Delaware County Regional Water Quality Control Authority (DELCORA)
CSO Long Term Control Plan Update

PUBLIC BRIEFING DOCUMENT

September 2018

GREELEY AND HANSEN

This document provides a summary of the DELCORA Recommended Long Term Control Plan to address Combined Sewer Overflows in Chester, Pennsylvania where necessary. Also covered in the summary are the following key issues: (1) an overview of the DELCORA System and Wet Weather Issues, (2) a summary of progress to date, (3) response to public comments to date, (4) review of sensitive areas, (5) the range of alternatives considered, (6) DELCORA's recommended overflow control plan, (7) the implementation schedule and, (8) post construction monitoring of the overflow control program.

Overview of the DELCORA System

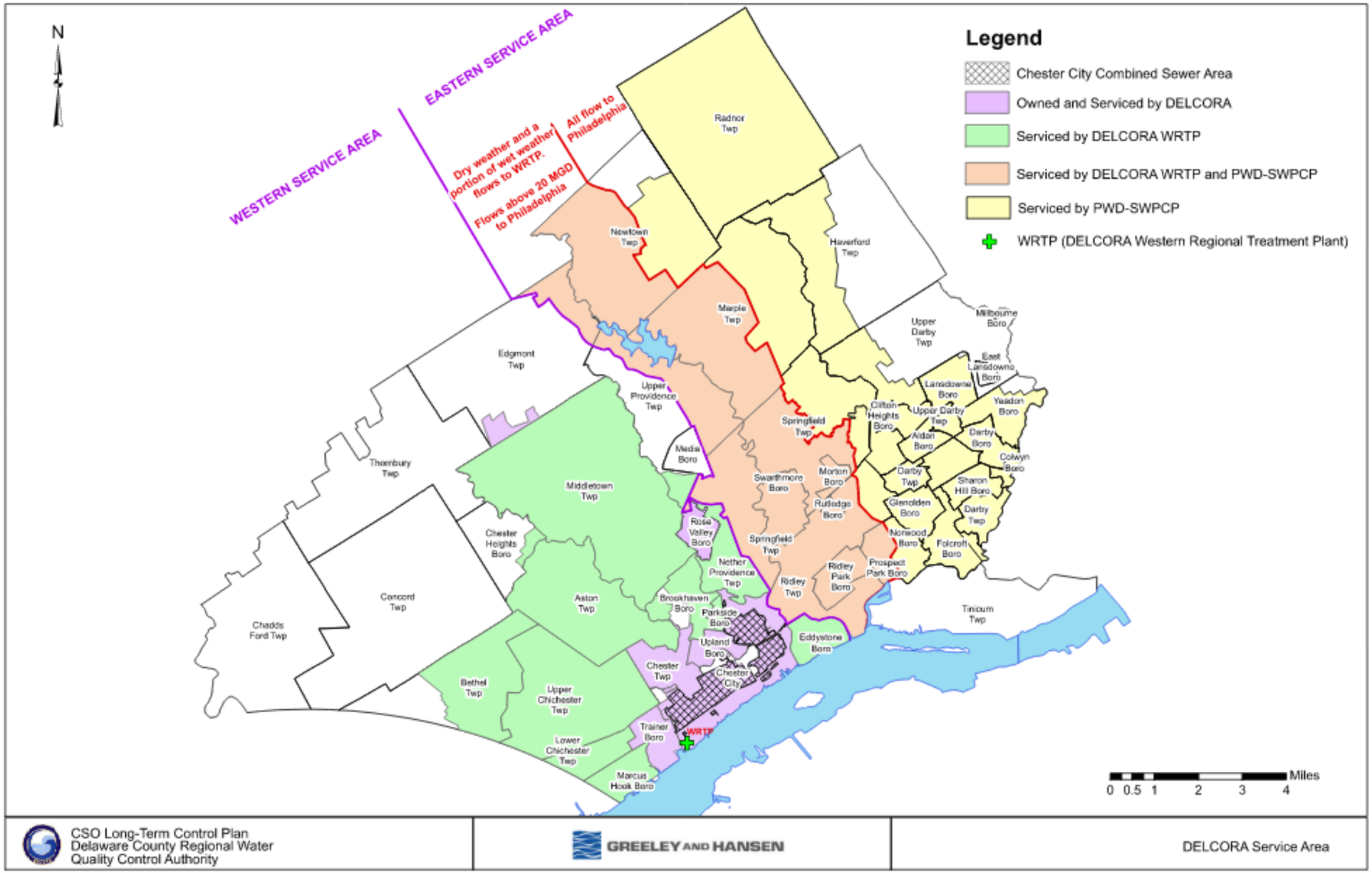
The DELCORA service area comprises two distinct areas. The first is the "DELCORA Owned" area, where DELCORA owns and operates all sewer infrastructure. The second is the "DELCORA Contracted" area where the communities served continue to own and/or operate their sewer collection and conveyance infrastructure while delivering flows to DELCORA for treatment. DELCORA does not own facilities in the "DELCORA Contracted" Area.

A map of the DELCORA service area is shown on the next page. Flows in the Eastern Service Area are treated at the Philadelphia Water Department Southwest treatment plant. All other DELCORA service areas send flow through Chester to the DELCORA Western Regional Treatment Plant located in Chester, Pennsylvania. Most of the DELCORA service area has separate storm and sanitary sewers. There is a relatively small area where stormflows and sanitary wastewater are collected in the same combined sanitary and stormwater conveyance sewer. There are 25 permitted combined sewer overflow locations in Chester where combined stormwater and sanitary wastewater can discharge (overflow) into Ridley Creek, Chester Creek and the Delaware River during wet weather. These are called combined sewer overflows (CSOs). The combined flow shares conveyance piping to the treatment plant with the upstream separate sanitary areas, and restrictions into this shared conveyance piping contribute to CSOs. In a typical year, these CSOs average about 36 discharges a year, with half of the CSO outfalls activating more than 43 times a year. In addition, during less frequent, relatively large rainfall events, there are overflow locations in the separate sewer areas where the collection system can be overwhelmed with a combination of sanitary wastewater and stormwater that has leaked into the separate sewer system.

Addressing Wet Weather Issues: The Current Situation

During moderate and large rainstorms, CSOs occur in the combined sewer area shown on the map above. In large storms, flows from the separate areas completely fill the conveyance system in the CSO area, and may on occasion fully utilize or exceed the capacity of the wastewater treatment plant. Under these conditions, the combined area flow delivered to the DELCORA treatment plant is greatly reduced or stopped by CSO regulator devices that restrict flow. The combined area flow rates to the conveyance system are controlled to allow most of the separate area flows to be delivered for treatment. However, even with these CSO regulator controls limiting the combined flow entering the system, some separate area flows escape the system, causing sanitary sewer overflows.

Monitoring and modeling of Ridley and Chester Creeks indicate that these creeks often do not meet water quality standards for recreation. Monitoring and modeling also show that the Delaware River meets recreational standards most of the time. The vast majority of the contamination in the creeks and Delaware River in the service area comes from sources outside of DELCORA's CSOs. These waters would not meet standards even if the CSOs were removed. The CSOs by themselves do not prevent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EASTERN SERVICE AREA
WESTERN SERVICE AREA
Dry weather and a portion of wet weather flows to WRTP.
All flow to Philadelphia
Flows above 20 MGD to Philadelphia
Legend
Chester City Combined Sewer Area
Owned and Serviced by DELCORA
Serviced by DELCORA WRTP
Serviced by DELCORA WRTP and PWD-SWPCP
Serviced by PWD-SWPCP
WRTP (DELCORA Western Regional Treatment Plant)
Radnor Twp
Newtown Twp
Haverford Twp
Marple Twp
Upper Darby Twp
Millbourne Boro
East Lansdowne Boro
Lansdowne Boro
Yeadon Boro
Clifton Heights Boro
Aldan Boro
Darby Boro
Colwyn Boro
Darby Twp
Sharon Hill Boro
Glenolden Boro
Norwood Boro
Folcroft Boro
Prospect Park Boro
Ridley Park Boro
Ridley Twp
Springfield Twp
Rutledge Boro
Swarthmore Boro
Morton Boro
Rose Valley Boro
Nether Providence Twp
Upper Providence Twp
Media Boro
Edgmont Twp
Thornbury Twp
Middletown Twp
Chester Heights Boro
Concord Twp
Chadds Ford Twp
Aston Twp
Brookhaven Boro
Parkside Boro
Upland Boro
Chester City
Chester Twp
Eddystone Boro
Tinicum Twp
Bethel Twp
Upper Chichester Twp
Lower Chichester Twp
Trainer Boro
Marcus Hook Boro
WRTP
Miles
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DELCORA Service Area

(preclude) meeting water quality standards. However, even though controlling CSOs alone will not fully address the problem, DELCORA is moving forward to address overflows from both the combined and separate areas to reduce pollution and prepare for a time in the future when the other pollution loads are better controlled.

While not a part of this long-term control plan, DELCORA and the municipal authorities it serves face significant challenges with its Eastern Service Area. The cost of providing service to this area has the potential to rise significantly in the near future.

Addressing Wet Weather Issues: Progress to Date

DELCORA developed a long-term control program to address CSOs in 1999. The Pennsylvania Department of Environmental Protection (PADEP) approved this previous program. Since that time and in addition to operating expenses, approximately $150M in capital investment has been made to the system to increase the amount of combined and separate area flow treated by DELCORA. These projects have included upgrades to the collection and conveyance system pipes, repair of damaged pipes to prevent additional water from leaking into the system, expanded and new pump stations, and increased capacity at the DELCORA wastewater treatment plant. DELCORA has conducted extensive flow monitoring and water quality receiving stream monitoring throughout the DELCORA service area, both in the DELCORA Serviced and DELCORA Owned areas. Based on this monitoring, it has been determined that there are collection system improvements that are needed in the separate areas in addition to what is recommended to address the CSOs in Chester.

In addition to the capital improvements for wet weather control, DELCORA continues to comply with requirements to invest and implement the Nine Minimum Controls (NMCs), which are best management practices designed to reduce CSOs and their effects on receiving water quality. One example of an existing NMC is an ongoing 10-year inlet replacement program to help screen debris and prevent it from entering the collection system. DELCORA provided $75,000 a year for 10 years to the City of Chester, which in turn installed this control. Another example is DELCORA's implementation of public outreach, which includes periodic mail notifications.

Addressing Wet Weather Issues: Public Comments and Sensitive Areas

The term "Sensitive Areas" is specifically defined under federal law as areas including Designated Outstanding National Resource Waters, National Marine Sanctuaries, waters with threatened or endangered species and their habitat, waters with primary contact recreation, public drinking water intakes or their designated protected areas, and shellfish beds. After study and evaluation, it has been determined that no sensitive areas as defined by federal law need to be addressed by the DELCORA plans in the Chester and Ridley Creeks or in the Delaware River. However, DELCORA conducted public outreach and three prior public meetings during the development of this plan that identified areas of special concern to the public which comprises the Chester Riverfront and specifically the boat ramp at

Flower Street. As described below, the DELCORA recommended plan makes this area a high priority for CSO control.

CSO Control Technologies

DELCORA conducted a comprehensive alternatives analysis to identify and evaluate a wide range of options for applicability to our local conditions. This included the type of control provided, the cost, the impact on the community, the ancillary benefits, and more.

DELCORA evaluated over 50 traditional and innovative sewer overflow control technologies including:

- Source Control/Green Infrastructure
- Sewer Separation
- Conveyance to the Treatment Plant
- Storage in the System
- System Control Improvements

Source control/green infrastructure reduces the amount of rainwater getting into the sewers by reducing impervious areas (like streets and roofs) by planting trees, grasses and other vegetation. It can also include pervious materials that allows rainwater to pass through pavement. On private property, it can include raingardens, the disconnection of downspouts, areaway drains, and sump pumps from the sewer system.

Sewer separation involves installing either a new sanitary sewer system or a new stormwater sewer system in the combined sewer area where only one combined pipe currently exists in the street. With complete separation using a new sanitary pipe, each individual sanitary connection must be connected to the new sewer. In addition, separation on private property to remove downspouts, areaway drains and sump pumps is typically required. If a new stormwater pipe is utilized instead of a new sanitary line, it is possible to provide more economical and less disruptive partial separation by connecting only the streets inlets to the new storm sewer.

Conveyance to the treatment plant involves greatly expanding the existing conveyance capacity through pipes or tunnels and expanding the wastewater treatment plant to accept the greatly increased peak wet weather flow.

Storage tanks can also be built up in the combined area to capture flow in tanks that would otherwise overflow to surface waters. The captured combined wastewater is typically drained back into the system for treatment over a period of days following the wet weather event.

System control improvements include a wide range of improvements to the existing conveyance system. These can include raising overflow weirs in the CSO regulators or installing controls so CSO discharges are delayed until the pipes downstream are full. There are a number of bottlenecks in the system where capacity exists above and below the bottleneck. Removing the bottlenecks with system control improvements allows more flow capacity to be delivered to the treatment plant, thereby reducing overflows.

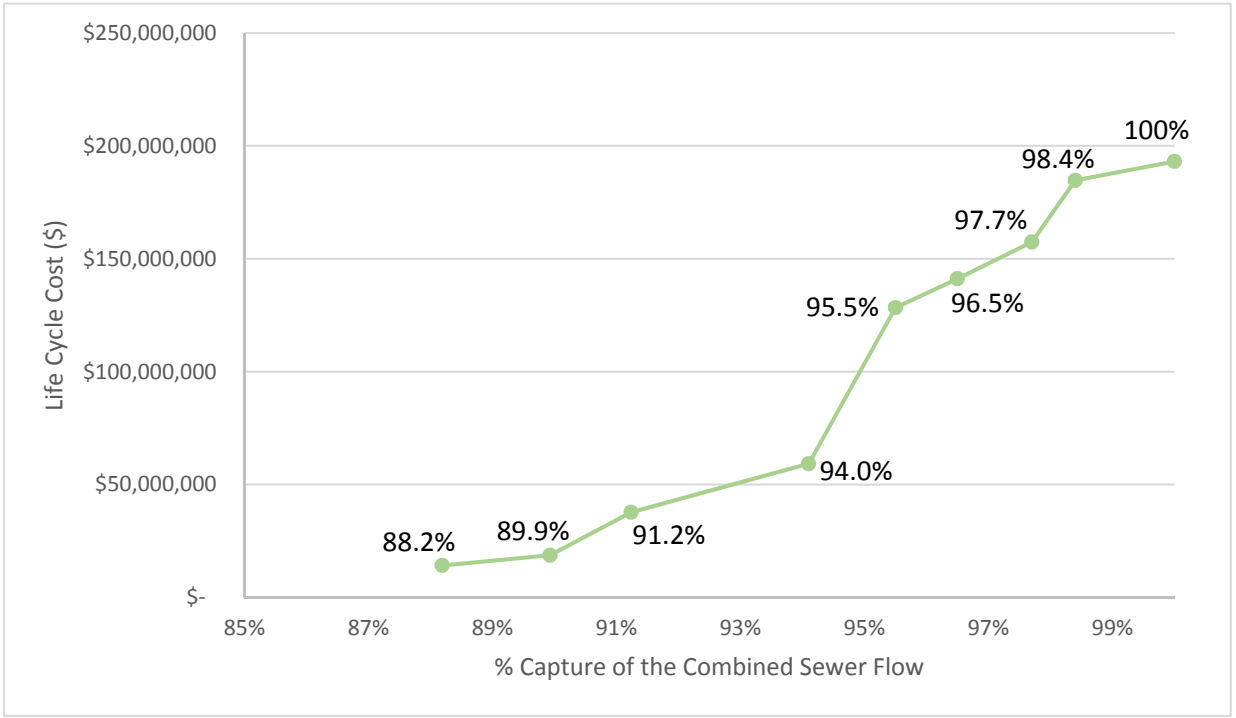
Alternatives Analysis

DELCORA examined 15 combined alternatives that utilized all five categories of the technologies described above. One alternative examined the use of subsurface tanks. These tanks would store combined flows that would otherwise discharge to the surface waters, and release it back to the combined sewer system when the pipes can handle additional flow. Another alternative examined using deep underground tunnels. These two alternatives were examined further by incorporating green infrastructure to reduce tank sizes. Making improvements to the treatment plant and maximizing the combined flow conveyance was another alternative, as was complete sewer separation for the entire combined sewer system.

The remaining 9 alternatives all use system control improvements called regulator modifications, with the added technologies described above located in strategically targeted areas. Regulator modifications are meant to move water into available spaces in the sewer system instead of discharging to surface waters. Regulator modifications can be adjusted to find the appropriate increase in flow to the treatment plant without overwhelming the pipe system.

The alternatives were evaluated in a cost vs. performance comparison called a “Knee-of-the-Curve” graph, where the alternative Life Cycle Cost (initial construction cost with 20 years of operation and maintenance) is plotted for each CSO capture percentage. This method allows identification of the alternative beyond which each dollar spent has less improvement than the previous dollars. In other words, the point where spending more money provides less benefit for the additional investment.

Knee of the Curve Graph of Evaluated Alternatives



The alternative with 88.2% control exceeds the control required under Federal CSO policy (85%). Increasing the control to 89.9% is slightly less cost effective, requiring more investment, but providing slightly higher CSO capture. This trend of slightly lower cost-effectiveness continues as the level of control increases to 91.2% and to 94%, but there is a significant increase in cost after the alternative providing 94% capture. Going beyond 94% provides much less capture for the increased cost. While not as cost effective as the 88% control, the 94% alternative still provides good public benefits for the additional investment. Any further increases in capture from the 94% alternative comes with sharply increased costs, and the additional capture gained may not be as justified as the previous cost increases. DELCORA will pursue the 94% level of control because in addition to meeting regulatory requirements and providing a higher level of control for the public good, it can be implemented to better address the boat dock/river front areas that were raised by the public as important areas impacted by CSOs.

To have a regulatory margin of safety, while targeting 94% wet weather capture in the design year, DELCORA's regulatory performance measure will be a wet weather capture of greater than or equal to 90% of system wide wet weather flow in the design year.

Recommended Plan

DELCORA's recommended plan comprises of the three elements described below. Minimizing community impacts is one of the cornerstones and key benefits of the Recommended Plan. However, DELCORA's plan will likely trigger some public and private impacts from construction/implementation activities. There will be some re-purposing of public land, a need for rights of way, and potentially the need for some land now in private ownership. Nevertheless, these impacts are expected to be relatively minor in comparison to other similar programs.

Regulator Control Improvements

DELCORA identified 19 locations in the existing collection system where modifying CSO regulator weirs, orifices, gates, and outflow pipes pushes more water into the conveyance piping, while also utilizing upstream pipes as temporary storage. These improvements increase the level of system wide annual average wet weather flow capture to 88%. This level of capture exceeds Federal Clean Water Act requirements under United States Environmental Protection Agency's (USEPA) "presumption" approach.

Targeted Overflow Reduction

While the regulator control improvements meet the presumption approach requirements, monitoring and modeling indicate that the frequency and volume of CSOs are exacerbated by excessive peak flows from the separate sewer areas. These separate area flows can be addressed cost-effectively by adding to the prior improvements with the following additional controls:

- Multiple locations for green Infrastructure, with currently identified areas in Widener University's campus, between Providence Ave and Upland Street, on Edgemont Avenue north of I-95, Crozier Street, and other viable areas[1].
- Partial sewer separation of the neighborhood upstream of Veterans Memorial Park.
- Improving flow to bottlenecks in conveyance piping along the Delaware River by adding to, extending, and rehabilitating the existing piping.
- Installing a storage tank near the Taylor Arboretum to address capacity issues in the Ridley Interceptor[2].
- Public outreach to inform the general public about the status of the DELCORA system.

Each of these CSO control technology projects have specifically targeted effects to improve reduce overflow in the DELCORA service area. For example, the removal of the noted sewer bottlenecks significantly increases the peak wet weather flows that can be delivered to the wastewater plant. These controls will also significantly reduce the impact on the Boat Ramp on the Delaware River.

As a result of delivering greater peak wet weather flows to the treatment plant through the regulator control improvements and these targeted overflow reduction projects, the current capacity of the treatment plant would be exceeded about 3 times in the design year. While these flows could be discharged out the combined system, two other CSO control technologies will be included with these targeted projects. It will be necessary to install some real-time motor operated valves and controls in the regulators and conveyance system to provide confidence that this increased flow does not back up into homes or deliver so much flow to the treatment plant that it cannot be handled. In the event these real-time controls cannot address these flows, the DELCORA treatment plant will be modified to provide excess flow wet weather treatment. Excess flow wet weather treatment will include screening to remove trash and grit settling, (settling of solids and removal of floatables). This treated excess wet weather flow will be discharged out the existing CSO located adjacent to the plant. This partially treated flow will not increase the frequency of overflows at this CSO. This approach will simply capture more flow for partial treatment a few times in a typical year, whereas the flow would otherwise be discharged out of a CSO outfall without any treatment.

[1] In addition to the specific Green Infrastructure Project in the (CSO 18 & CSO 19) Neighborhoods, DELCORA anticipates funding additional Green Projects where such projects contribute to the cost-effective reduction of overflows.

[2] The location of this tank has not been determined and will be open to public comment after more study is completed and before implementation

Adaptive Management

The previous two parts address the Clean Water Act Requirements for CSO and attain a CSO annual average system wide wet weather capture of 90% or higher. In addition, although not required, the average occurrence across all 25 CSOs is reduced to less than 15 per average year with some having more and most having fewer. The expected results meet the necessary requirements, but additional monitoring is still planned by DELCORA, especially in locations with CSOs that may continue at a higher frequency. Two areas with overflow frequency concerns include the Hancock Street and Sun Drive overflow on Ridley Creek which is estimated to overflow about 41 times per typical year and the 14th Street and Arbor Drive overflow on Chester Creek which will overflow 35 times per average year with the targeted overflow reduction projects installed.

DELCORA plans to conduct post construction monitoring, after the regulator control improvements and targeted overflow reduction projects are completed. These projects will be monitored to determine if they are operating as intended, and the Clean Water Act and community goals are met. If this post construction monitoring indicates more investment or actions are needed, those investments and actions will be evaluated and a supplemental control plan will be developed for review and approval by the PADEP. Special attention to locations with higher frequencies of activation will be evaluated during this post construction monitoring period and based on results, DELCORA will continue to examine sewer system optimization through additional monitoring and potentially using real time control to further reduce the frequency at these overflow points. Further measures will be implemented to the modeled area as necessary, depending on the technologies' performance, and will include a schedule that takes into the account the modeled area's financial capability at that time.

The estimated life cycle costs in millions of dollars for the improvements mentioned are listed in the table below.

Regulator Control Improvements	Millions $ (July 2018)
Regulator Modifications	$ 14.2
Targeted Overflow Reduction	
Parallel Delaware River Interceptor	$ 3.6
WE Interceptor Rehab & Extension	$ 2.5
CSO-5 Partial Sewer Separation	$ 4.5
CSO 18 & 19 Green Infrastructure	$ 11.8
Arboretum Tank	$ 10.0
Monitoring and Modeling	$ 5.0
Public Outreach	$ 3.0
Plant Expansion/Upgrade	$ 28.8
Real-Time Control	$ 2.9
Adaptive Management	
Adaptive Management Estimate	$ 10.0
Program Operation Costs	$ 5.0
Total	$ 101.3

Implementation

With regulatory approval, the Regulator Control Improvements can proceed with the current and anticipated finances available to DELCORA. Targeted Overflow Reduction implementation is dependent on a number of factors including the following:

- Upstream communities' excessive infiltration and inflow into leaking pipes can be affordably addressed;
- DELCORA's Eastern Service Area costs do not upset Chester's financial capability to implement its share of these wet weather controls;
- Excess flow wet weather treatment as recommended at the DELCORA treatment plant to obtain over 90% capture, is approved by PADEP and USEPA.

If the above factors can be addressed, it is anticipated that the Regulator Control Improvements can begin implementation immediately and the Targeted Overflow Reduction projects can be fully implemented within the next 10 years.

All Elements of the program will be evaluated as the program progresses in an adaptive management approach where the program may be adjusted as monitoring and modeling show cost-effectiveness. The implementation schedule will be examined as an on-going part of the adaptive management program.

While not a direct component of the CSO Long-Term Control Plan, Federal and State law also require DELCORA to address peak excess flows in the sanitary systems. Such flows can cause sanitary sewer overflows, local sewer surcharging, and impact downstream users of the sewer system. Consistent with PADEP and USEPA requirements, DELCORA will continue a program to identify such peak excess flows and support other municipalities in the sanitary sewer systems.

DELCORA's plans involve actions within two areas:

- Addressing CSO controls in its owned and contracted service areas
- Addressing the cost of the Eastern Service Area treatment provided by Philadelphia Water

Given the localized nature of these issues, State oversight of program implementation clearly would make the most sense. DELCORA plans to propose this implementation approach to both PADEP and USEPA for their consideration.

END OF PUBLIC BRIEFING DOCUMENT

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