Executive Summary

Long Term Control Plan Modification for Green Infrastructure

May 2015

prepared by

dc water is life

District of Columbia
Water and Sewer Authority
Washington, DC

dc clean RIVERS PROJECT
RESTORING OUR RIVERS
PROTECTING OUR DISTRICT

FINAL

General Manager's Message

I am pleased to announce the completion of the process to modify DC Water's Long Term Control Plan to enable a significant investment in Green Infrastructure. This plan represents an enormous body of work and painstaking analysis performed by DC Water and its contractors. Exploring Green Infrastructure to reduce combined sewer overflows to the Potomac River and Rock Creek was a personal priority for me when I accepted the position of General Manager at DC Water in 2009. Since then, DC Water has invested $14 million in ratepayer funds to further our understanding of this innovative solution to stormwater control that will bring environmental, social, and economic benefits to the residents of the District of Columbia.

DC Water CEO & General Manager
George S. Hawkins

This document is a product of methodical outreach and collaboration with our regulatory, environmental, and community stakeholders. DC Water solicited feedback on its plans for Green Infrastructure by holding multiple summits, more than 14 public meetings, and notifying District residents through a proactive ad campaign. The updated proposal reflects the nearly 500 comments we received from the public, and I am confident will position DC Water as a leader in the responsible use of Green Infrastructure for combined sewer overflows. We are grateful for the comments we received, and we strongly believe that our proposal is much better for it.

The release of this document marks an important moment in DC Water's history. Some argue about the role of Green Infrastructure in comparison to gray. We have learned over this process that embracing both techniques in a complementary manner builds on their relative strengths and yields an outcome that is better than either alone. I want to thank all who have engaged DC Water on this herculean effort, and I look forward to collaborating with the public and our stakeholders as DC Water begins to make this plan a reality in the District of Columbia.

George S. Hawkins

What is the Purpose of this Initiative?

DC Water is proposing to implement **Green Infrastructure** or **GI** as part of our plan to control Combined Sewer Overflows (CSOs). CSOs are one of the sources of pollution impairing the quality of the District's waterways. The current plan to control overflows in the District's Potomac River and Rock Creek sewersheds relies largely on the construction of large tunnels ("gray" infrastructure) designed to capture CSO during heavy rains and transport it to the Blue Plains Advanced Wastewater Treatment Plant (Blue Plains) for treatment. GI reduces the scope of gray infrastructure needed to control stormwater runoff that contributes to CSOs, and has the potential to provide many environmental, social, and economic benefits to the community. While additional time is needed to effectively implement GI, it will deliver earlier pollutant reductions through phased construction when compared to gray infrastructure. This report explains the basis for this initiative and why a modification to DC Water's plan for controlling CSOs (called the Long Term Control Plan, LTCP or DC Clean Rivers Project) is required to implement it.

Bioretention in the Public Right of Way

What is the Consent Decree?

The Consent Decree is the 2005 agreement among DC Water, the District, the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Justice (DOJ) that establishes schedules for construction of the tunnels and related CSO control facilities, including a 2025 deadline to construct and place the tunnels in operation.

What is Green Infrastructure?

GI, also known as Low Impact Development (LID), uses plants, trees and other measures to mimic natural processes to control stormwater, resulting in cleaned, cooled, and slowed stormwater runoff. These systems promote rainwater detention and infiltration into the soil and include techniques such as rain gardens, porous pavements, green roofs and other technologies.

Typical Green Infrastructure Measures
• Rain Gardens (Bioretention)
• Porous Pavements
• Green Roofs
• Rain Barrels and Downspout Disconnections

By integrating natural processes into the urban environment, GI provides not only stormwater management, but also can 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.

DC Water's recommended plan is to construct a hybrid green-gray solution to control CSOs while improving the quality of life in the District.

What is a Combined Sewer Overflow?

Like many older cities in the United States, the sewer system in the District is comprised of both combined sewers and separate sanitary sewers. While sanitary sewers carry only sewage, combined sewers carry both sewage and runoff from storms.

Modern practice is to build separate sewers for sewage and stormwater. No new combined sewers have been built in the District since the early 1900's. Approximately one-third of the District is served by combined sewers, the majority of which are in the older, developed sections of the District.

CSO Facts
• **"CSO"** stands for **C**ombined **S**ewer **O**verflow • About 1/3 of the District is served by combined sewers • Combined sewers have not been built in the District since the early 1900's • Combined sewers overflow when stormwater runoff exceeds the sewer capacity

In a combined sewer system, sewage from homes and businesses during dry weather conditions is conveyed to DC Water's Advanced Wastewater Treatment Plant at Blue Plains, located in the southwestern part of the District on the east bank of the Potomac River. There, the wastewater is treated to remove pollutants before being discharged to the Potomac River. When the capacity of a combined sewer is exceeded during storms, the excess flow, which is a mixture of sewage and stormwater runoff, is discharged to the Anacostia and Potomac Rivers, Rock Creek and tributary waters. This excess flow is called Combined Sewer Overflow (CSO). There are 47 active CSO outfalls in the District's combined sewer system.

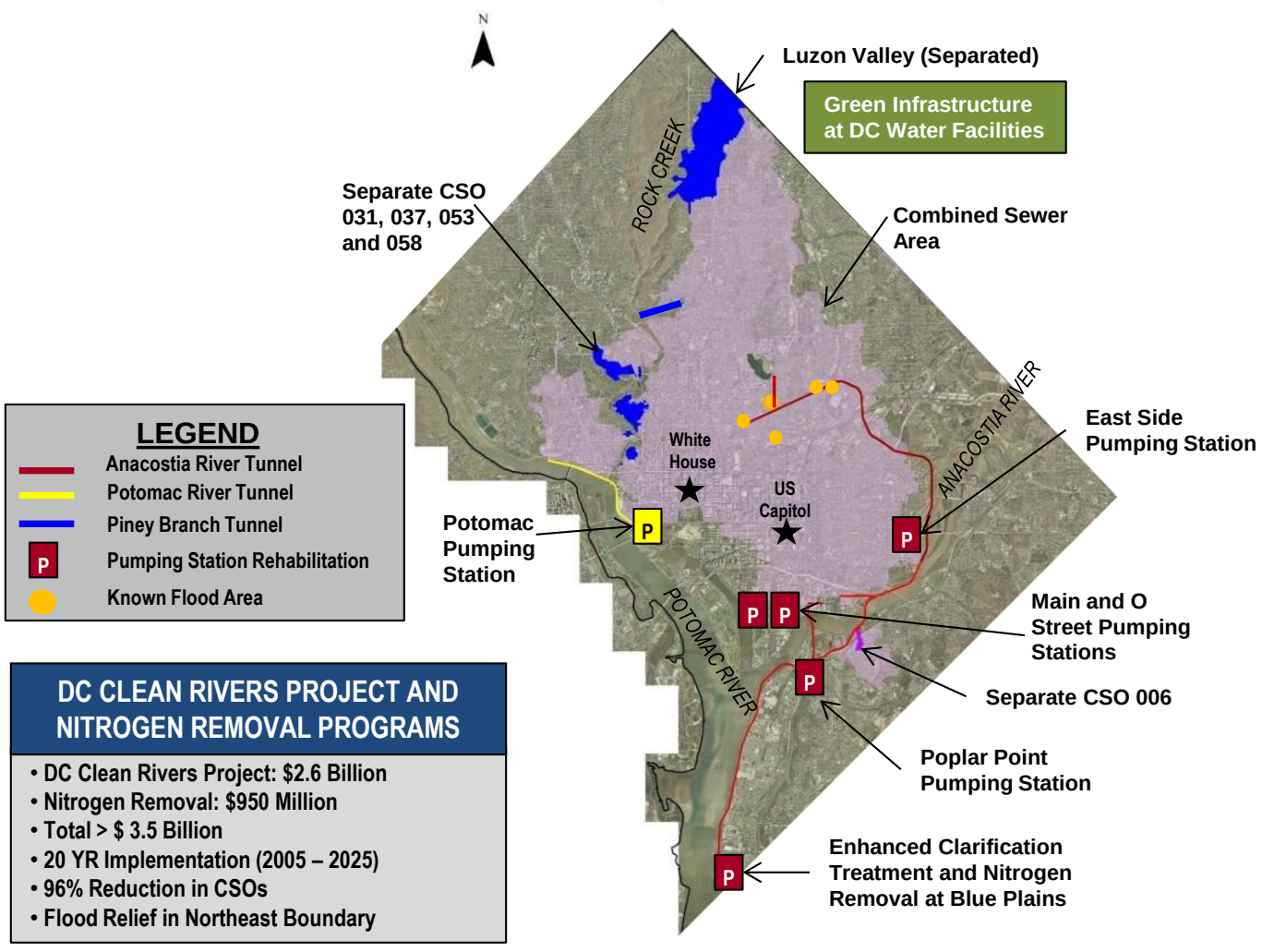
"Lady Bird" Tunnel Boring Machine for the Blue Plains Tunnel

What is the DC Clean Rivers Project?

The DC Clean Rivers Project (DCCR) is DC Water's massive infrastructure program to reduce combined sewer overflows into the District's waterways - the Anacostia and Potomac Rivers and Rock Creek. It includes more than 13 miles of tunnels that are larger than the Metro tunnels and are constructed more than 100 feet below the ground. The tunnels are designed to capture CSO during heavy rains and transport it to Blue Plains for treatment. The tunnels to control CSOs on the Anacostia River are currently under construction.

With the DC Clean Rivers Project, DC Water will improve our waterways by reducing CSOs system-wide by 96% in the average year. The DC Clean Rivers Project will also provide flood relief to neighborhoods in the Northeast Boundary section of the city, such as Bloomingdale, LeDroit Park, Trinidad and Ivy City.

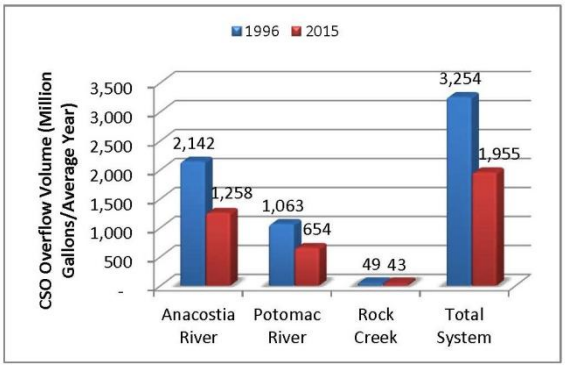
DC Water has reduced CSO overflow volume by approximately 40% since 1996 and has issued more than $1.3 billion in engineering and construction contracts.



Existing Plan

What Progress has already been made in CSO Control?

DC Water has made great strides toward reducing CSOs since the Authority was created in 1996. Since 1996, CSO overflow volume has been reduced by about 40% on a system-wide basis in an average year of rain. DC Water has done this by replacing and upgrading pumping stations and control structures and separating combined sewers in selected sewersheds. The investments have already improved water quality and reduced trash in our waterways.



DC Water has Reduced CSO Overflow Volume by 40% Between 1996 and 2013

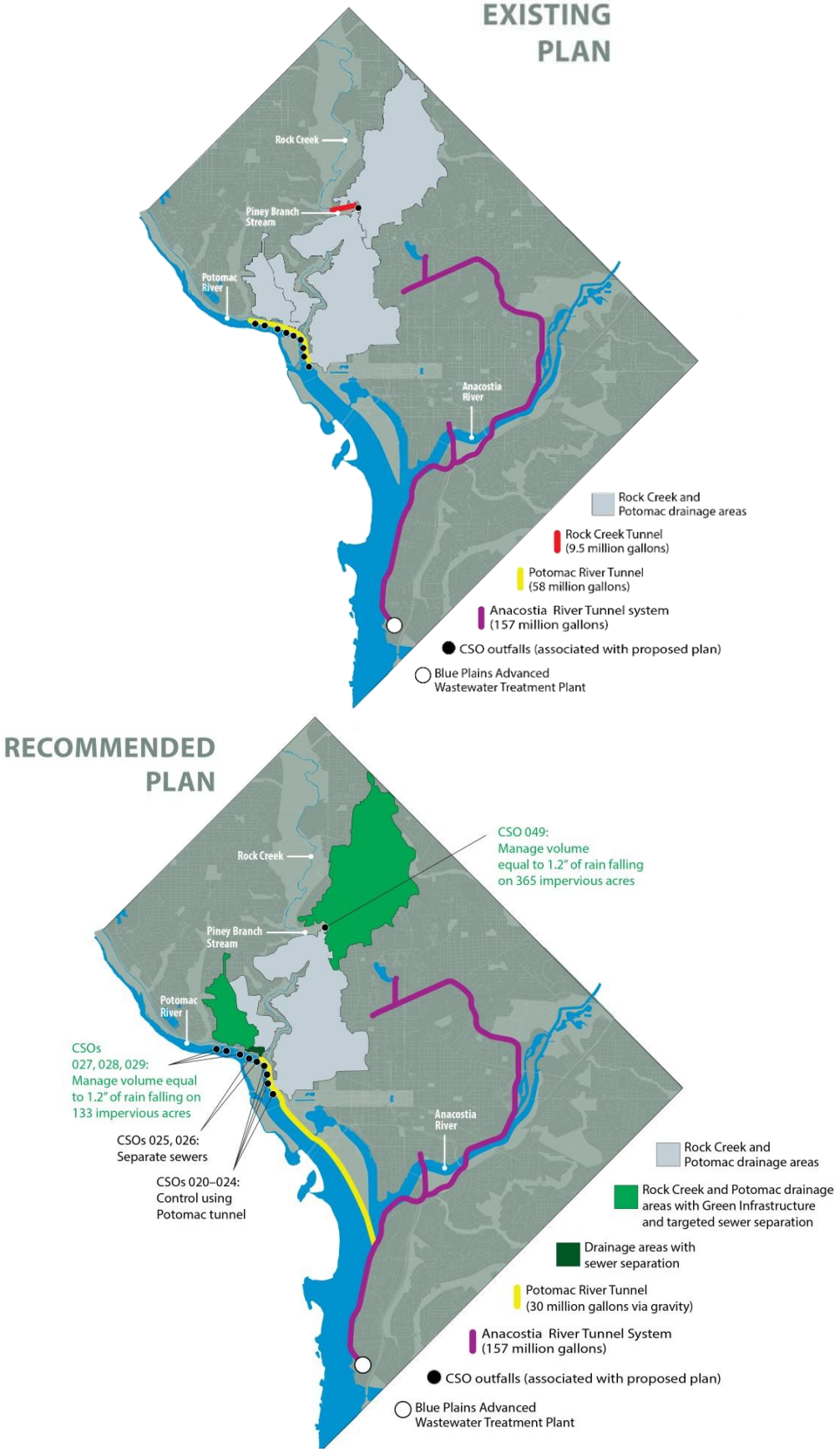
DC Water is currently constructing the tunnel system for the Anacostia River. This will achieve an 81% reduction in CSO volume on the Anacostia by 2018 when the tunnel from Blue Plains to RFK Stadium is placed into operation and a 98% reduction in volume when all Anacostia River controls are placed into service. While the Consent Decree deadline for completion of the Anacostia River Tunnel system is 2025, DC Water is accelerating the work to achieve a completion date of 2022 to provide early flood relief to Bloomingdale and LeDroit Park per the Mayor's Task Force Recommendations.

What is DC Water's Recommended Plan?

On the Anacostia River, DC Water will complete construction of the tunnel system and will meet the existing aggressive schedules. For the Potomac River and Rock Creek, DC Water will implement a hybrid plan of green and gray infrastructure, where each technology will be applied in areas selected to maximize their effectiveness.

For Rock Creek, DC Water will construct GI and targeted sewer separation to manage the volume of runoff produced by 1.2" of rain falling on 365 impervious acres instead of the Rock Creek Tunnel to control the Piney Branch CSO Outfall. This approach is feasible in this sewershed because of its low CSO overflow volumes and because of the lower density of

Receiving Water	Existing Plan	Recommended Plan
Rock Creek	• Construct Rock Creek Tunnel by 2025	• Raise the diversion weir at CSO 049 (Piney Branch) by 2020 • Construct GI and targeted sewer separation to manage the volume of runoff produced by 1.2" of rain falling on 365 impervious acres to control CSO 049 (Piney Branch) by 2030
Potomac River	• Construct Potomac Tunnel by 2025	• For CSOs 027, 028 and 029, construct GI and targeted sewer separation to manage the volume of runoff produced by 1.2" of rain falling on 133 impervious acres by 2027 • For CSO 025 and 026, separate these sewersheds by 2023 • For CSOs 020, 021, 022 and 024, construct a 30 million gallon Potomac Tunnel by 2030. Configure the tunnel to drain by gravity to the Blue Plains Tunnel


EXISTING PLAN
Rock Creek
Piney Branch Stream
Potomac River
Anacostia River
Rock Creek and Potomac drainage areas
Rock Creek Tunnel (9.5 million gallons)
Potomac River Tunnel (58 million gallons)
Anacostia River Tunnel system (157 million gallons)
CSO outfalls (associated with proposed plan)
Blue Plains Advanced Wastewater Treatment Plant
RECOMMENDED PLAN
CSO 049: Manage volume equal to 1.2" of rain falling on 365 impervious acres
CSOs 027, 028, 029: Manage volume equal to 1.2" of rain falling on 133 impervious acres
CSOs 025, 026: Separate sewers
CSOs 020–024: Control using Potomac tunnel
Rock Creek and Potomac drainage areas
Rock Creek and Potomac drainage areas with Green Infrastructure and targeted sewer separation
Drainage areas with sewer separation
Potomac River Tunnel (30 million gallons via gravity)
Anacostia River Tunnel System (157 million gallons)
CSO outfalls (associated with proposed plan)
Blue Plains Advanced Wastewater Treatment Plant

development in the sewershed. GI projects will start in 2017 and will be completed by 2030.

For the Potomac River, DC Water will implement a hybrid green and gray solution. GI and targeted sewer separation will be used to control CSO 027, 028 and 029, while CSO 025 and 026 will be separated because the drainage areas for these outfalls are very small. Implementation will start in 2017 and will be completed by 2027. The largest CSOs are outfalls 020 through 024 and these will be controlled by a modified Potomac Tunnel, with a storage volume of 30 million gallons. The Potomac Tunnel will be drained by gravity to the Blue Plains Tunnel, thereby eliminating the need for a new very large pumping station to empty the tunnel near the National Mall. The Potomac Tunnel will be placed in service by 2030.

For both the Potomac River and Rock Creek, the recommended plan will result in CSO reductions and water quality improvements equivalent to those predicted for the CSO controls in the existing plan.

What are the Benefits of the Recommended Plan?

The hybrid GI plan offers many more benefits than the existing tunnel-only solution. These benefits include:

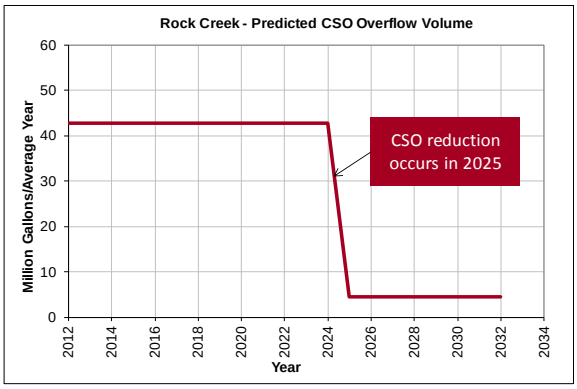
1. *Timing of CSO Reduction*

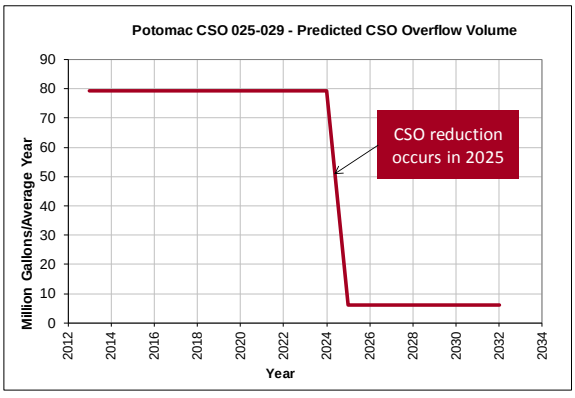
Under the existing plan, the District would need to wait until the tunnels are placed in service in 2025 before any additional CSO reduction is achieved. With the recommended plan, CSO reduction will begin to occur much earlier (in 2017).

Although the controls for Potomac CSOs 020-024 will be placed in operation in 2030

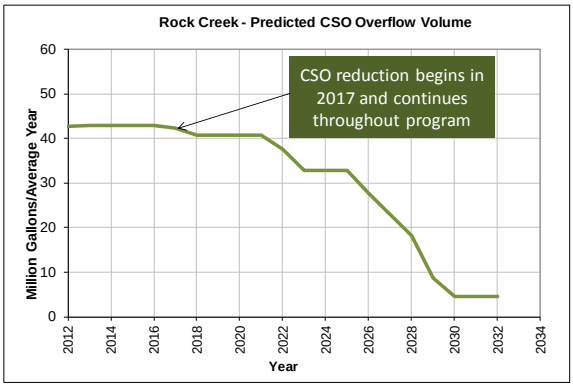
CSO Reduction versus Time

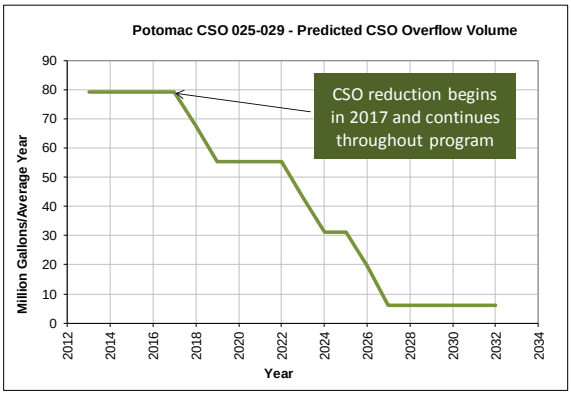
Existing Plan





Recommended Plan





instead of 2025, installation of these controls would likely have been delayed with the existing plan due to several factors including new federal requirements to perform an Environmental Impact Statement, and new planning and location challenges which did not exist when the original Consent Decree was signed. Establishing a new deadline will also mitigate the financial burden on rate payers for the $2.6 billion project.

2. *Added Environmental, Social and Economic Benefits*

GI can offer environmental, social and economic benefits that gray infrastructure does not, including, but not limited to, increased property values, neighborhood beautification, reduced heat island effects, habitat creation, green jobs, and enhanced community gathering spaces.

costs associated with the schedule of the existing plan coupled with other necessary sewer and wastewater improvements are projected to be unaffordable for more than 40% of households by 2018. The analysis also showed that extension of both the Consent Decree schedule and optimization of capital spending for other sewer and wastewater projects is necessary to maintain affordable rates.

To complete the CSO control program as early as possible, DC Water evaluated engineering constraints and determined that extending the Potomac River Tunnel schedule by five years and the GI schedule by five years would result in the earliest affordable, practical, and technically achievable schedules for CSO control. With the Consent Decree extended, DC Water

Triple Bottom Line Benefits of Green Infrastructure

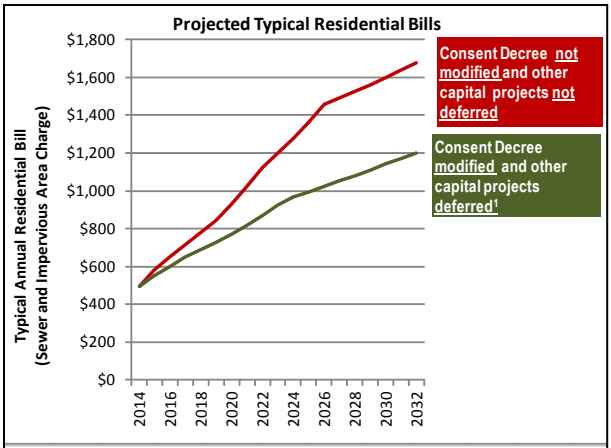
3. *Reduced Financial Impact on Ratepayers by Spreading Out Construction*

DC Water updated its 2002 affordability analysis as part of evaluating GI plans for CSO control. The analysis showed that the

determined that more than $2.5 billion dollars of other sewer and wastewater projects must be considered in an optimization of capital spending between 2015 and 2032 to meet the affordability criteria established by the analysis. As shown in the figure below, extending the

Consent Decree schedule and optimizing implementation of other capital projects is projected to reduce typical residential sewer bills from about $1,675 per year to about $1,200 per year.

Given that median sewer age will be approaching nearly 100 years by 2032, optimization of capital spending for other projects inevitably presents risks to customer service, environmental protection, and management of infrastructure. DC Water balanced these risks with our obligations to complete the CSO control program as soon as is practicable when the recommended schedule for CSO control described in this report was developed.



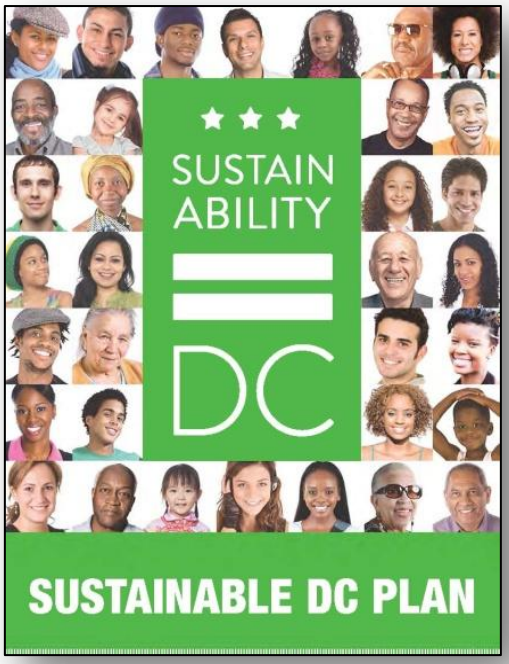
Notes:
1. With Consent Decree Modification and Capital Improvement Progam projects deferred to achieve residential sewer + Impervious Area Charge not more than 2% of household income for incomes at upper limit of second quintile, adjusted for cost of living in Washington DC or $33,926 in 2013. See Section 4 and Appendix E of the *Long Term Control Plan Modification for Green Infrastructure* for a detailed description of the analysis.

4. *Opportunity for Local, Green Jobs*

GI will increase opportunities for local, green jobs both for construction and for long term maintenance of the facilities. DC Water's economic analysis suggests that GI has the potential to create about 190 more local jobs over three decades than the current plan. See Appendix D of the *Long Term Control Plan Modification for Green Infrastructure* for details.

5. *Supports Sustainable DC Plan*

DC Water's GI program supports and advances the District's plan to make it the healthiest, greenest, most livable city in the nation over the next 20 years.



Sustainable DC Plan
(http://sustainable.dc.gov/)

Why is Time Needed to Implement the Hybrid GI Approach for the Potomac River and Rock Creek?

DC Water has determined that an extension of the schedule is required in order to implement the GI hybrid approach in the District's Potomac River and Rock Creek watersheds. Specifically, additional time is needed to implement GI for the following reasons:

- **Large-scale GI is new in the District.** Given the scale of such a project, time will

be needed to select GI technologies suitable for urbanized areas, address planning issues, develop agreements, and perform outreach to ensure successful GI implementation.

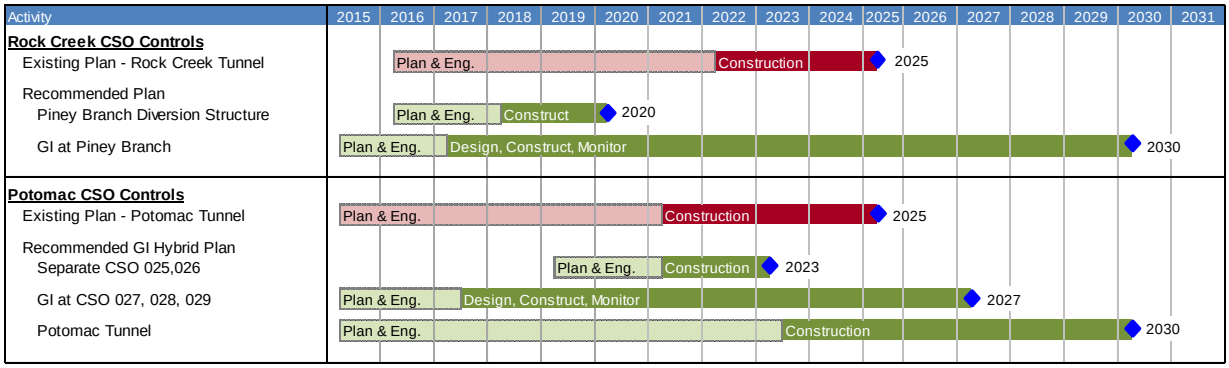
- **Adaptive Management.** DC Water will use an Adaptive Management Approach to implement GI. This means that projects will be constructed in a sequential fashion. In between construction phases, the projects will be monitored and assessed to evaluate their performance. Data collected and lessons learned during the monitoring will be used when planning and designing the next round of GI projects. This will ensure that the GI projects are practical and effective for CSO control and the betterment of the community.

Under both the existing and recommended plans, additional time will be needed to implement the Potomac Tunnel, due to the following:

- **New Federal Requirement to Prepare Environmental Impact Statement.** The development of the LTCP and the Consent Decree included a significant public process to select the CSO controls for each receiving water. Since the existing CSOs are located on National Park Service (NPS) property, and the Potomac Tunnel facilities may have a significant impact on their property, the NPS is requiring that an Environmental Impact Statement be prepared for the Potomac Tunnel. This was not envisioned when the schedule in the Consent Decree was entered in 2005. The NPS indicates that at least three years should be allowed for this process.

Green Roof at Eastside Pumping Station

- **Planning and Location Challenges.** The Potomac riverfront has changed significantly since the existing plan was finalized. The NPS has improved and completed facilities along the riverfront such as the Georgetown Waterfront Park, leaving few undeveloped or vacant sites other than valuable parkland in which to construct facilities. As a result, planning and obtaining approval for the Potomac facilities will take considerably longer than previously anticipated. DC Water's GI proposal will allow shortening the Potomac Tunnel, thereby minimizing impacts to riverfront resources such as the



Schedule Comparison – Existing and Recommended Plans

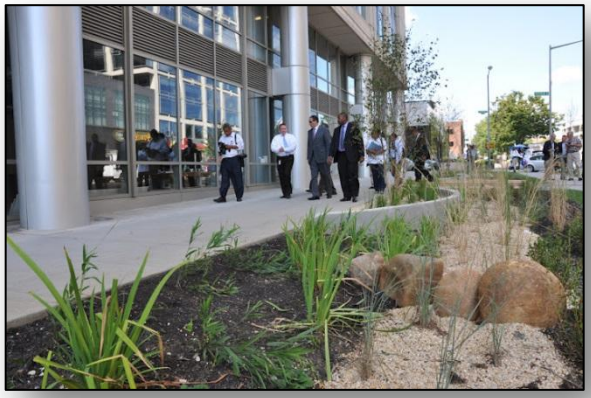
Georgetown Waterfront Park.

Together, the Environmental Impact Statement and planning and location challenges are expected to extend completion of the Potomac Tunnel beyond the 2025 deadline in the existing plan. DC Water's recommended schedule extension accounts for this anticipated extension.

- **Utility Relocation.** Experience gained on the Anacostia River Tunnel System demonstrates that up-front time is needed to identify utilities and arrange for relocation prior to tunnel and shaft construction. This increases the time required to construct the Potomac Tunnel.

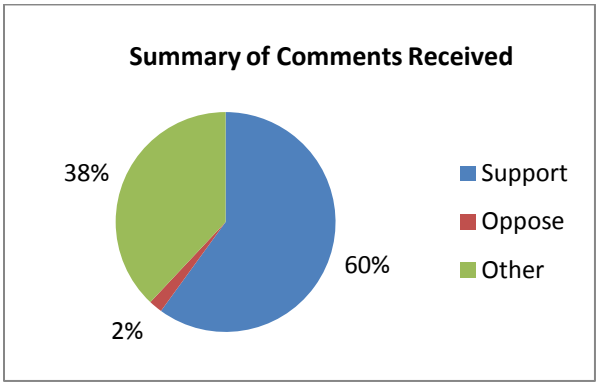
Public Comments and Responses

DC Water issued its Proposed Draft LTCP Modification to include GI in January 2014. The public comment period was open from January 12, 2014 through April 14, 2014. An extensive public outreach program was conducted to provide information about the Proposed Draft LTCP Modification and to solicit public comments. In response to the outreach, 366 commenters submitted 471 comments on the draft LTCP Modification for GI. The comments received have been bound in a separate report titled "*Public Comments, Long Term Control Plan Modification for Green Infrastructure,*" DC Water, May 2015 and a detailed response to the comments is provided in Appendix K.



Bioretention at DDOE Headquarters, 1200 First Street NE

The figure shows the disposition of the comments, with the majority of comments supporting the Proposed Draft LTCP Modification.



DC Water has made significant revisions to the draft plan in response to the comments. The key comments received and revisions to the plan are summarized below:

Nature of Commitment

DC Water's Proposed Draft LTCP Modification included committing $60 million for GI in Rock Creek and $30 million for GI for the Potomac CSOs 027, 028 and 029. This magnitude of expenditures was based on the estimated costs of the GI. A limit on the financial commitment was proposed given the uncertainties in terms of the cost to construct GI and in order to manage these risks to ratepayers. There was also precedent for a financial commitment in other enforceable documents such as New York City's order with the State of New York to construct GI.

Some commenters indicated that a financial commitment would not ensure that the

necessary amount of GI was constructed to provide the degree of CSO control required. These commenters suggested that the commitment to GI should be expressed in terms of acres of GI constructed, gallons stored, or a performance standard other than or in addition to a financial commitment.

In response to these comments, DC Water has removed the limit on its financial commitment to GI and expressed the commitment in terms of constructing sufficient GI and targeted sewer separation to manage the volume of runoff produced by 1.2" of rain falling on the number of impervious acres specified for the applicable sewershed. This is a commitment to manage a specified volume of runoff and will ensure that the necessary amount of GI is in place in order to provide the degree of CSO control required.

Feasibility/Effectiveness of GI

Some commenters indicated that GI may not be feasible to construct at a sufficient application rate to provide the degree of CSO control needed, or may not be as effective as anticipated.

Green Roof During Construction at DC Water's East Side Pumping Station

Given the lack of large scale implementation of GI in the District, DC Water has revised the LTCP Modification to provide for constructing the first GI project in the Potomac and Rock Creek sewersheds and then evaluating GI in terms of constructability, operability, efficacy, public acceptability and cost effectiveness. If, based on that evaluation, it is determined that it is impractical to complete all of the specified GI projects by the specified deadlines, then DC Water would be required to construct the gray controls as specified in the LTCP Modification. Should this occur, DC Water would be required to construct the gray controls within the same timeframe allowed for GI so there is no extension of the time allowed for implementation. If GI is determined to be practicable after the first project, then DC Water will continue to implement the remaining GI projects by the specified deadlines.

Schedule

Some commenters suggested that the seven year extension was too long and advocated for a shorter schedule. In addition, some commenters urged DC Water to accelerate individual components of the controls where feasible.

For GI, the schedule extension allows an adaptive management approach to be implemented to ensure that performance of the GI projects is optimized. Adaptive management means early GI projects will be monitored and assessed so that later projects are as practical and effective as possible. In response to comments, DC Water has evaluated the engineering, fiscal and practicality issues and has revised the modification to complete projects as early as practical. In addition, the separation at CSO 025 and 026 and Piney

Facility	Place in Operation Deadline		
	Proposed Draft LTCP Modification	Recommended Final LTCP Modification	Change
Potomac River			
1. Separate CSO 025, 026	2032	2023	9 years earlier
2. Potomac GI	2028	2027	1 year earlier
3. Potomac Tunnel	2030	2030	No change
Rock Creek			
4. Piney Branch Diversion Str. Improvements	2032	2020	12 years earlier
5. Rock Creek GI	2032	2030	2 years earlier

Branch Diversion Structure improvements have been substantially accelerated. The schedule revisions are summarized in the table above.

For the Potomac Tunnel, extra time in the schedule is needed compared to the original LTCP plan due to a new requirement to complete environmental studies, in view of the increased development in recent years along the Potomac River waterfront, and to mitigate the tremendous financial impacts on ratepayers. It is therefore not feasible to shorten the schedule for the Potomac Tunnel earlier than 2030.

Disruption due to Tunnel in Georgetown, NPS Property and Mall area

Some commenters expressed concern about potential disruption caused by tunneling, particularly in the Georgetown and National Park areas.

The Proposed Draft LTCP Modification included a 21 million gallon, approximately 4,500 foot long Potomac Tunnel to capture CSOs 020-024, a new pumping station to empty the tunnel and the addition of 75 million gallon per day of capacity at the Tunnel Dewatering Pumping Station and Enhanced Clarification Facility at Blue Plains. As part of the response to comments, DC Water has evaluated an approximately 23,000 foot long gravity Potomac Tunnel that would run from the Potomac River CSOs to connect to the Blue Plains Tunnel at Joint Base Anacostia-Bolling (formerly Bolling Air Force Base). This would eliminate the need for a tunnel dewatering pumping station for the Potomac Tunnel. This is advantageous because of the complexity of the station, the difficulty in siting such a facility in the vicinity of the National Mall area, long term operational and power requirements and costs and the need for a permanent building associated with a large deep pumping station. The alternative gravity tunnel provides substantially less disruption both

Bioretention Facility

DC Water Bioretention Facility at Irving St NW

during and after construction.

The gravity Potomac Tunnel also allows interconnecting the storage volumes of the Potomac and Anacostia River Tunnel Systems into one tunnel system, allowing any CSO on either water body access to the entire storage volume of both tunnels. DC Water's analyses have demonstrated that a 30 million gallon gravity Potomac Tunnel for CSO 020-024 connected to the Blue Plains Tunnel provides a degree of CSO control equal to the LTCP without the need to expand the Blue Plains Tunnel Pumping Station and wet weather treatment system. The gravity tunnel offers greater reliability and avoids a new pumping station, making it the recommended plan.

Stewardship for Ratepayer Dollars

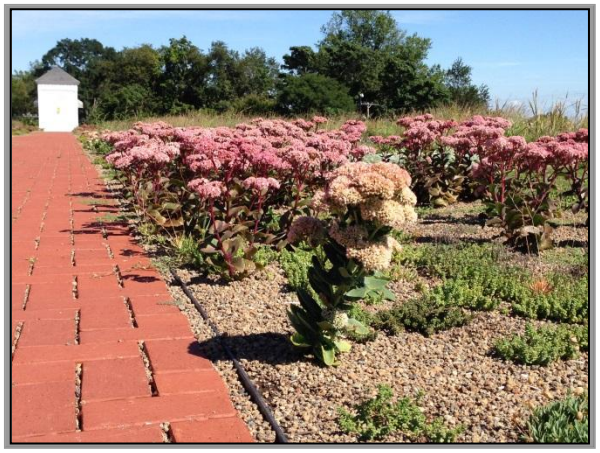
Some commenters expressed concern over affordability for ratepayers.

DC Water is acutely aware of the heavy financial burden born by District ratepayers to implement the DC Clean Rivers Project and has taken steps to both mitigate and spread out water rate increases over time. Unfortunately, this is not voluntary spending by DC Water but is mandated to comply with the Clean Water Act through a Federal Consent Decree signed by the Department of Justice, EPA, the District of Columbia and DC Water. The Final LTCP Modification will mitigate rates by extending the schedule for the Potomac Tunnel, thereby slowing the rate of increase in rates compared to what otherwise would be required.

Maintenance

Some commenters expressed the importance of maintenance in assuring the GI is effective over the long term.

DC Water will perform maintenance or will arrange for others to perform maintenance of all GI implemented to control CSOs. DC Water will be ultimately responsible to ensure that maintenance is performed adequately to maintain the CSO reduction functions of the GI. DC Water also anticipates that this will be a requirement included in its National Pollutant Discharge Elimination System (NPDES) Permit issued by EPA.



Green Roof at Ft. Reno Reservoir

Support for Green Jobs

Some commenters supported the long term economic benefits of GI, specifically the ability to make jobs more accessible to unemployed local residents. This is especially true considering labor required to construct the facilities, as well as that required for long term maintenance.

GI will increase opportunities for local, green jobs both for construction and for long term maintenance of the facilities. DC Water will work to promote green jobs with a living wage for District residents. Activities may include establishing a certification program for GI jobs, partnering with organizations to provide training that ultimately leads to certification, conducting outreach in the District and partnering with local organizations.

Where Can I Obtain More Information?

More information is available on DC Water's website at www.dcwater.com/green or by contacting DC Water's Office of External Affairs at (202) 787-2200.