0.15 |
| Maximum Intensity (in/hr) | 1.32 | 1.31 | 1.25 | 1.29 | 1.30 |
| Percentile[3] | 14th | 90th | 68th | 68th | -- |

Notes: 1. Ronald Reagan National Airport hourly data, 1949-1998

2. Individual events separated by a minimum of 6 hours with no rain.

3. Percentile is based on total annual rainfall.

DC Water has used the MIKE URBAN Model and its predecessor (the MOUSE Model) for all of its hydrologic and hydraulic analyses dating back to 1998. Both models are products of DHI, formerly the Danish Hydraulic Institute (www.dhigroup.com).The models were applied to support a wide range of projects and studies including development of the original LTCP for the combined sewer system (CSS). The MOUSE Model incorporating both hydrologic and hydraulic modeling capabilities was selected by DC Water in 1998 to support development of the LTCP. MOUSE was chosen at the time because it had the capability to directly simulate Real Time Control (RTC) operations, a feature that was not then available in the widely-used Storm Water Management Model (SWMM).

During model development, sewersheds for both the CSS and the municipal separate storm sewer system (MS4) in the District were delineated based on sewer maps and topography. Hydrology parameters in the hydrologic model (e.g., pervious vs. impervious, infiltration, etc.) were based on available soil, land use, and zoning maps. Hydraulic controls (e.g., regulators, pump stations, outfalls, inflatable dams, etc.) were based on drawings, pump curves, operations documents, and other studies.

Model calibration and validation was based on rainfall and flow records in the CSS collected during 1999-2000. This included 24 rainfall events for model calibration and another 20 rainfall events for model validation. Several rain gages in the District and observed rainfall at DC National Airport were used to drive the hydrologic model. The hydrologic model was calibrated ahead of the hydraulic model. Overall, the emphasis of calibration and validation was placed on developing a mass balance of flow at Blue Plains, and a reasonable representation of the frequency and volume of CSO discharges.

Since the original model was developed to support the LTCP, a number of software upgrades and model improvements have been made. DHI upgraded the MOUSE model engine to the current incarnation of MIKE URBAN in 2003. The upgrade to MIKE URBAN improved the model application in several ways. It was able to be applied in a continuous simulation mode, a very important consideration where long multiple year simulations are required. MIKE URBAN also included GIS-based software. This made it easier to use GIS data sets for impervious surfaces (e.g., roads, sidewalks, parking lots, etc.) and soils more spatially and directly. In addition, DC Water had

its sewer maps (i.e., counter maps) digitized and developed as a geodatabase that could be directly linked to MIKE URBAN. The result of this update was a much improved representation of surface conditions across the CSS in the hydrologic model. In addition, the pipe network in the hydraulic model was based on better information on pipe slopes, diameters, roughness, and other relevant characteristics. New and more robust flow data from suburban jurisdictions and from the District's separate sewer system were also integrated into the model boundary conditions. Figures 2-1 and 2-2 provide a visual representation of the model elements and the land cover for Potomac and Piney Branch sewersheds, respectively.

MIKE URBAN was recalibrated during the period 2005-2006 based on metered flow data for the collection system and Blue Plains. This flow data was supplemented with point rainfall data at National Airport and other District of Columbia stations, with radar rainfall estimates on a square kilometer basis available for some key rainfall events.

Since this recalibration, the MIKE URBAN model has continued to be employed in a number of capacities for DC Water. The model has been used for emergency operations planning, Inter Municipal Agreement (IMA) negotiations, multi-jurisdictional use facilities planning and cost allocation, the Anacostia Facilities Plan, the updated LTCP/Total Nitrogen-Wet Weather Plan, the Federal Triangle and other flood studies, and quarterly NPDES reporting of CSO estimates.

For DC Water's analysis of green infrastructure potential, a suite of modeling software packages (including MIKE URBAN and SWMM5) was evaluated to identify the best modeling tool to utilize. The results of this evaluation are presented in Technical Memorandum No. 2, Approach to Hydrologic and Hydraulic Modeling. This evaluation resulted in the selection of EPA's SWMM5 runoff application to perform the hydrologic evaluation and paired with the existing MIKE URBAN hydraulic model. EPA SWMM5 features options for explicit characterization and simulation of specific GI practices that the MIKE URBAN hydrologic model does not.

# Collection System Modeling

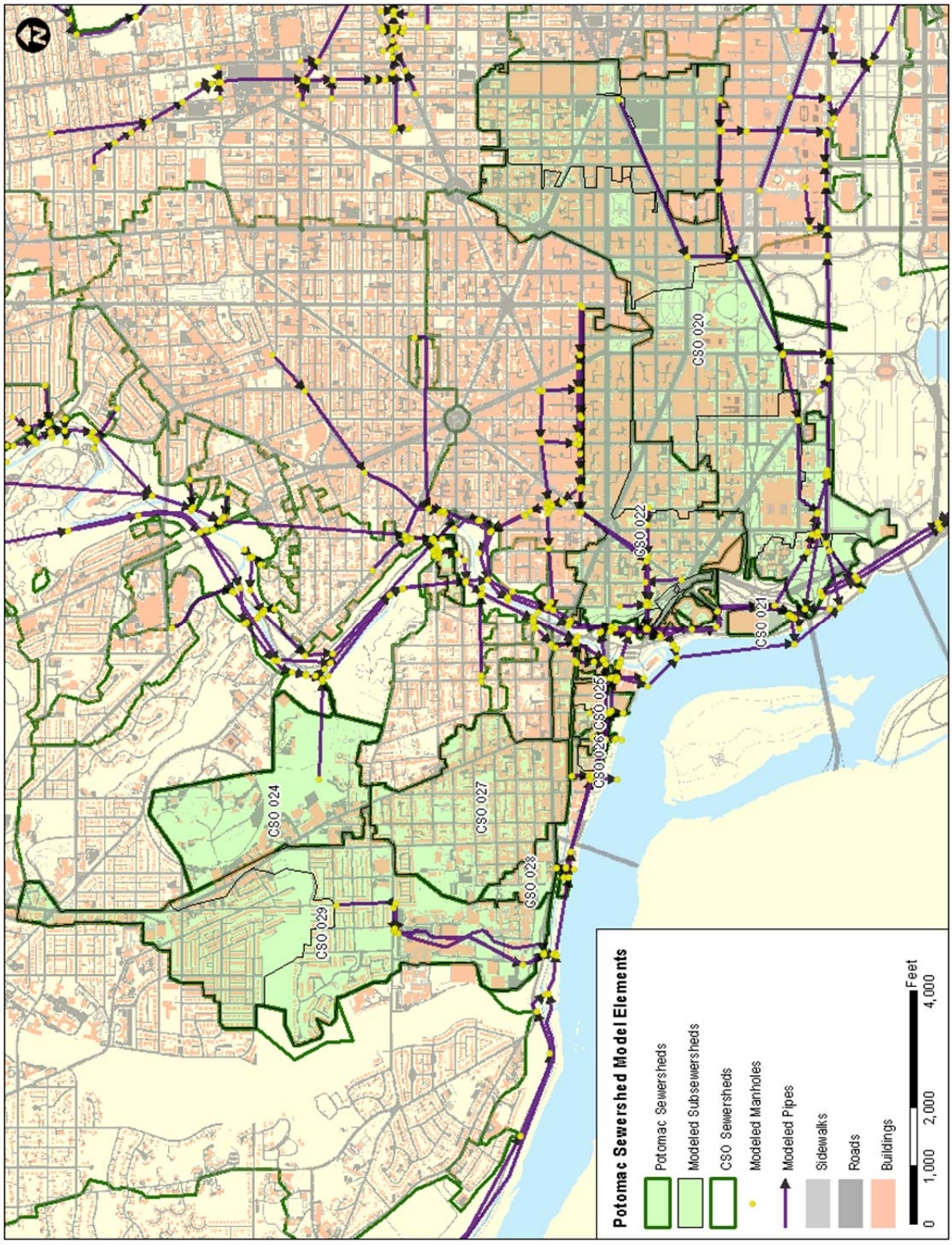


**Figure 2-1. Potomac Sewershed Model Elements**

# Collection System Modeling

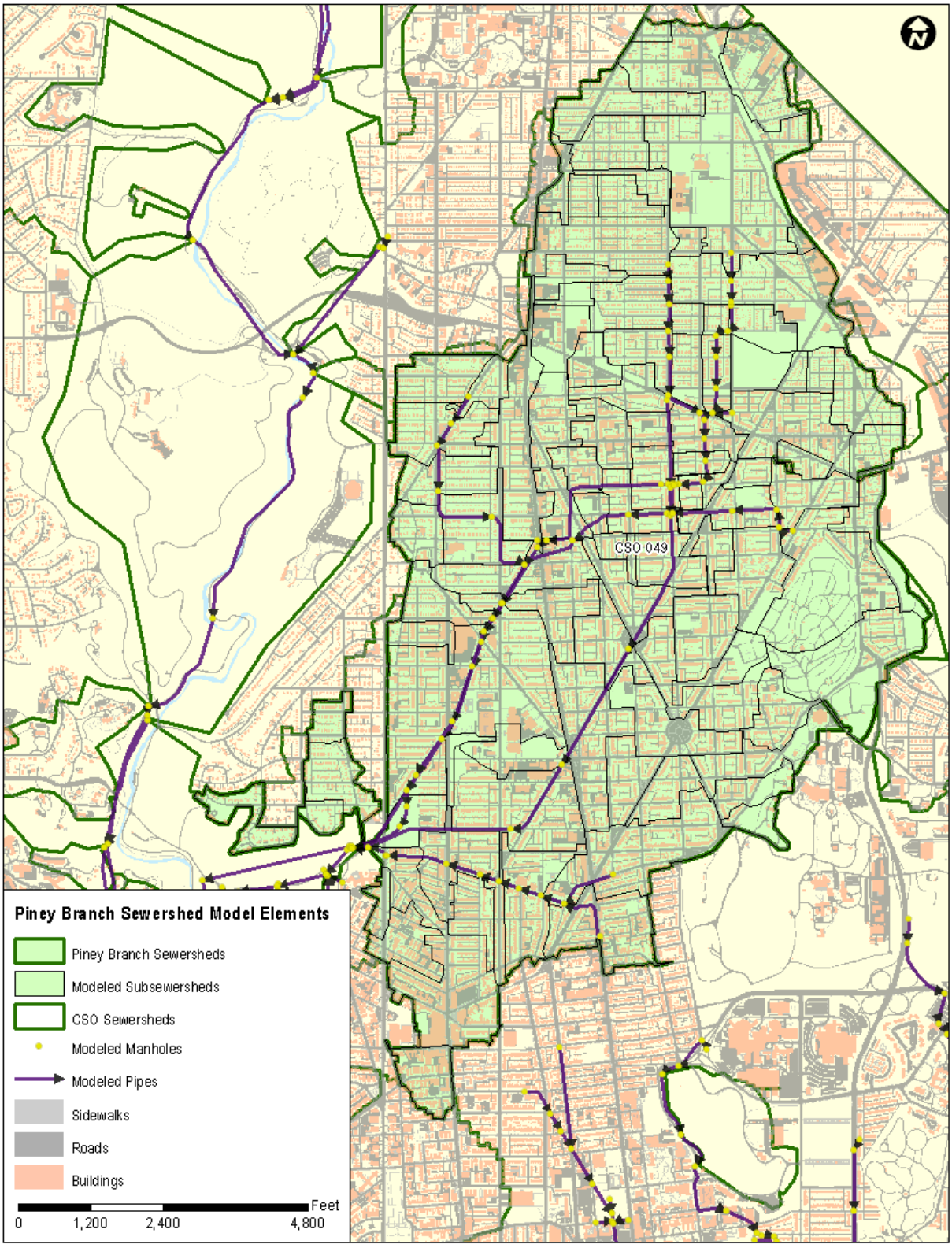


**Figure 2-2. Piney Branch Sewershed Model Elements**

## 2.2 Model Development

For this GI screening analysis, the SWMM5 hydrologic model was used for runoff simulation and the existing hydraulic portion of the MIKE URBAN model was used to model flow through the collection system. The SWMM5 runoff model was developed based on the runoff portion of the MIKE URBAN model as described below, and results were compared to the MIKE URBAN model to ensure consistency with previous model runs.

Historically, the purpose of the MIKE URBAN model was to predict combined sewer volumes and overflows entering receiving waters from the DC Water combined sewer service area. Developing a model for GI simulation requires finer subsewershed, pipe, and manhole resolution than previously existed in the MIKE URBAN runoff model. To accommodate this, the Piney Branch sewershed was redelineated to a higher resolution of 101 geographically separate model subsewersheds. Potomac model subsewersheds were deemed to be of sufficient resolution that finer delineations were unnecessary. There are 138 modeled subsewersheds throughout the Piney Branch and Potomac sewersheds with a median area of 19 acres. Ninety percent (90%) of the modeled subsewersheds are less than 140 acres.

Existing runoff parameters from MIKE URBAN were converted to SWMM5 runoff parameters. Parameters were copied when the exact analog to the MIKE URBAN parameter existed in SWMM5. Other parameters were converted to match as closely to the parameters in MIKE URBAN and then checked for consistency. Horton infiltration parameters were updated based on NRCS SSURGO soil data for the model area.

In order to effectively model water loss within GI practices, evapotranspiration (ET) was refined so that it could be applied to GI practices and the model in general. In MIKE URBAN, ET was applied only to water in storage, which was a representation of green infrastructure practice storage. SWMM5 does not have an option to apply ET solely to a practice; instead it is applied to the model as a whole. ET for SWMM5 was based on daily temperatures and climate at the Ronald Reagan Washington National Airport using a modified Thornwaite approach. Of the several accepted methods that could be used to approximate ET, this approach provided results most similar to the MIKE URBAN runoff model.

The models were run for the 1988-1990 period for validation. Time series output from both SWMM5 and MIKE URBAN runoff models was used as an input to the MIKE URBAN hydraulic model. Several metrics were used to compare the two models and insure the SWMM5 model was consistent with the MIKE URBAN runoff model including runoff volume, overflow volume, and frequency of CSO overflows.

## 2.3 Model Application

GI practices are represented in SWMM5 as "LID controls" (Low Impact Development). LID controls were used in the model for the Piney Branch and Potomac River areas of the combined sewer area. SWMM5 is a lumped parameter model that assumes uniformity across a single modeled sewershed. This means that LID controls were designed to represent the total of all GI practices contained within the modeled sewershed instead of representing each GI practice separately. This is common practice in a lumped parameter model.

GI practices are grouped into the four following LID control categories based on their general design and purpose:

- Rain Barrels
- Cisterns
- Bioretention
- Porous Pavement

Each type of LID control treats runoff from a specific area and drainage areas do not overlap. In SWMM5, each of the contributing areas to the four types of LID control is simulated as a separate subcatchment. Each type of impervious cover exists throughout the Potomac and Rock Creek sewersheds leading to a generally uniform distribution of LID controls. The modeling analysis focused on aggregate area of each impervious cover type without regard to public or private ownership. For scenarios that examine a high level of GI control, it is possible that opportunities for private GI implementation could be limited. In these cases, it is assumed that opportunities exist on public-owned property to compensate for the lack of opportunity on private property, and runoff passes through public property before entering the collection system.

In SWMM5, runoff from the surface to be treated by an LID control is routed to the control before entering the hydraulic model (MIKE URBAN). For example, if the scenario calls for 30% GI treatment, 30% of the contributing area from the variety of types of impervious surfaces is routed to LID controls identified for the specific type of impervious surface. Runoff not entering a LID control flows directly to the hydraulic model. Figure 2-3 shows the modeling framework used by SWMM5 to route flow to LID controls.

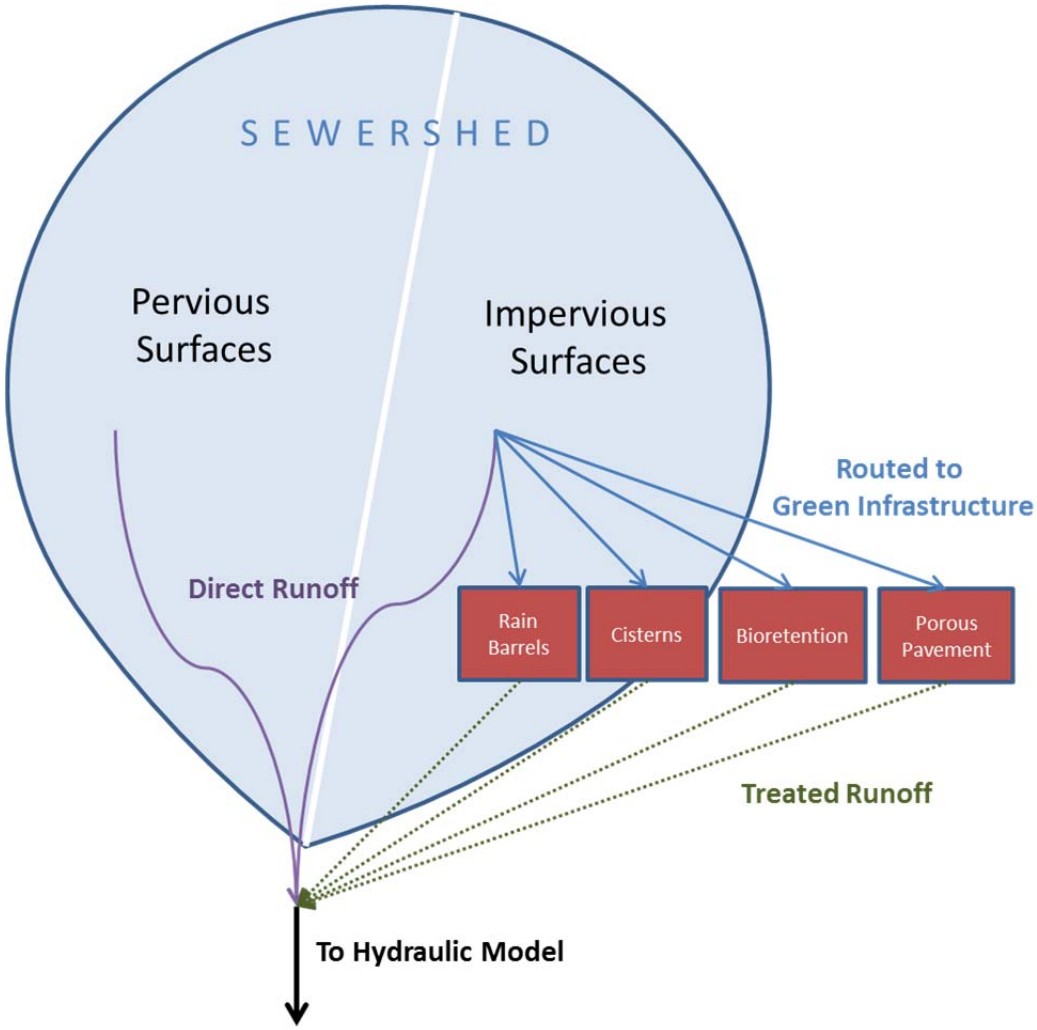


**Figure 2-3: SWMM5 LID Control Routing**

SWMM5 represents LID controls as shown in Figure 2-4. All LID controls use the same framework, with runoff entering the LID through the surface layer and passing to other layers or out of the LID practice through ET, overflow, underdrain, or infiltration based on parameters defined for each LID practice.

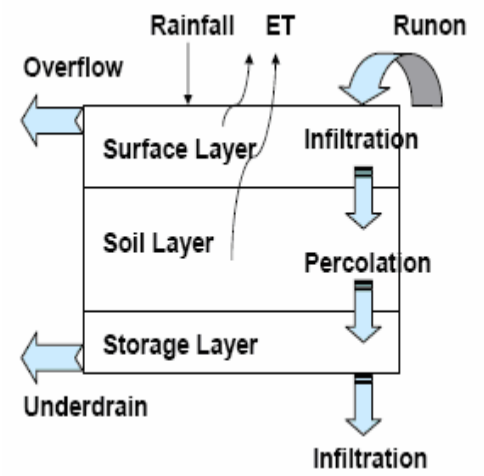


**Figure 2-4. SWMM5 LID Control Representation**

Each LID control is sized to completely contain the runoff volume produced from a 1.2 inch storm over the area treated. Other LID control parameters are determined based on accepted literature values for the types of LID controls and design guidelines used in the Concept Plan (see Technical Memorandum No. 3). Table 2-2 shows the LID control parameters used in the SWMM5 runoff model. Bioretention cell and porous pavement parameters for infiltration and underdrains varied due to site-specific soil conditions and infiltration potential across the modeled area.

Infiltration from each of the LID controls into the underlying soil is assumed to occur at a rate equal to the Horton method minimum infiltration rate for the subsewershed within which it is contained. This is a conservative assumption and accounts for probable soil compaction under the LID control.

Each LID control has a simulated underdrain. The underdrain diameter and height from the bottom of the control are optimized to allow the control to drain or infiltrate within 48 hours of the end of the storm and allow the water surface elevation in the control to remain below the surface of the practice. Rain barrels and cisterns do not have infiltration and the underdrains are simulated at the bottom of the control. Underdrain outflow from rain barrels is assumed to drain to the surface of the subshed where the rain barrel is located. Underdrain outflow from the other practices is assumed to flow directly into the collection system.

**Table 2-2. SWMM5 LID Practice Parameters**

| Parameter | Units | Rain Barrel | Cistern | Bioretention Cell | Porous Pavement |
|---|---|---|---|---|---|
| **Surface** | | | | | |
| **Storage depth** | in | | | 6 | 0.1 |
| **Surface slope** | % | | | 0 | 1.9 |
| **Soil/Pavement** | | | | | |
| **Thickness** | in | | | 24 | 6 |
| **Porosity** | frac | | | 0.3 | 0.2 |
| **Field Capacity** | frac | | | 0.105 | 0.105 |
| **Wilting Point** | frac | | | 0.047 | 0.047 |
| **Conductivity** | in/hr | | | 1.18 | 100 |
| **Conductivity Slope** | | | | 7 | 7 |
| **Suction Head** | in | | | 1.4 | 1.4 |
| **Storage** | | | | | |
| **Height** | in | 36 | 36 | 18 | 36 |
| **Void Ratio** | | | | 0.67 | 0.67 |
| **Infiltration** | in/hr | | | Varies | Varies |
| **Clogging Factor** | | | | 0 | 0 |
| **Drain** | | | | | |
| **Drain Coef.** | in/hr | 0.25 | 0.25 | Varies | Varies |
| **Drain Exponent** | | 0.5 | 0.5 | 0.5 | 0.5 |
| **Drain Offset** | in | 0 | 0 | Varies | Varies |
| **Drain Delay** | hr | 0 | 0 | | |

Various implementation scenarios were simulated to evaluate the expected runoff reduction and resulting tunnel size resulting from implementing various distributions of LID practices described above. The specific scenarios, the modeling approach, and the modeling results are presented in Section 5.

# 3 Green and Green/Gray Controls for Piney Branch and Potomac River

DC Water is proposing to modify its LTCP to change the CSO control plan for Piney Branch and the Potomac River. The proposed control plan includes green and green/gray controls. Each control technology will be used where it is the most appropriate. The hybrid green/gray controls are predicted to provide a degree of CSO control equivalent to the gray controls in the LTCP. The hybrid approach will have a higher socio economic benefit to the District, especially in the communities served by GI. Figure 3-1 at the end of this section summarizes the proposed controls as compared to the LTCP.

## 3.1 Green Controls for Piney Branch

### 3.1.1 Scope

**Piney Branch**
**30% GI Implementation**
Total Sewershed area = 2,329 acres
Impervious area = 1,215 acres
GI @ 30% of Impervious Area = 365 acres

GI will treat approximately 30% (or 365 acres) of the impervious area in the Piney Branch drainage area, providing control for CSO 049. GI will be sized to provide a retention capacity equivalent to 1.2" of rain falling on an impervious surface. GI projects may include bioretention practices (bioretention cells, bioswales, vegetated filter strips, and tree box filters), rooftop collection practices (green roofs, blue roofs, downspout disconnection, rain barrels, and cisterns), permeable pavement, and large-volume underground storage. These facilities will be constructed in both public and privately-owned spaces. In addition to GI, targeted sewer separation may be utilized to offload storm water from the combined sewer system.

In addition to GI, the weir height of the existing diversion structure serving CSO 049 will be raised to increase the capture of combined sewage. The resulting captured sewage will be diverted to the existing East Rock Creek Diversion Sewer for conveyance to Blue Plains for treatment This control structure modification is not predicted to increase overflow frequency or volume at other downstream CSOs in the Rock Creek sewershed.

### 3.1.2 Predicted Performance

Hydraulic modeling predictions indicate that GI implementation and modifications to Structure 70 will eliminate the need to construct 9.5 MG of tunnel storage included in the LTCP. The GI program is predicted to provide a degree of CSO control equivalent to the gray controls in the LTCP, as summarized in Table 3-1.

Predicted water quality is summarized in Table 3-2 and the GI controls are predicted to provide a degree of water quality performance in the receiving water equivalent to the gray controls in the LTCP.

# Green and Green/Gray Controls

**Table 3-1**
**Piney Branch Predicted CSO Overflows in Average Year**

| Parameter | Before LTCP[1] | LTCP | Green Controls[2] |
|---|---|---|---|
| No. of Overflows (#/avg yr) | 25 | 1 | 1 |
| Overflow Volume (mg/avg yr) | 39.73 | 1.41 | <1 |
| % reduction from Before LTCP | -- | 96% | 96% or greater |

**Table 3-2**
**Predicted Water Quality in**
**Rock Creek after Piney Branch (Segment 17) in Average Year**

| Parameter | Before LTCP[1] | LTCP | Green Controls[2] |
|---|---|---|---|
| # Months Fecal Geomean>200 (all loads) | 12 | 12 | 12 |
| # Months Fecal Geomean>200 (CSO only) | 0 | 0 | 0 |
| | | | |
| # Days Fecal>200 (all loads) | 335 | 335 | 335 |
| # Days Fecal>200 (CSO Only) | 24 | 1 | 1 |
| | | | |
| # Days Fecal>200 (all loads) May - Sept | 135 | 135 | 135 |
| # Days Fecal>200 (CSO Only) May - Sept | 15 | 1 | 1 |
| | | | |
| # Months E. Coli Geomean>126 (all loads) | 12 | 12 | 12 |
| # Months E. Coli Geomean>126 (CSO only) | 0 | 0 | 0 |
| | | | |
| # Days E. Coli>126 (all loads) | 365 | 365 | 365 |
| # Days E. Coli>126 (CSO Only) | 24 | 1 | 1 |
| | | | |
| # Days E. Coli>126 (all loads) May - Sept | 153 | 153 | 153 |
| # Days E. Coli>126 (CSO Only) May - Sept | 15 | 1 | 0 |
| | | | |
| # Days D.O.< 5 mg/L (all loads) | 0 | 0 | 0 |
| # Days D.O.< 5 mg/L (CSO Only) | 0 | 0 | 0 |

Notes for Tables 3-1 and 3-2:

1. Results shown for Before LTCP are without Phase1 Controls in place (i.e. without inflatable dams, pumping station rehabilitations and Northeast Boundary Swirl Facility in operation).
2. At the low levels of CSO overflows projected herein, model accuracy is highly dependent on many variables such as the accuracy of rainfall data, information on the drainage area and other factors. Further, additional overflows will occur for rain events which exceed or are not represented in the average year. The model predictions contained herein do not change the level of CSO control determined to be adequate to meet water quality standards which was included by DC Water in its LTCP, and subsequently approved by EPA and the D.C. Department of the Environment.

## 3.2 Green/Gray Controls for Potomac River

### 3.2.1 Scope

DC Water will construct the following controls for the Potomac River CSOs:

- **Potomac Tunnel (CSOs 020 – 024)**
  The Potomac Storage Tunnel will capture CSOs 020 through 024. These outfalls serve the major interceptors draining Rock Creek and the large downtown areas in the Potomac sewershed. Given the large overflow volume produced by these outfalls and the highly urbanized nature of the sewershed, DC Water will construct gray infrastructure to control these CSOs. The tunnel in the LTCP was a 58 million gallon (mg) facility with a tunnel dewatering pumping station at the low end. After rain events, the pumping station would bleed captured flow via the existing system to Blue Plains for treatment. The large size of the tunnel was driven, in part, by the inability to completely dewatering the tunnel during back-to-back rain events.

  As part of this modification, DC Water is proposing to construct a gravity tunnel from CSO 024 all the way to interconnect with the Blue Plains Tunnel on the Anacostia System. The total volume of the Potomac Tunnel will be 30 mg and the tunnel will be emptied by gravity. This configuration will create one interconnected tunnel system. The advantages of this system include:

  - The Potomac and Anacostia Tunnel Systems will be interconnected, with a total system storage volume of 187 mg (30 mg for the Potomac + 157 mg for the Anacostia River Tunnel System). Since rainfall has both geographic and temporal variability, the interconnection of the tunnel system improves the ability of the system to provide CSO control. As an example, intense rain events in one part of the District can utilize the tunnel system volume as needed to control overflows. This, combined with the sewer separation and GI, allows the 30 mg Potomac Tunnel to provide a degree of control equivalent to the gray controls in the LTCP.

  - The gravity tunnel does not require construction of a new pumping station in the National Mall area. This preserves space for other higher value use. In addition, it reduces the need operation and maintenance associated with a complex mechanical system. Elimination of the pumping station also improves reliability and redundancy since the gravity tunnel does not require electrical power or other mechanical equipment to function.

  - The gravity tunnel improves the reliability and operability of the existing sewer system. The system will be configured such that if Potomac Pumping Station loses power, then normal sanitary flows in the system will drop into the tunnel by gravity for conveyance to Blue Plains thereby preventing a dry weather overflow. Further, if Potomac Pumping Station or the Potomac Force Mains experience equipment failures

or need to be worked on for repair or maintenance, the gravity tunnel can be used as a backup to convey flows to Blue Plains for treatment.

- The gravity Potomac Tunnel is more environmentally responsible because it eliminates the need for an energy intensive pumping station.

- **Separation of Combined Sewers (CSOs 025 – 026)**
  The drainage areas for CSO 025 (17 acres) and CSO 026 (3 acres) are very small and, therefore, it is practical to separate the tributary combined sewers. Separation will result in the elimination of combined sewer overflows from these sewersheds.

**CSO 025 Separation**
Sewershed = 17 acres

**CSO 026 Separation**
Sewershed = 3 acres

- **Green Infrastructure (CSOs 027 – 029)**
  GI will provide CSO control in these outlying sewersheds. GI will treat 30% of impervious areas in the CSO 027 and 028 sewersheds, and 60% of impervious areas in the CSO 029 sewershed, for a total of 133 impervious acres. GI will be sized to provide capture equivalent to 1.2" of rain falling on an impervious surface. GI projects may include bioretention practices (bioretention cells, bioswales, vegetated filter strips, and tree box filters), rooftop collection practices (green roofs, blue roofs, downspout disconnection, rain barrels, and cisterns), permeable pavement, and large-volume underground storage. In addition to GI, targeted sewer separation may be utilized to offload storm water from the combined sewer system. Diversion structures within the CSO 027, 028, and 029 sewersheds will be modified to increase diversion capacities. The diversion structure improvements coupled with the GI are predicted to provide a degree of CSO control comparable to the LTCP.

**CSO 027 30% GI Implementation**
Sewershed = 164 acres
Impervious = 104 acres
30% GI = 31 acres

**CSO 028 30% GI Implementation**
Sewershed = 21 acres
Impervious = 13 acres
30% GI = 4 acres

**CSO 029 60% GI Implementation**
Sewershed = 330 acres
Impervious = 164 acres
60% GI = 98 acres

### 3.2.2 Predicted Performance

Hydraulic modeling predictions indicate that the hybrid green/gray controls are predicted to provide a degree of CSO control equivalent to the gray controls in the LTCP. Predicted CSOs are summarized in Table 3-3. Predicted water quality is summarized in Table 3-4 and the data show that the GI controls are predicted to provide a degree of water quality performance in the receiving water equivalent to the gray controls in the LTCP.

**Table 3-3**
**Potomac River Predicted CSO Overflows (Average Year)**

| Parameter | Before LTCP[1] | LTCP | Green/Gray Controls[2] |
|---|---|---|---|
| No. of Overflows (#/avg yr) | 74 | 4 | 4 |
| Overflow Volume (mg/avg yr) | 953 | 79 | 59 |
| % reduction from Before LTCP | -- | 92% | 92% or greater |

**Table 3-4**
**Potomac River Predicted Water Quality**
**Memorial Bridge (Segment 6) in Average Year**

| Parameter | Before LTCP[1] | LTCP | Green/Gray Controls[2] |
|---|---|---|---|
| # Months Fecal Geomean>200 (all loads) | 3 | 1 | 1 |
| # Months Fecal Geomean>200 (CSO only) | 0 | 0 | 0 |
| | | | |
| # Days Fecal>200 (all loads) | 142 | 109 | 109 |
| # Days Fecal>200 (CSO Only) | 57 | 6 | 3 |
| | | | |
| # Days Fecal>200 (all loads) May - Sept | 64 | 44 | 44 |
| # Days Fecal>200 (CSO Only) May - Sept | 33 | 4 | 1 |
| | | | |
| # Months E. Coli Geomean>126 (all loads) | 2 | 0 | 0 |
| # Months E. Coli Geomean>126 (CSO only) | 0 | 0 | 0 |
| | | | |
| # Days E. Coli>126 (all loads) | 118 | 77 | 74 |
| # Days E. Coli>126 (CSO Only) | 60 | 6 | 3 |
| | | | |
| # Days E. Coli>126 (all loads) May - Sept | 57 | 36 | 30 |
| # Days E. Coli>126 (CSO Only) May - Sept | 35 | 5 | 1 |
| | | | |
| # days D.O.< 5 mg/L (all loads) | 0 | 0 | 0 |
| # days D.O.< 5 mg/L (CSO Only) | 0 | 0 | 0 |

Notes for Tables 3-3 and 3-4:

1. Results shown for Before LTCP are without Phase1 Controls in place (i.e. without inflatable dams, pumping station rehabilitations and Northeast Boundary Swirl Facility in operation).
2. At the low levels of CSO overflows projected herein, model accuracy is highly dependent on many variables such as the accuracy of rainfall data, information on the drainage area and other factors. Further, additional overflows will occur for rain events which exceed or are not represented in the average year. The model predictions contained herein do not change the level of CSO control determined to be adequate to meet water quality standards which was included by DC Water in its LTCP, and subsequently approved by EPA and the D.C. Department of the Environment.

# Green and Green/Gray Controls

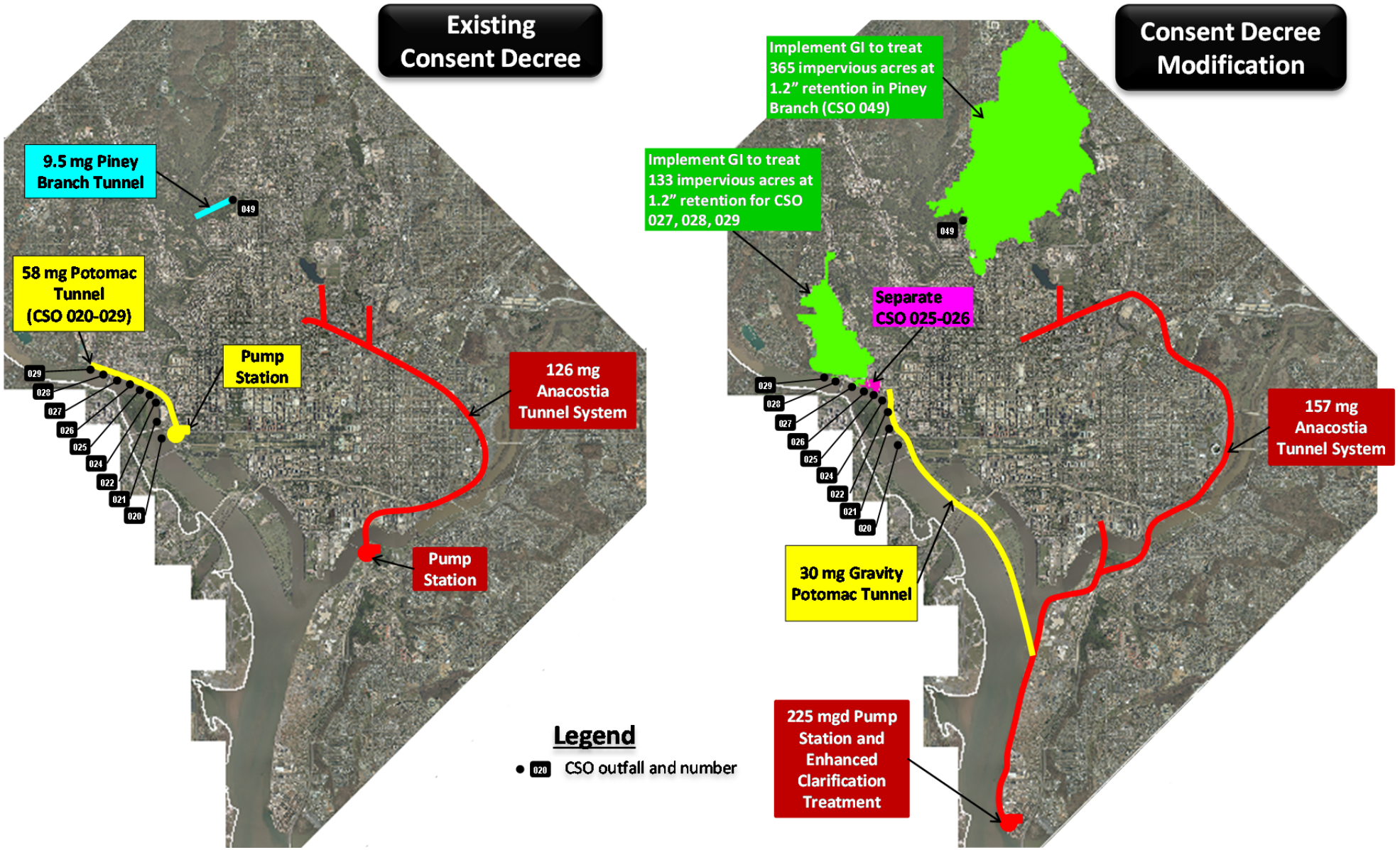


**Figure 3-1: Green and Green/Gray Controls**

# APPENDIX F

# APPENDIX F
# GREEN INFRASTRUCTURE PROGRAM FOR THE POTOMAC AND ROCK CREEK SEWERSHEDS

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## I. Green Infrastructure Program Plan

Within 12 months after the Effective Date of the First Amendment to the Consent Decree, DC Water shall submit to EPA for approval pursuant to Section X (EPA Approval of Plans and Submissions) of this Consent Decree a Green Infrastructure Program Plan (the "GI Program Plan"). The GI Program Plan shall include the information described in subsections A, B, and C below:

A. **Green Infrastructure Control Measures**.

1. Identification and description of the GI control measures (including any targeted sewer separation projects) that DC Water intends to install (or have the District or other entities install on its behalf), the approximate locations of the sites for the measures, and the estimated cost to implement the measures.

2. The conceptual project location identifications and descriptions, and cost estimates for the measures that DC Water intends to install (or have the District or other entities install on its behalf), which shall correspond to the individual GI Projects set forth in the schedule in Section II of this Appendix F.

3. An estimate of the number of acres of land projected to be effectively retrofitted with GI in the Potomac and Rock Creek sewersheds prior to 2030 pursuant to the District's MS4 permit and storm water regulations.

B. **Preservation and Maintenance of Constructed Green Infrastructure Projects**. A plan to (1) preserve and maintain the GI control measures installed pursuant to the GI Program Plan and (2) ensure that future site or land use changes do not result in the loss of the runoff reduction benefits of the GI control measures installed pursuant to the GI Program Plan, unless that loss is compensated for by other controls in the same CSO drainage area.

C. **Public Outreach**. A plan to engage property owners in the Potomac and Rock Creek sewersheds and interested stakeholders to promote and facilitate installation of GI on private property and to ensure public input into the site selection process and concept design for the control measures that DC Water proposes to install as part of the GI Program Plan.

## II. DC Water Implementation Schedule

DC Water shall construct and Place in Operation the GI control measures assigned to it and set forth in the GI Program Plan developed pursuant to Section I of this Appendix F in accordance with the following schedule.

**A.** Six months prior to the award contract for construction for each of the projects listed in this section, DC Water shall submit a Project Description to EPA for review and comment. The Project Description shall contain:

1. An identification of the CSO areas where the projects are to be implemented
2. The types of GI control that are to be employed and the rational for their use
3. The approximate location of the controls
4. The estimated acreage that will be controlled to a 1.2" retention standard
5. A schedule for implementation of the controls
6. The estimated cost for each type of control to be employed
7. The total cost for the Project
8. Post Construction Monitoring and Modeling Program for this project to demonstrate the capture efficiency of the controls to be implemented

**B.** Six months following the completion of a project's post construction monitoring program, DC Water shall submit a Post Construction report for EPA review and comment. The Post Construction Report shall contain:

1. A comparison of planned projects under the Project Description and actual implemented projects:
   (a) Costs
   (b) Acreage treated to 1.2" retention standard
   (c) Estimate of run-off control.
2. Identification of barriers to implementation of projects and steps taken by DC Water and the District to address any identified barriers for this and future projects
3. Post Construction Monitoring and Modeling Program results assessing the efficiency of the controls implemented

4. Changes proposed for future projects

**C. Potomac Sewershed Projects: In accordance with the following schedule, construct GI, including targeted sewer separation, in the CSO 027, 028 and 029 sewersheds designed to:**

1. Project No. 1: Control 44 acres to the 1.2" Retention Standard

   (a) Award Contract for Construction: June 23, 2017

   (b) Place in Operation: June 23, 2019

2. Project No. 2: Control 46 acres to the 1.2" Retention Standard

   (a) Award Contract for Construction: June 23, 2022

   (b) Place in Operation: June 23, 2024

3. Project No. 3: Control 43 acres to the 1.2" Retention Standard

   (a) Award Contract for Construction: June 23, 2025

   (b) Place in Operation: June 23, 2027

4. Controlled acres placed in operation in excess of those specified for a given project in this paragraph II.C may be credited against the acres required to be controlled on subsequent projects.

5. No later than 15 months following the Place in Operation date for Project No. 1 above, DC Water shall submit to EPA and the District Post Construction Monitoring Report No. 1 for the Potomac Sewershed Projects (Potomac Report No. 1). In addition to the information required in Subsection II.B above, the report shall contain DC Water's determination of the practicability of controlling at least 133 acres to the 1.2" Retention Standard in the CSO 027, 028 and 029 sewersheds by the Place in Operation deadline for Project No. 3 above based on its experience with implementing Project No. 1. Such determination shall consider the constructability, operability, efficacy, public acceptability and cost per impervious acre treated of the controls.

6. EPA shall either approve or disapprove of the determination required by Paragraph 5 above. If EPA fails to either approve or disapprove the determination within 180-days following receipt of Potomac Report No. 1, any subsequent deadline that is dependent upon such approval or disapproval shall be extended by the number of calendar days beyond the 180-day period that EPA uses to approve or disapprove the determination.

The process for approving or disapproving the determination shall be governed by Paragraph 39 of the Consent Decree.

7. In the event DC Water determines that it is not practicable to control at least 133 acres to the 1.2" Retention Standard in the CSO 027, 028 and 029 sewersheds by the Place in Operation deadline for Project No. 3 above and such determination is approved by EPA, DC Water shall:

   (a) Plan, design, and construct the Potomac River Storage/Conveyance Tunnel with a total storage volume of not less than 40 million gallons, at any time up to, but no later than the following schedule

      (i) Award Contract for Detailed Design: Three (3) months after EPA approval

      (ii) Award Contract for Construction: Two (2) years and six (6) months after EPA approval

      (iii) Place in Operation: Nine (9) years after EPA approval

   (b) Be relieved of its obligation to implement Project Nos. 2 and 3 above; and

   (c) Operate and maintain the GI constructed in Project No. 1 in accordance with its NPDES Permit.

**D. Rock Creek Sewershed Projects: In accordance with the following schedule, construct GI, including targeted sewer separation, in the CSO 049 (Piney Branch) sewershed designed to:**

1. Project No. 1: Control 20 acres to the 1.2" Retention Standard

   (a) Award Contract for Construction: March 30, 2017

   (b) Place in Operation: March 30, 2019

2. Project No. 2: Control 75 acres to the 1.2" Retention Standard

   (a) Award Contract for Construction: January 23, 2022

   (b) Place in Operation: January 23, 2024

3. Project No. 3: Control 90 acres to the 1.2" Retention Standard

   (a) Award Contract for Construction: March 23, 2025

   (b) Place in Operation: March 23, 2027

4. Project No. 4: Control 90 acres to the 1.2" Retention Standard

   (a) Award Contract for Construction: September 30, 2027

   (b) Place in Operation: September 30, 2029

5. Project No. 5: Control 90 acres to the 1.2" Retention Standard

   (a) Award Contract for Construction: March 23, 2028

   (b) Place in Operation: March 23, 2030

6. Controlled acres placed in operation in excess of those specified for a given project in this paragraph II.D. may be credited against the acres required to be controlled on subsequent projects.

7. No later than 15 months following the Place in Operation date for Project No. 1 above, DC Water shall submit to EPA and the District Post Construction Monitoring Report No. 1 for the Rock Creek Sewershed Projects (Rock Creek Report No. 1). In addition to the information required in Subsection II.B above, the report shall contain DC Water's determination of the practicability of controlling at least 365 acres to the 1.2" Retention Standard in the CSO 049 sewershed by the Place in Operation deadline for Project No. 5 above based on its experience with implementing Project No. 1. Such determination shall consider the constructability, operability, efficacy, public acceptability and cost per impervious acre treated of the controls.

8. EPA shall either approve or disapprove of the determination required by Paragraph 7 above. If EPA fails to either approve or disapprove the determination within 180-days following receipt of Rock Creek Report No. 1, any subsequent deadline that is dependent upon such approval or disapproval shall be extended by the number of calendar days beyond the 180-day period that EPA uses to approve or disapprove the determination. The process for approving or disapproving the determination shall be governed by Paragraph 39 of the Consent Decree.

9. In the event DC Water determines that it is not practicable to control at least 365 acres to the 1.2" Retention Standard in the CSO 049 sewershed by the Place in Operation deadline for Project No. 5 above and such determination is approved by EPA, DC Water shall:

   (a) Construct a Rock Creek Storage Facility the (Facility), which shall store combined sewer flow from the Piney Branch Outfall, CSO 049, in accordance with DC Water's NPES Permit. The storage capacity of the Facility will be at least nine and one-half (9.5) million gallons. After the Facility is Placed in Operation, in the

event of wet weather causing the facility to be used for storage, DC Water shall dewater the Facility to the CSS as soon as practicable, but in no event longer than 59 hours, and shall convey the contents of the Facility to Blue Plains for treatment in accordance with DC Water's NPDES permit. The location of the Facility will be finalized during Facility Planning and design, but it will be between CSO 049 and Rock Creek and its approximate location is depicted in Page ES-9 of Appendix A to this Decree;

(b) Plan, design, construct and Place in Operation the Facility at any time up to, but no later than the following schedule:

(i) Award Contract for Detailed Design: Three (3) years six (6) months after EPA approval

(ii) Award Contract for Construction: Five (5) years six (6) months after EPA approval

(iii) Place in Operation: Nine (9) years after EPA Approval

(c) Be relieved of its obligation to implement Project Nos. 2, 3, 4 and 5 above; and

(d) Operate and maintain the GI constructed in Project No. 1 in accordance with its NPDES Permit.

**E. Credit for Other Controlled Acres**. Controlled acres from the implementation of the District's MS4 Permit and Stormwater Regulations will be credited against DC Water's obligations to control acres in paragraphs II.C. and II.D. if:

1. They are located in the CSO areas targeted for GI implementation by DC Water; and

2. The design of the control measures and their level of control has been verified by DC Water to achieve the 1.2" retention standard or any portion thereof. Where green infrastructure installations by any party do not meet the full 1.2" design criterion and are counted towards meeting the requirements of this consent decree, DC Water may proportionally credit the control achieved; and

3. DC Water, the District or a private party has assumed operation and maintenance responsibilities in a legally binding document or as part of its statutory or regulatory authority.

**F. DC Water Commitments to Coordinate with the District.** The commitments of DC Water in coordinating with the District are:

1. DC Water shall consult with the District's Program Coordinator and relevant District agencies in selecting planned GI projects proposed for District property or rights of way to ensure coordination with District infrastructure policies and priorities;

2. DC Water shall submit draft GI construction staging packages identifying facilities to be constructed, including preliminary engineering plans and specifications, staging areas, estimated construction durations, work hours and traffic management plans for review by the District and shall do so sufficiently in advance of construction of the various GI contract divisions in order to allow adequate time for the District to review the packages, for the District and DC Water to resolve any issues, and for the District to issue the permits before the expected start date of construction;

3. DC Water shall prepare 30%, 60%, 90% and 100% documents each for RFP and design for District review and comment prepared in accordance with terms agreed to by the District and DC Water;

4. DC Water shall submit a maintenance and monitoring plan, including the funding methodology, for each GI Project to the District agencies having jurisdiction.

5. DC Water shall submit applications for public space, construction, and any other necessary permits for each project or facility;

6. DC Water shall submit the documents required by this section sufficiently in advance of construction in order to allow adequate time for the District to review the document, for the District and DC Water to resolve any issues, and for the District to issue the permits or other legal authority before the expected start date of construction of the project.

7. DC Water shall work with the District to coordinate and align capital projects and expenditures, where feasible and practical, to allow implementation of the GI projects in a manner that enables the efficient use of resources and minimizes costs to the taxpayers and rate-payers.

8. DC Water shall assure that GI credited towards meeting DC Water's obligations to control acres in paragraphs II.C. and II.D is inspected no less than once every three years and that any deficiencies are corrected.

## III. District of Columbia Government Commitments

**A.** The commitments of the District in support of the GI Projects are:

1. The District agrees to provide the public space necessary for DC Water to construct GI to control 365 acres to the 1.2" Retention Standard in the CSO 049 sewershed and 133 acres to the 1.2" Retention Standard in the

CSO 027, 028 and 029 sewersheds, less any acres controlled from implementation of the District's MS4 Permit and Stormwater Regulation. The District and DC Water will establish procedures for identifying GI locations, technologies, and issuance of permits for construction, operation and maintenance and other matters in a Memorandum of Understanding. The Memorandum of Understanding will be executed within 24 months of the Effective Date of the First Amendment to Consent Decree.

2. The District will appoint an executive-level District official as the District's Program Coordinator within 6 months of Effective Date of the First Amendment to the Consent Decree. The Coordinator will be charged with coordinating and expediting the work of the relevant District offices, departments and agencies;

3. After submission by DC Water of each construction staging package, the District shall review the proposed construction staging areas, construction durations, maintenance of traffic, parking mitigation, work hours and facilities to be constructed, and work with DC Water to resolve any concerns and issue approval letters identifying the conditions that must be met in order to obtain permits for construction;

4. The District shall issue permits for construction within thirty (30) business days of submittal of a complete application package prepared in accordance with an approval letter;

5. After submission and review of the maintenance and monitoring plan for a GI Project submitted by DC Water, the District shall issue permits or other legal authority to DC Water in advance of the completion of construction of the GI Projects allowing access for the maintenance and monitoring of the project; unless, as part of the maintenance and monitoring plan submitted by DC Water and approved by the District, the District or private party will be responsible for the maintenance and monitoring of the project.

6. The District shall revise its storm water policies regarding in-lieu fees to include the following:

   (a) In-lieu fees paid by regulated projects in the CSO 027, 028, 029 and 049 sewersheds will be used to fund construction of GI in those sewersheds; and

   (b) In-lieu fees paid by regulated projects in combined sewersheds will not be used to fund projects in combined sewersheds controlled by the Gray CSO Controls required by this Consent Decree.

7. The District shall submit a report to EPA for review and comment no later than March 1, 2016 identifying impediments to implementation of the GI Projects and identifying proposed changes to the regulations, codes, standards, guidelines and policies by reviewing the following items at a minimum:

   (a) Storm water regulations and policies; including a review of the practicability of incentivizing storm water retention credits (SRCs) to maximize water quality benefits;

   (b) District Department of Transportation ("DDOT") Design and Engineering Manual;

   (c) Zoning regulations;

   (d) Plumbing and Building Codes;

   (e) DDOT Urban Forestry Guidelines;

   (f) DDOT Green Infrastructure Standards; and

   (g) DC Water Utility Protection Guidelines.

8. The District shall take the following actions with respect to the proposed amendments to the regulations, codes, standards and guidelines included in the reports described in paragraphs above:

   (a) For statutory amendments, the District shall submit to the Council by no later than March 1, 2017, proposed legislation to enact the statutory amendments;

   (b) For regulatory amendments that require Council approval, the District shall publish a notice of proposed rulemaking by March 1, 2017, and shall submit to the Council by no later than January 1, 2018, a proposed resolution to approve the final rules;

   (c) For regulatory amendments that require Zoning Commission approval, the District shall submit proposed zoning language to the Zoning Commission for its approval by no later than March 1, 2017;

   (d) For regulatory amendments that do not require Council or Zoning Commission approval, the District shall issue a notice of proposed rulemaking by March 1, 2017;

   (e) For statutory amendments and for regulatory amendments that require Council approval, the District shall take such actions as are

necessary to obtain the Council's approval of the proposed legislation by March 1, 2018;

(f) For regulatory amendments that require Zoning Commission approval, the District shall take such actions as are necessary to obtain the Zoning Commission's adoption of the regulatory amendments by March 1, 2018; and

(g) For regulatory amendments that do not require Council or Zoning Commission approval, the District shall issue a notice of final rulemaking no later than March 1, 2018.

**B. Anti-Deficiency Act Events:** Nothing in this Decree shall be construed to require an expenditure, obligation or contract in violation of the Anti-Deficiency Act, 31 U.S.C. §§ 1341 et seq. Where an expenditure, obligation or contract is subject to the Anti-Deficiency Act, the District's obligations shall be subject to the availability of appropriated funds.

## IV. Additional Coordination between DC Water and District

DC Water and the District will work together to coordinate and align capital projects and expenditures, where feasible and practical, to allow implementation of the GI Projects in a manner that enables the efficient use of resources and minimizes costs to the taxpayers and rate-payers. As part of this process, the District and DC Water will identify capital projects in the sewersheds for CSO 027, 028, 029 and 049 that are projected to be completed during the subsequent three (3) years and that provide an opportunity to include more than $200,000 of green infrastructure in excess of that required by District law. DC Water may request the District to incorporate in one or more of these projects GI in excess of that required by District law. The District agrees to grant such requests if DC Water agrees to fund the incremental design, construction, monitoring and maintenance costs of GI implemented by the District in excess of GI required by District law, the amount of such funding is agreed to by the District and DC Water, and the proposed GI is consistent with the District's current and potential future program for the project. Such excess GI will be credited to the acres required to be controlled in Subsections II.C and II.D of this Appendix F.

## V. Reporting

A. Following EPA's approval of the GI Program Plan, DC Water shall report on the status of implementation of the GI Program Plan in each Quarterly Report required by Section XI (Reporting) of this Decree. The reports shall describe the status (i.e., in design, in procurement, under construction, or completed) of the control measure projects identified in the Plan. As part of the First Quarterly Report of each calendar year, DC Water shall include the following information for the prior calendar year:

1. Total acres of impervious area treated by GI installed and by sewer separation since the Effective Date of the First Amendment to the Consent Decree in the sewersheds for CSO 027, 028, 029 in the Potomac and CSO 049 (Piney Branch);

2. Acres of impervious area treated by GI pursuant to the District's MS4 permit and Stormwater Regulations installed since the Effective Date of the First Amendment to the Consent Decree in the sewersheds for CSO 027, 028, 029 in the Potomac and CSO 049 (Piney Branch); and the numbers of such acres credited in accordance with Section II.C of this Appendix F;

3. The activities the District and DC Water have taken to coordinate and align capital projects to minimize costs associated with implementation of the GI Projects by DC Water.