THE CITY OF
COLUMBUS
MICHAEL B. COLEMAN, MAYOR

DEPARTMENT OF
PUBLIC UTILITIES

City of Columbus Department of Public Utilities

The Integrated Plan and 2015 WWMP Update Report

September 15, 2015

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COLUMBUS
Clean streams.
Strong neighborhoods.

CITY OF
COLUMBUS, OHIO
DEPARTMENT OF PUBLIC UTILITIES
DIVISION OF SEWERAGE AND DRAINAGE

THE CITY OF COLUMBUS' INTEGRATED PLAN
AND
2015 WWMP UPDATE REPORT

SEPTEMBER 15, 2015

ARCADIS
100 EAST CAMPUS VIEW BLVD., SUITE 200
COLUMBUS, OHIO 43235

September 15, 2015

Mr. Craig W. Butler, Director
Ohio Environmental Protection Agency
50 W. Town Street, Suite 700
Columbus, Ohio 43215

Dear Director Butler:

In 2005, the City submitted its Wet Weather Management Plan (WWMP) to Ohio EPA. The WWMP was intended to bring the City into compliance with its consent orders regarding the City's sewer overflows. The WWMP proposed extensive new infrastructure that would allow the City to control combined sewer overflows (CSOs) and eliminate sanitary sewer overflows (SSOs).

In the 10 years since the WWMP was submitted, significant progress has been made. The City has spent over one billion dollars towards implementing the WWMP and has dramatically reduced sewer overflows, in particular CSOs.

In 2012 and 2013, the Ohio EPA agreed that the City could reanalyze the remaining components of the WWMP. This reanalysis was warranted in light of new emerging technologies, such as green infrastructure. Additionally, the USEPA provided more flexibility to communities with its Integrated Planning Framework. In particular, the City was concerned that building 28 miles of tunnels to eliminate SSOs was of questionable value, because SSOs are such a small volume of overflows compared to CSOs. The proposed tunnels would cost approximately $2 billion and only be used 4 or 5 times a year.

This Integrated Plan and 2015 WWMP Update Report are the result of that reanalysis. Pursuant to our agreement with Ohio EPA, this report provides two plans for achieving compliance with our two consent orders. The first is an integrated plan that meets the requirements of USEPA's Integrated Plan Framework. The second is an update of the 2005 WWMP. Also, in accordance with our agreement with Ohio EPA, the City evaluated both plans on the original schedule from the WWMP, 40 years from 2005, and on schedules that are 5, 10 and 15 years faster.

The City is requesting that Ohio EPA allow it to proceed with the integrated plan, which we refer to as Blueprint Columbus. In addition, the City is requesting that Ohio EPA approve a schedule that is **10 years shorter** than the original plan.

The City's recommended plan, Blueprint 2035, has many advantages.

It is faster and cheaper. The 2005 WWMP included a 40 year schedule, meaning that the improvements would not be completed until 2045. As a result of the reanalysis, which included more sophisticated modeling technology, the City discovered far less infrastructure was needed to meet the requirements of the original consent orders. If the City were to proceed with implementing the 2005 WWMP, it will have to spend $2.5 billion over the next thirty years. Instead, the City is proposing to implement Blueprint Columbus, which will cost $1.8 billion over 20 years and achieve the same or even better results.

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It is greener. Blueprint Columbus will be significantly better for the environment than the original plan because of the green infrastructure contained in the improvements In fact, as previously noted, the City has already dramatically reduced CSO overflows. Both the WWMP and Blueprint will eliminate the remaining overflows, but Blueprint will also improve stormwater discharges, resulting in better water quality.

It is more affordable. Even with the accelerated schedule the City will be able to manage rate increases. Unlike the 2005 WWMP, the Blueprint plan should not create any double digit rate increases.

It is more innovative. One of the most exciting aspects to Blueprint is its creativity. Sanitary sewer overflows occur when rainwater gets into the sewer and overwhelms it. The WWMP and all traditional plans just treat the symptom – too much water in the sewers – by building larger pipes. Blueprint attacks the root problem by addressing the rain water that is entering the sewer system. Instead of building more infrastructure, Blueprint will invest in rehabilitating and correcting existing infrastructure.

It is better for our neighborhoods and our local economy. Blueprint will create neighborhood amenities. For instance, in the Clintonville pilot area, the City is proposing to build a porous pavement street, which will include a sidewalk. In the Barthman-Parsons pilot area, the City is building a park, , rain gardens and a porous pavement basketball court. Blueprint will also create more jobs and have a greater impact on our local economy.

It is what our community wants. The City has done significant public outreach as part of this planning effort. This includes an advisory panel, focus groups, canvassing surveys and educational events. While many residents are concerned about rates, once it is explained that there is "no do-nothing" alternative, the community is over-whelming in support of Blueprint. As the Dispatch opined, "If the city of Columbus has to spend $2.5 billion to stop stormwater from overwhelming sanitary-sewer lines, getting the job done by turning roadside strips, vacant lots and patches of park into grassy rain gardens is far more appealing than building 28 miles of underground tunnels that would sit empty all but a few days per year." Columbus Dispatch Editorial, March 19, 2014.

We look forward to working with you to obtain approval of the Blueprint Columbus plan.

Sincerely,

Michael B. Coleman
Mayor

Table of Contents

Table of Contents

Table of Contents

Page		Section

Table of Contents

List of Appendices

List of Exhibits

List of Exhibits (continued)

List of Exhibits (continued)

List of Exhibits (continued)

List of Worksheets

List of Tables

List of Tables (continued)

List of Figures

List of Figures (continued)

List of Abbreviations

A

ART	Alum Creek Relief Tunnel

C

CAP	Community Advisory Panel
CEPT	Chemically Enhanced Primary Treatment
CMOM	Capacity, Maintenance, Operations and Management
CSA	Contract Service Area
CSO	Combined Sewer Overflow

D

DOSD	Department of Sewerage and Drainage
DPU	Department of Public Utilities
DSR	Designed Sanitary Relief

F

FCA	Financial Capability Assessment
FMPV	Full Market Property Value

H

HGL	Hydraulic Grade Line
HRT	High Rate Treatment

I

I/I	Inflow and Infiltration

J

JPWWTP	Jackson Pike Wastewater Treatment Plant

L

LOS	Level of Service
LOT	Lower Olentangy Tunnel
LSSS	Large Scale System Strategy
LTCP	Long Term Control Plan

M

MG	Million Gallons
MGD	Million Gallons per Day
MHI	Median Household Income
MS4	Municipal Separate Storm Sewer System
MSA	Metropolitan Statistical Area

N

NFA	No Feasible Alternatives
NPDES	National Pollutant Discharge Elimination System

O

O&M	Operation and Maintenance
OARS	Olentangy Scioto Interceptor Sewer Augmentation and Relief Sewer
Ohio EPA	Ohio Environmental Protection Agency
Ohio RC	Ohio Revised Code
OMI	Olentangy Main Interceptor
ORT	Olentangy Relief Tunnel
OSIS	Olentangy Scioto Interceptor Sewer

P

PATC	Pilot Area Technical Committee
POTW	Publicly Owned Treatment Works

R

RI	Residential Indicator

S

SECAP	System Evaluation and Capacity Assurance Plan
SSES	Sewer System Evaluation Study
SSO	Sanitary Sewer Overflow
STORMS	State of Ohio Rain Monitoring Systems
SWMM	Storm Water Management Model
SWMM5	Storm Water Management Model, Version 5
SWWTP	Southerly Wastewater Treatment Plant

T

TMDL	Total Maximum Daily Load

U

USEPA	United States Environmental Protection Agency

W

WIB	Water In Basement
WSST	Whittier Street Storm Tank
WWMP	Wet Weather Management Plan
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

THE CITY OF
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MICHAEL B. COLEMAN, MAYOR

DEPARTMENT OF
PUBLIC UTILITIES

The Integrated Plan and
2015 WWMP Update Report

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EXECUTIVE SUMMARY

Executive Summary

In accordance with the Ohio Environmental Protection Agency's (Ohio EPA's) January 24, 2013 letter, the city is submitting this integrated plan and 2015 Wet Weather Management Plan (WWMP) Update Report. This report includes the following elements from the city's August 12, 2012 letter to the Ohio EPA:

- An integrated plan, branded "Blueprint Columbus" that follows the United States Environmental Protection Agency's (USEPA's) integrated planning memo and "general accountability considerations for green infrastructure"
- Revised WWMP schedule, branded the "gray plan" or "2015 WWMP"
- An affordability analysis consistent with the Ohio EPA's 2009 approval letter
- A comparison of plans for water quality advantages
- Proposed milestones and schedules
- Storm Water Management Model (SWMM) system-wide modeling results
- Results of public outreach
- Results of suburban outreach

REGULATORY AND FUNCTIONAL REQUIREMENTS

The main regulatory driver of this plan is the city's consent orders with the Ohio EPA:

Sanitary Sewer Overflow consent order

Consent order with the Ohio EPA, created to ensure that the city took all feasible steps to stop and mitigate the impact of sanitary sewer overflows (SSOs) and water in basement events (WIBs), as well as to provide adequate capacity to convey and treat base and peak flows for all parts of the collection system.

Combined Sewer Overflow Consent Order

Consent order with the Ohio EPA, created to ensure the city completes specific milestones to address discharges from any overflows or outfalls identified as combined sewer overflows (CSOs) within the system.

CURRENT SYSTEM PERFORMANCE (2015)

The city of Columbus' collection system is made up of three types of sewers: sanitary, combined and storm. Sanitary and combined wastewater is conveyed to one of two treatment plants: the Southerly Wastewater Treatment Plant (SWWTP) or the Jackson Pike Wastewater Treatment Plant (JPWWTP). Storm sewers convey stormwater to nearby streams and rivers in accordance with municipal separate storm sewer system (MS4) best management practices.

The combined sewer system is the oldest part of the system, located in the downtown and university areas. Two storage tank facilities provide extra capacity during periods of high flow, but the system often becomes overloaded during periods of heavy flow. To provide relief, the system has built-in overflows (CSOs), which discharge combined sewage directly to surface waters without treatment. Since 2005, three CSOs out of 32 present in 2005 have been completely eliminated, and CSO discharges have significantly decreased. To increase storage capacity and further minimize CSO discharges, the city is currently constructing the Olentangy Scioto Interceptor Sewer Augmentation and Relief Sewer (OARS), a deep tunnel capable of storing 60 MG (million gallons).

Storm sewers convey flow from rainwater and snowmelt directly to nearby surface waters without treatment. Keeping this flow out of the wastewater collection system reduces the size required for treatment plants and conveyance infrastructure.

Sanitary sewers are designed to only convey wastewater, but are subject to inflow and infiltration (I/I). During large storms, I/I causes high flow in sanitary sewers. Designed sanitary relief structures (DSRs) function to prevent overloading and sewage backups by allowing flow to leave the sanitary system. These discharges are considered SSOs if caused by high I/I. Since 2005, 21 of the 90 DSRs present in 2005 have been eliminated, and the total number of releases has decreased.

The two treatment plants are capable of treating flow through physical, chemical and biological treatment processes to remove pollutants from wastewater. In 2005, the plants' combined total capacity was 302 million gallons per day (MGD). Major renovations since that time have increased the combined capacity to 480 MGD currently. By 2020, the SWWTP will have a chemically enhanced primary treatment (CEPT) train, capable of providing enhanced primary treatment for up to 110 MGD. This option would be utilized after normal treatment systems are at full capacity, in order to prevent bypassing raw or screened sewage directly to surface waters. Wastewater is only bypassed when there are no other feasible alternatives.

In addition to flows from the city of Columbus service area, regional flows come from the city's contract service areas (CSAs). These 25 communities do not currently have restrictions on flow or excessive I/I, but are required through the Ohio EPA Director's Final Findings and Orders (DFFO) to develop a sewer system evaluation study (SSES) to identify whether or not excessive I/I is present and to recommend ways to address any issues identified.

PUBLIC PARTICIPATION

During the development of the integrated plan, Blueprint Columbus, the public was solicited for feedback and included in decision-making to make sure stakeholder viewpoints were considered and to fully incorporate diverse points of view. This effort included two main components:

- Community-wide engagement process: branding, market research, determining how to reach a representative sample of each community and engagement activities.
- External advisory group – Community Advisory Panel (CAP)

The results of the community-wide engagement process and the external advisory group have been overwhelmingly positive in support of Blueprint Columbus.

MODELING

A collection system model built in SWMM was utilized to determine the improvements needed to meet the previously approved level of service (LOS) in the city's collection system. This entire-system model contains all elements of the collection system, including sewers (8-inch sewers and larger within Blueprint areas, 12-inch and larger for all other areas), manholes, storage structures, weirs, bypasses, overflow points, etc., including detailed information such as slope, elevation, length and roughness.

In order to identify the portions of the system with limited capacity or anticipated capacity problems in the future, a base condition was developed for comparison purposes. This condition was based on the 2025 physical collection system condition and the 2050 future population and land development condition.

The model captures detailed hydrologic and hydraulic information at the parcel level, producing robust predicted flow calculations, collection system runoff and I/I numbers. The chosen technique utilizes the USEPA Storm Water Management Model Version Five (SWMM5) groundwater module to predict I/I from various sources. The physically based setup represents the complex hydrological cycle, including filling depression storage, evapotranspiration, runoff generation and groundwater infiltration into aquifers. By splitting service areas into sub-catchment features that correspond to various I/I sources, the user can model the entire hydrological cycle and accurately model back-to-back storms.

The collection system model was calibrated against a total of 147 flow meters. If sufficient data was available, meters were calibrated using two to three years of continuous flow data. Typically, 20 to 30 wet weather response events were used as a basis of comparison to check the calibrated model.

BLUEPRINT COLUMBUS

Blueprint Columbus is the integrated plan to address SSOs, WIBs and stormwater quality by removing I/I from the system, allowing the system to function properly without backing up. The four pillars of Blueprint Columbus include the following:

LATERAL REHABILITATION

Prevents I/I from private properties from entering sewers. Previous studies conducted by the city indicate that lining residential laterals can reduce I/I by 30%.

ROOF REDIRECTION

Directs water from rooftops to the curb or to private lawns at least seven feet from the buildings, instead of directly to sewers or to foundation drains.

SUMP PUMPS

Prevents water near home perimeters from entering foundation drains, which are typically connected to sanitary sewers in older homes.

GREEN INFRASTRUCTURE

A solution for city-owned properties or right-of-ways to improve stormwater quality while allowing water to drain through the soil in otherwise impervious areas, reducing total runoff quantity. In addition, green infrastructure improves water quality, improves quality of life in neighborhoods and creates local jobs.

In order to solve issues on private properties, the city analyzed the legal criteria required to ensure it has the capability to address such issues and concluded the city's efforts to maintain its sewer system, and thereby protect the public from harmful exposure, falls within its police powers. In addition, the city has a strong factual basis for its private I/I removal program, ensuring it is both reasonable and not arbitrary. The program is supported by the robust comprehensive collection system model, and the general approach is supported by the USEPA.

As part of the negotiations with the Ohio EPA to reevaluate the WWMP, several WWMP projects were deferred in order to undertake several new projects, which align with the new plan direction. Updates on those projects are included in the report.

Total capital cost of the Blueprint Plan is $1.7 billion, including both conventional and Blueprint infrastructure components.

GRAY SOLUTIONS

The gray alternative reflects an updated version of the original 2005 WWMP, and does not rely on I/I mitigation to achieve the desired LOS. Instead, it makes use solely of gray technologies, including new tunnels, weirs and pipes, bulkhead removal, bulkhead construction, weir removal, pipe upsizing, pipe replacement, pipe rehabilitation, flow redirection, pipe cleaning and pipe lining.

The total estimated cost of the gray alternative is $1.6 billion, $1.1 billion of which is associated with the Lower Olentangy Tunnel (LOT) and the Alum Creek Relief Tunnel (ART).

ANALYSIS OF ALTERNATIVES

Comparing the Blueprint and gray alternatives reveals two primary water quality advantages to the Blueprint plan: a greater reduction in overall overflows, and a positive impact on stormwater quality. While both plans meet the requirements of the consent orders for overflows, the Blueprint plan generally reduces the amount of overflows from the system more than the gray alternative, and significantly reduces the CEPT discharge frequency and volume. Once Blueprint implementation is complete, an estimated 342 tons of sediment will be removed by green infrastructure each year, reducing total suspended solids (TSS) entering surface waters. The gray alternative has no impact on stormwater quality. In order for the gray alternative to provide comparable water quality, an additional $148 million would be required for equipment such as hydrodynamic separators. Even with that addition, the gray alternative would still fail to mitigate I/I entering the system.

One additional benefit of the Blueprint alternative is its positive impact on the local economy. In the city's experience, local construction companies do not bid on large tunnel projects. In addition, the gray alternative would require significantly more land acquisition, which does not contribute to the local economy. The Blueprint alternative will have significantly fewer tunnels, and mostly consist of small jobs local construction companies can handle. In order to verify these conclusions, the city retained Regionomics to assess the two plans. The following are highlights from their findings:

- The impact of Blueprint on the central Ohio economy is far greater than the gray plan's impact
- Over 20 years, Blueprint will create an additional $2.8 billion in regional output, $977 million in earnings and create more than 700 jobs

The Blueprint program will provide a boost to small business and entrepreneurs in the region, and will thus help address a weakness of the local economy

The Blueprint plan also provides opportunities to improve the quality of life in neighborhoods in ways the gray plan does not. The creation of significant amounts of green infrastructure improves the aesthetics of a neighborhood, provides greenhouse gas reductions, provides wildlife habitat and can improve home values by up to 7%. This approach also provides the city with an opportunity to repurpose vacant and abandoned property in a positive way, such as by creating parks. Homeowners also save on the cost of maintaining their private laterals, a $453 million benefit.

Finally, the Blueprint plan is more sustainable in the long term, since it addresses the cause of the issue directly. Over time, it is reasonable to assume that I/I will increase as infrastructure deteriorates. Continuing to address overflows with gray infrastructure to transport and treat the I/I would require more and more tunnels and treatment capacity as time goes on. Resolving the underlying problem is a long-term plan that is sustainable.

AFFORDABILITY

An affordability analysis was performed in accordance with US and Ohio EPA requirements to compare the Blueprint plan and the 2015 WWMP (gray plan). The city elected to prepare a long-term financial model, which allowed trends to be analyzed and provided a full picture of how rate increases over time could impact ratepayers. The city also took a closer look at demographics, including persistently impoverished regions, which would struggle to handle significant rate increases. In order to determine whether rates would be managed in a way that is affordable, the city developed measures of success, focusing on customer response to bill increases and the overall financial health of the utility.

As part of the Ohio EPA's 2009 approval of the city's WWMP, the city was required to complete the Financial Capability Assessment (FCA) analysis outlined in the USEPA's 1997 FCA guidance for the entire service area. The FCA was completed, based on two components: residential indicator (RI) and financial capability.

As required by the Ohio EPA's 2009 letter, the city developed schedules that were consistent with the original schedule (work completed in 2045), as well as schedules that were five (2040), ten (2035) and 15 (2030) years shorter. The city is recommending a schedule that will complete all work in 20 years, by 2035, which is ten years shorter than the original WWMP. The longer schedules were eliminated as a result of the work done with the affordability model. The shortest schedule (2030) was rejected on the basis that the Blueprint approach is unprecedented on this scale, and so there is a level of uncertainty regarding scheduling. In addition, if projects started too frequently, after several years, the city would be managing four to five projects simultaneously. Due to the nature of the work, each project will effectively consist of thousands of small, property-scale projects. In addition, a cost benefit analysis does not support the shortest schedule.

RECOMMENDED ALTERNATIVE AND SCHEDULE

Between the gray and Blueprint alternatives, the recommended alternative is the Blueprint alternative with the 2035 schedule. Both plans provide similar LOSs. However, the Blueprint plan was chosen over the gray plan based on the additional social and environmental benefits it provides. The 2035 schedule allows for the city to come into compliance with its consent orders ten years earlier than expected.

POST-CONSTRUCTION MONITORING

DSRs will continue to be monitored in order to report the frequency of overflows. WIBs cannot be monitored and will continue to be gathered by the city's voluntary call-in system. CSOs will be monitored to verify that the implemented controls are achieving the predicted levels of control.

Green infrastructure shall be logged in an inventory, maintained regularly, and undergo scheduled inspection. The city is committed to keeping their green infrastructure sites well maintained, enhancing the city's image by having clean, well-kept areas that exhibit civic pride.

IMPROVEMENTS TO THE PLAN

USEPA's integrated planning framework memo recognizes that an integrated plan may need to be modified over time, and suggests that the plan include a process for proposing new projects and/or modifying existing projects. The city proposes to continue to request changes to this plan as it has been doing for the last ten years of the WWMP implementation, by submitting requested changes to the Ohio EPA with supporting documentation. In addition, the city has been and will continue to submit annual reports that track and summarize the status of all projects, including any delays or changes.

1

INTRODUCTION

THE CITY OF COLUMBUS
MICHAEL B. COLEMAN, MAYOR

DEPARTMENT OF PUBLIC UTILITIES

The Integrated Plan and 2015 WWMP Update Report

BLUEPRINT COLUMBUS
Clean streams.
Strong neighborhoods.

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1 INTRODUCTION

1.1 Background

On August 1, 2002, the city entered into a consent order with the Ohio Environmental Protection Agency (Ohio EPA) to address sanitary sewer overflows (SSOs) and basement back-ups (water in basements, or WIBs). The SSO consent order required the city to provide adequate capacity for base and peak flows in the system and to “take all feasible steps to stop and mitigate the impact of SSOs and WIBs” from its system. The order required the city to submit a System Evaluation and Capacity Assurance Plan (SECAP) by July 1, 2005 to meet the requirements of the consent order.

On September 17, 2004, the city entered into another consent order with the Ohio EPA, this one addressing combined sewer overflows (CSOs). The CSO consent order required the city to submit a Long Term Control Plan (LTCP) by July 1, 2005. The purpose of the LTCP was to bring the city’s CSO discharges into compliance with various regulatory requirements, including the United States Environmental Protection Agency’s (USEPA’s) CSO Policy.

On July 1, 2005, the city submitted a Wet Weather Management Plan (WWMP) to the Ohio EPA. The WWMP included the SECAP and the LTCP in one combined plan. The elements of the WWMP are described below. The Ohio EPA approved the interim plan in the WWMP on March 7, 2008, and gave the overall plan a conditional approval on January 26, 2009. The approval was conditioned on the city resubmitting an affordability analysis in 2015 that analyzed various shorter schedules.

Since the original WWMP was submitted, the city has undertaken numerous projects and spent over a billion dollars in addressing its wet weather overflows. The completed WWMP projects are discussed more specifically below. In general, the city plan front-loaded CSO work and, as required by the CSO consent order, obtained a substantial reduction in CSO volumes by 2010.

In 2012, as the city was designing the first SSO tunnel, the Alum Creek Relief Tunnel (ART), the city approached the Ohio EPA about re-evaluating the WWMP. Specifically, on August 8, 2012, the city sent a letter to the Ohio EPA requesting permission to delay certain projects, including ART, so that the city could explore integrated planning. In that letter, the city suggested submitting an integrated plan by September 2015. On August 24, 2012, the Ohio EPA largely agreed with the resubmittal of the plan and delay of certain projects, except for ART. On October 31, 2012, the city submitted a report further supporting the delay of ART. On December 4, 2012, the Ohio EPA sent a letter suggesting that the city commit to constructing a High Rate Treatment/Chemically Enhanced Primary Treatment (HRT/CEPT) unit at Southerly in lieu of immediately constructing ART. In a letter dated December 10, 2012, the city agreed to this suggestion. In January 2013, the Ohio EPA formally agreed to allow the city to submit an integrated plan on September 15, 2015. Copies of all of this correspondence may be found in Appendix A.

This integrated plan and 2015 WWMP Report fulfills the requirements of the city’s initial August 8 request to the Ohio EPA. The letter states that the city would do the following:

- Submit an integrated plan: the city has branded its integrated plan “Blueprint Columbus”. Details of this plan are presented in Section 6.
- Resubmit a revised WWMP schedule: as discussed below, the city re-evaluated the entire WWMP as part of its modeling efforts. The revised plan, referred to herein as the “gray plan” or the “2015 WWMP”, is presented in Section 7.

- Submit an affordability plan consistent with the 2009 approval letter: this is presented in Section 9.
- Follow USEPA's integrated planning memo and "general accountability considerations for green infrastructure": as discussed below, this report is organized into the elements set forth in USEPA's guidance document.
- Include modeling results: these can be found in Section 5, Section 6 and Section 7.
- Set forth legal authority to accomplish private inflow and infiltration (I/I) removal: this is presented in Section 6.
- Include public input and a plan for future input: this is presented in Section 4.
- Include results of suburban outreach: this is presented in Section 6.
- Perform certain pilot projects: the status of pilot projects is presented in Section 6.

1.2 Review of Original WWMP and Changes to Date

As noted, the 2002 SSO consent order required the city to develop a SECAP, while the 2004 CSO consent order required the development of a LTCP. The SECAP and LTCP were combined to create the WWMP with the overall purpose of addressing SSO and CSO discharges, satisfying the requirements of both consent orders. Specifically, the city decided to combine the SECAP and LTCP given the overall objective of improving water quality in the watershed, the connectivity of the sanitary sewer system with the combined sewer system and the similarities between the SSO and CSO planning processes. The WWMP was submitted to the Ohio EPA on July 1, 2005.

The WWMP organized the projects necessary to satisfy the consent orders into several groups. The CSO improvements were in the LTCP, consisting primarily of a CSO tunnel and other projects. The SSO improvement in the SECAP included two major categories: the system-wide improvements, known as the Large Scale System Strategies (LSSS) and the smaller, local projects, known as the priority areas. The priority areas designated by the SECAP are smaller sections of the separate sewer system with high levels of SSOs and WIBs not mitigated by the LSSS. Another major project of the WWMP was the treatment plant improvements, which increased wet weather treatment by fifty percent, providing benefit to CSO, SSO and plant bypasses and helping achieve the goals of both the LTCP and the SECAP.

The WWMP proposed different levels of control for the various parts of the system. The levels of control are summarized in Section 2 and discussed in the sections below.

The WWMP also discussed affordability. Several economic analyses were conducted to determine the benefits of a 30-year and 40-year schedule. Environmentally speaking, the two are very similar since most of the major capital improvements were planned to take place before 2025, decreasing the pollution amount by 85%. The WWMP recommended the 40-year plan. The Ohio EPA conditionally approved this schedule on January 26, 2009.

1.2.1 The Long Term Control Plan

The LTCP's objectives are to satisfy the goals of the CSO consent order:

- Bring all wet weather CSOs and CSO outfall discharge points into compliance with the technology-based and water-quality-based Clean Water Act (CWA) requirements and Ohio Revised Code (RC) 6111
- Minimize CSO impacts on water quality, aquatic biota and human health
- Minimize the discharge of pollutants

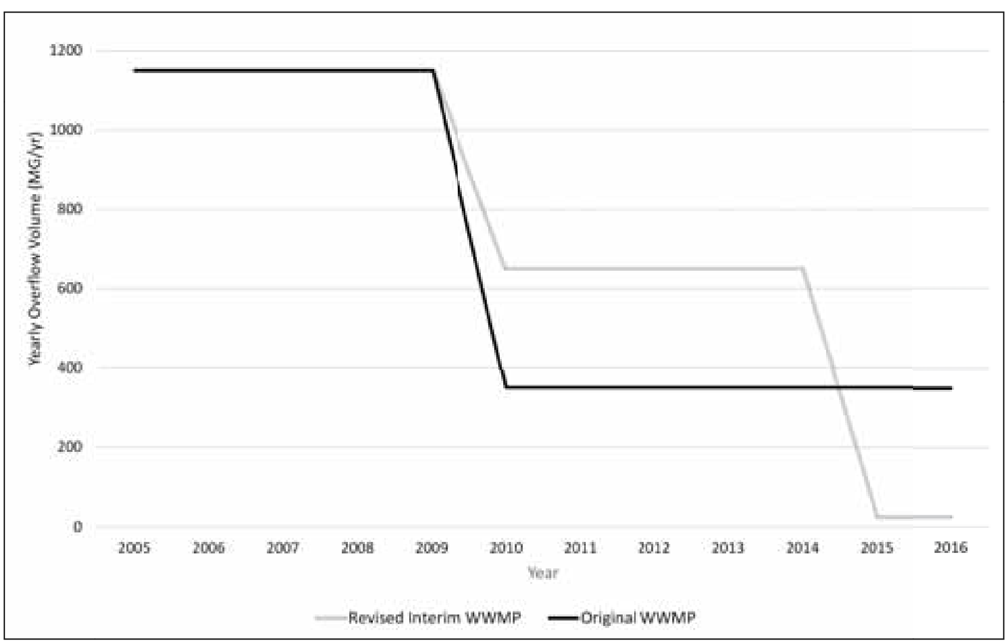
Along with these goals, the CSO consent order required the development of an interim plan with one specific requirement: the city had to achieve a substantial reduction of flows and/or pollutant loads from the Whittier Street Storm Tanks (WSSTs) by July 1, 2010. At the time of the WWMP, the largest contributing CSO was the WSST facility; it accounted for 85% of the city's CSO discharges, activating around 25 times a year, releasing more than 1 billion gallons of combined wastewater in a typical year. The LTCP proposed building a near surface conduit, known as the Olentangy Scioto Interceptor Sewer Augmentation and Relief Sewer (OARS), to consolidate CSO flows and transport them to the treatment plants. The first phase of OARS was scheduled to be completed July 1, 2010. That improvement, along with the proposed treatment plant updates, was modeled to reduce CSO flows in 2010 by 67%. This was designed to meet the requirement of the CSO consent order to achieve a substantial reduction at WSSTs by July 1, 2010.

The city's combined sewer system had 32 CSOs at the time of the WWMP in 2005. The LTCP proposed many other improvements to the combined system to be completed by July 1, 2025. After that, there would be no CSO discharges in a typical year, except near Jackson Pike Wastewater Treatment Plant (JPWWTP), where primary treatment and disinfection would be provided for all but the four largest storms of the typical year. Refer to Section 5 for the updates on the proposed plans of the LTCP.

1.2.1.1 OARS

As noted above, the original WWMP called for the first phase of OARS to be completed by July 1, 2010, as part of the interim plan to reduce overflows at WSSTs. However, due to constructability issues, the OARS design was changed from a near-surface conduit to a deep tunnel which would be constructed all at once instead of in phases. Even without the first phase of OARS, overflow volume from the WSSTs was still reduced 40% by July 1, 2010 as a result of the treatment plant improvements. Moreover, constructing OARS all at once accelerated the OARS schedule by more than 10 years. The Ohio EPA approved the revised OARS plan on March 7, 2008. Exhibit 1.2.1 compares the original to the revised interim plans in terms of CSO reductions.

EXHIBIT 1.2.1 » ESTIMATED YEARLY CSO VOLUME AT WHITTIER STREET STORM TANKS



The OARS tunnel is designed to eliminate all overflows from the WSSTs during a typical year, which historically comprised 85% of all the annual CSO volume. The OARS project ran behind schedule due to site condition challenges and was not operational by the original deadline set for the end of 2014. The city of Columbus and the Ohio EPA agreed to extend the schedule so that OARS is now planned to be operational on September 1, 2017.

1.2.1.2 CSO Weir Raises

The WWMP outlined 18 weirs in the combined sewer system to be raised in order to reduce CSOs. By June 1, 2008, the city had completed 14 of the original 18 weir raises in CSO locations. Detailed engineering studies revealed the heights to which the weirs could be raised without causing WIB events. Four of the original locations were unable to be raised due to risk of WIBs revealed by the detailed studies. The rest of the weirs were evaluated and raised to the appropriate height, some lower than originally planned in the WWMP due to risk of WIBs.

1.2.1.3 Other CSO Projects

The WWMP proposed seven local storage tanks, with four of the tanks located near CSOs discharging to the Olentangy River. These individual storage tanks proposed on the Olentangy were further analyzed after July 1, 2005 to identify an optimal solution including tank consolidation, green infrastructure or more conveyance. Green infrastructure was not feasible due to high capital cost, even with the offsetting environmental and social benefits it provides. The evaluation resulted in either a single larger storage tank located in the heart of The Ohio State University campus or additional conveyance provided by a new pipe that connects to the OARS tunnel. The single large storage tank needed to be approximately 1.73 million gallons (MG) in size to eliminate CSO. However, after evaluation, it was deemed not feasible due to its high capital, maintenance and operational costs. The new pipe is the preferred alternative and is discussed in Section 5 as the Lower Olentangy Tunnel (LOT).

The remaining CSO sewer sheds not addressed by OARS or storage tanks were addressed with inflow redirection. Inflow redirection redirects existing surface drainage (e.g. street runoff) into separate storm sewers via construction of new storm sewers.

1.2.2 The Large Scale System Strategy Plan

The LSSS objectives are to address hydraulic capacity issues within the city's separate sewer system and both wastewater treatment plants (WWTPs). The LSSS is geared toward reducing SSOs and WIBs. However, some initiatives of the LSSS, such as upgrading the WWTPs, also help to reduce CSOs. In order to identify hydraulic deficiencies, the city's collection system model needed to be updated to include modeling the main trunk lines and interceptors of the city's separate sewer system. Once the deficiencies were identified, the WWMP analyzed many combinations of different components in order to develop the best LSSS plan that suited the SECAP requirements from the SSO consent order. The LSSS plan includes building large-diameter relief tunnels, a pump station for one of the tunnels and improvements to maximize treatment capacity at both WWTPs.

1.2.2.1 Large Diameter Relief Tunnels

In order to reduce SSOs, the LSSS calls for two large-diameter tunnels, 14 feet in diameter, designed to store excess wastewater during wet weather. The tunnels are called the Olentangy Relief Tunnel (ORT) and Alum Creek Relief Tunnel (ART), and were intended to be a total of

28 miles long. The ORT and ART would provide a 10-year level of service for the mainline SSOs. The ART has enough slope to be drained by gravity, but the ORT will need a pump station in order to drain. The ORT tunnel was scheduled to enter the design phase in 2015 and the ART design was initiated but put on hold.

1.2.2.2 Southerly and Jackson Pike Wastewater Treatment Plant Expansions

The LSSS and LTCP called for the maximization of Southerly Wastewater Treatment Plant (SWWTP) and JPWWTP in order to reduce SSOs and CSOs. The ORT and ART were sized to provide a 1.4-year level of service at the bypass at SWWTP. The WWMP included an optimization study on improving or expanding both WWTPs' existing physical and/or biological processes to maximize wet weather treatment capacities. The results recommended improvements focused on increasing capacity by reducing hydraulic bottlenecks throughout treatment operations and enhancing wet weather processes, including step-feed and increased final clarifier capacity. Detailed plans on the specific improvements were outlined in the WWMP.

As noted before, the CSO consent order required the city to achieve a substantial reduction of flow at the WSSTs by July 1, 2010. The WWMP included an interim plan for meeting this requirement, which was implementing phase one of OARS and the WWTP expansions. The collection system model predicted this would reduce CSO volumes by 67%. However, as mentioned above, the OARS design changed and in 2008 the city requested and received approval for a revised 2010 interim plan. The new revised interim plan still included maximizing SWWTP and JPWWTP by July 1, 2010, but delayed the completion of OARS until December 31, 2014. The WWTP expansions were completed by July 1, 2010 and have achieved a 40% reduction in CSO volumes. This met the requirements of the 2008 revised interim plan and the CSO consent order.

SOUTHERLY WASTEWATER TREATMENT PLANT EXPANSION

Prior to expansion, SWWTP had a peak design flow rate of 200 million gallons per day (MGD). The WWMP recommended increasing Southerly's peak design flow rate to 330 MGD by 2010. See Exhibit 1.2.2 for a list of the capital projects associated with increasing the peak capacity of SWWTP.

EXHIBIT 1.2.2 » SOUTHERLY WWTP IMPROVEMENT PROJECTS AND COMPLETION DATES

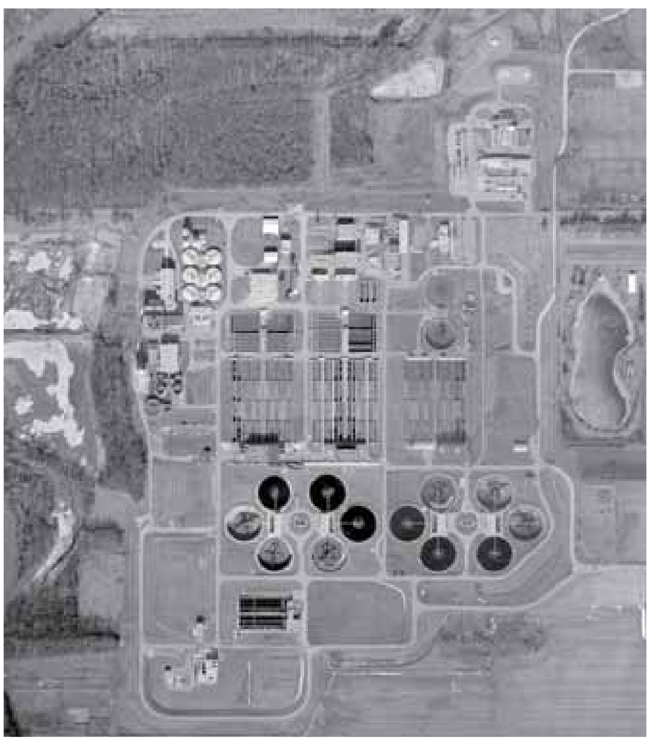
WWTP-Contract	Project	Fully Operational On
Southerly-70	Levee, Dewatering and Mass Excavation	November 30, 2007
Southerly-71	New Effluent Pump Station	October 23, 2009
Southerly-72	Retrofit and New Clarifiers	June 1, 2010
Southerly-73	Headworks Part 2	May 1, 2010
Southerly-74	Primary and Aeration Improvements	June 15, 2010
Southerly-76	Sludge Thickening Improvements	April 16, 2011

Exhibit 1.2.3 below is a 2007 aerial image of SWWTP before expansion improvements were constructed.

EXHIBIT 1.2.3 » SOUTHERLY WWTP 2007 AERIAL PHOTO, BEFORE EXPANSION

Exhibit 1.2.4 below is a 2015 aerial image of SWWTP after expansion.

EXHIBIT 1.2.4 » SOUTHERLY WWTP 2015 AERIAL PHOTO, AFTER EXPANSION



JACKSON PIKE WASTEWATER TREATMENT PLANT EXPANSION

Prior to expansion, Jackson Pike's designed peak capacity was 102 MGD. The WWMP recommended increasing to a designed peak capacity of 150 MGD. See Exhibit 1.2.5 below for a list of the capital projects implemented to increase the JPWWTP peak capacity.

EXHIBIT 1.2.5 » JACKSON PIKE WWTP IMPROVEMENT PROJECTS AND COMPLETION DATES

WWTP-Contract	Project	Fully Operational On
Jackson Pike-210	B-Plant Modifications	June 30, 2010
Jackson Pike-211	A-Plant Modifications	June 30, 2009
Jackson Pike-212	Effluent Pump Station Upgrade	June 15, 2010

In summary, with these updates both WWTPs met their increased treatment capacity goals by July 1, 2010. Therefore the CSO consent order requirement of substantial reduction of overflow from WSSTs was accomplished. Note the sludge thickening improvements were not fully operational until April 16, 2011; these improvements did not need to take place for the SWWTP to operate at 330 MGD. Thus the city asked the Ohio EPA for an extension beyond the original date of July 1, 2010. The sludge thickening improvements were up and running on April 16, 2011.

1.2.3 Priority Areas and I/I Study Results

The WWMP identified 12 priority areas with local designed sewer reliefs (DSRs) that the LSSS plan did not mitigate. A DSR is a structure in the sanitary sewer system created to allow flow to leave the system when flows are high. They were typically installed to reduce WIBs.

The purpose of the priority area analysis was to individually evaluate each area for a solution to provide a 10-year level of service for the local DSRs that were not solved by the LSSS. The WWMP indicated that I/I could be the issue causing sewer overflows and recommended I/I studies in many of the 12 priority areas. The purpose of these comprehensive I/I studies was to determine if the quantity of I/I was significant, and if significant, what the major sources were.

The I/I studies discussed above analyzed both public and private sources of infiltration and inflow. Private sources of infiltration and inflow are entering the city's system from private property, as opposed to entering directly into the city's system from city-owned property, such as right-of-ways. In general, it was found that more than half of the I/I was entering the sanitary system from private sources.

In addition to finding that private property is the major source of I/I, other general conclusions of the I/I studies are as follows:

- The I/I studies identified foundation drains, downspouts connected directly to the foundation drain, lateral and leaky joints or defects in laterals as the major contributors to I/I.
- Studies have determined that if water is discharged to the ground near the home, the water migrates down the side of the foundation to the foundation drain and through the foundation drain to the city's sanitary sewer.

- Downspouts contribute a significant portion of water discharged close to house foundations. Poor grading of the yard also magnifies infiltration into the foundation drain.
- Sump pumps and basement drains connected to the lateral contribute additional flow.
- The WWMP commissioned the I/I reports leading to specific recommendations for projects to reduce SSOs and WIBs in these areas. Implementation of the I/I reports has been delayed while the city examines the integrated plan approach.

1.2.4 WWMP Changes

Since 2006, the city has been documenting approved changes to the WWMP in its annual reports to the Ohio EPA. These changes are summarized in a chart in Appendix B.

1.3 The Blueprint Columbus Approach

As noted above, in 2012, Columbus sought and received permission to explore replacing the WWMP with an integrated plan, which the city refers to as Blueprint Columbus. The core of the city's approach was to determine whether it was possible to solve its SSO and WIB issues by removing I/I from the system, instead of continuing to allow I/I into the system and then transporting and treating it (as the WWMP would do).

The city has been studying I/I for decades, including the extensive work done in the last ten years on the priority area studies. These studies have confirmed most of the I/I originates on private property, particularly properties located in older residential areas. One of the key findings from the studies conducted by the city is that, although most homes do not have their downspouts directly connected to the sanitary sewer, many are connected indirectly. Specifically, homes that have downspouts that discharge at the side of the house are still, in essence, connected to the sewer. The discharged water quickly infiltrates along the side of the house to the foundation drain, which in older homes is often tied directly into the sanitary sewer lateral.

The city's approach to integrated planning had two main components. First, the plan would have to eliminate large amounts of I/I. This would include making sure the public assets (sewers, manholes, etc.) were lined. It would also have to involve residential areas. The city determined there were three steps that could be taken with houses to reduce I/I. First, the lateral would need to be rehabilitated or replaced. Rehabilitation could take the form of lining or replacement via pipe bursting. Second, the roof water would need to be directed away from the house at least seven feet, and often to the curb. Third, installation of sump pumps would provide the most direct solution to prevent the roof water and water from the home perimeter from entering the sanitary lateral. However, the city determined that a mandatory sump pump program might be problematic, as it is a very invasive technology. The city thus decided that lateral rehabilitation and roof redirect should be mandatory, while sump pump installation should be a voluntary program.

The second main component to the city's plan was to include green infrastructure. Green infrastructure is being sized to ensure that the I/I removal does not increase localized flooding or the peak rate of discharge. In addition, it is being sized to provide a significant water quality benefit, specifically, to reduce total suspended solids (TSS) by at least 20%. The green infrastructure will consist primarily of bioswales, although porous pavement may be included in some locations.

Together, the I/I reduction tactics (lateral rehabilitation, roof redirect and sump pumps) and green infrastructure are what the city refers to as the four pillars of Blueprint Columbus.

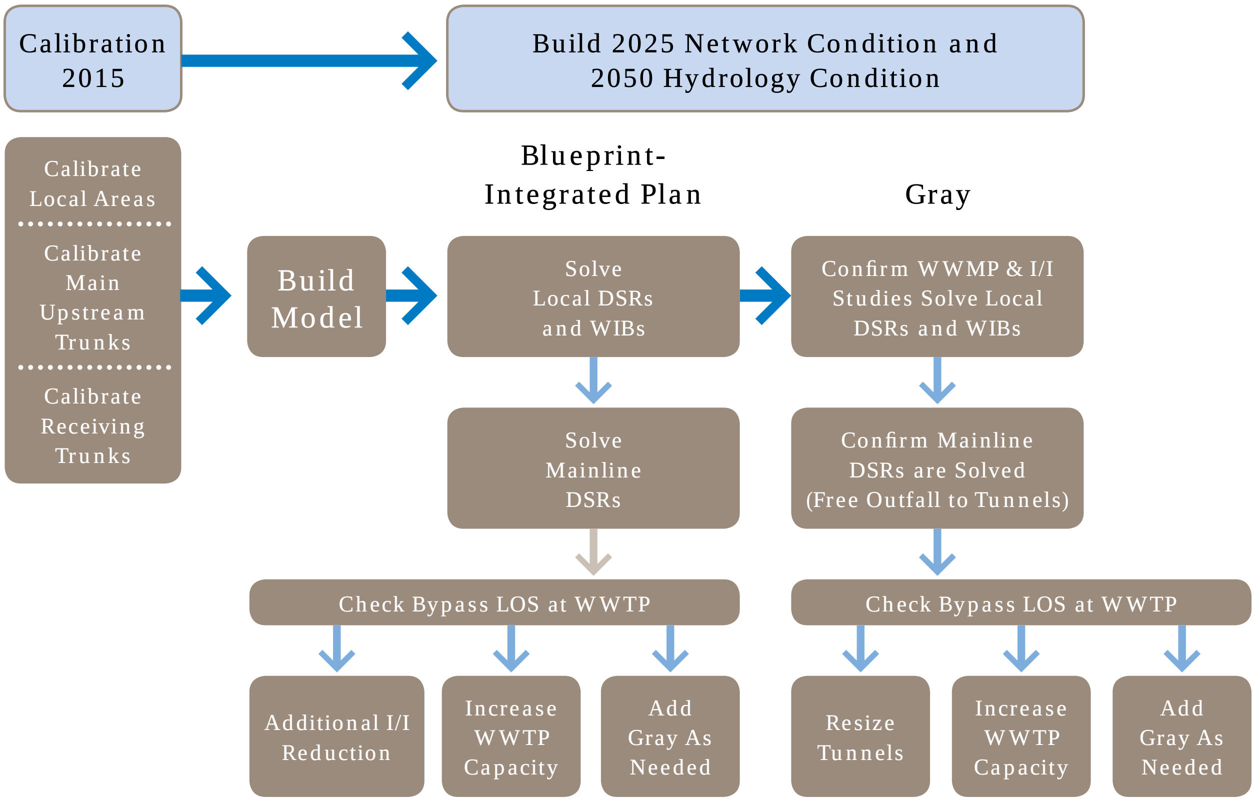
The areas that were targeted for I/I reduction were the areas historically investigated for high I/I in previous efforts. These areas had SSOs and WIBs and were identified in and prior to the 2005 WWMP. Since the 2005 WWMP, a number of the areas were thoroughly investigated in the field. In order to investigate the Blueprint Columbus concept, the modeling utilized these areas and the data developed during their study. These areas were referred to as Blueprint areas. Section 5 discusses the evolution of the Blueprint Columbus areas over the course of the modeling development.

1.4 Process for Developing This Report

The key to the development of this plan was development of the base model, discussed in more detail in Section 5. The Blueprint Plan was developed next by testing various scenarios regarding the three I/I reduction techniques. If the model was determined that the I/I removal was insufficient to achieve the necessary level of service, additional steps were taken, including adding gray infrastructure if necessary. See Figure 1.4.1. The Blueprint Plan is described in Section 6.

With regard to the gray plan, the city started with the 2005 WWMP, including the priority area I/I studies to determine if these projects would meet all of the applicable levels of service. The model was used to optimize the 2005 WWMP, eventually determining that the levels of service could be achieved with fewer tunnels than the original plan. This process is depicted in Figure 1.4.1. The 2015 WWMP is described in Section 7.

FIGURE 1.4.1 » PROCESS FOR DEVELOPING PLANS



SECTION 2

2

REGULATORY REQUIREMENTS AND LEVELS OF SERVICE

THE CITY OF COLUMBUS
MICHAEL B. COLEMAN, MAYOR

DEPARTMENT OF PUBLIC UTILITIES

The Integrated Plan and 2015 WWMP Update Report

BLUEPRINT COLUMBUS

Clean streams.
Strong neighborhoods.

Clean streams. Strong neighborhoods.

2 REGULATORY REQUIREMENTS AND LEVELS OF SERVICE

2.1 Applicable Regulations and Consent Orders

As discussed in Section 1, the city has entered two consent orders with the Ohio Environmental Protection Agency (Ohio EPA). These consent orders were a result of enforcement actions brought by the Ohio EPA to enforce the provisions of the state's clean water law, Ohio Revised Code (Ohio RC) Chapter 6111. The sanitary sewer overflow (SSO) consent order, entered in 2002, requires the city to eliminate SSOs and water in basements (WIBs). It does not have an end date for compliance. The combined sewer overflow (CSO) consent order, entered in 2004, required the city to control its CSO in compliance with the United States Environmental Agency's (USEPA's) CSO policy by July 1, 2025. The purpose of this report is to set forth the city's plan to comply with the consent orders and Ohio RC Chapter 6111.

The city's two wastewater treatment plants (WWTPs), Jackson Pike Wastewater Treatment Plant (JPWWTP) and Southerly Wastewater Treatment Plant (SWWTP), both have National Pollutant Discharge Elimination System (NPDES) permits. The permits regulate how much pollutants the WWTPs are authorized to discharge to nearby surface waters. Applications for new NPDES permits for SWWTP and JPWWTP were submitted to the Ohio EPA on January 29, 2015.

The NPDES also requires a No Feasible Alternatives (NFA) plan for bypassing wastewater and discharging it without treatment to the environment. The Wet Weather Management Plan (WWMP) provided a NFA plan which outlined all the possible options to consider before bypassing wastewater. If none of the options are feasible, then it is reasonable to bypass wastewater. The NFA plan resulted in a 1.4-year level of service to the SWWTP bypass and a 10-year level of service for the Jackson Pike bypass. Both of the plans presented in this report, Blueprint and 2015 WWMP, maintain the same level of service for the NFA for both WWTPs.

2.2 Identification and Characterization of Human Health Threats

Sewer overflows to the environment are a public health threat. Sewage contains a variety of harmful pathogens, which can cause illness if ingested. SSOs empty into local streams where people can be at risk of exposure when swimming in the water, through drinking from a contaminated water supply or eating contaminated fish or shellfish. Between 2009 and 2010 the Center for Disease Control recorded 296 cases nationally of illness from swimming in lakes, ponds and rivers. Three of these cases were from suspected algaecide (copper) contamination, leaving 293 cases that could be attributed to overflows into the environment. The organisms responsible for causing the illnesses are consistent with those found in sewage, or by conditions in streams exacerbated by sewage (algae growth). In fact, health professionals suspect that the actual number of cases from open water swimming is many times this number but most cases go unreported.

Wet weather WIB events occur when the city's collection system is full and sewage backs up into basements. WIBs are a result of flow conditions in the sanitary sewer main, not the building lateral that connects the building to the sewer system. The city of Columbus tracks WIB reports and investigates their cause. Elimination of WIBs is a requirement of the SSO consent order.

Exposure to sewage from a WIB persists through the time of cleanup and restoration. WIBs also create an environment that promotes mold growth that can cause further chronic health issues for the inhabitants long after the cleanup phase is completed. It has been the policy of the city to reduce WIBs due to human health concerns. In July of 2004 the city of Columbus began the Project Dry Basement program that installs backflow prevention devices for single and two-family houses in order to reduce citizen exposure to sewage.

2.3 Water Quality Review

The Ohio EPA's Water Quality Standards (WQS) are derived from the Clean Water Act's (CWA's) goals. The water quality impairments of the actual Watershed Assessment Units (WAUs) in the Blueprint areas are reported as well as the stormwater impairments across the entire Columbus Facility Planning Area (FPA). Each impaired watershed is required to have a total maximum daily load (TMDL) report developed and all the watersheds in the Columbus FPA are impaired. The approved USEPA TMDL reports in the Columbus FPA are the Olentangy River Watershed, the Big Walnut Creek Watershed and the Big Darby Creek Watershed. New water quality data, from 2010 to 2013, collected on the Scioto River and Big Walnut Creek, is compared to the Ohio EPA's criteria and discussed as well. Also at the end of the section, the total system overflow is compared from the baseline year 2005 to the recommended Blueprint alternative.

2.3.1 Water Quality Impairments in the Columbus FPA

Specific impairments of the watersheds where the Blueprint areas are located are listed in Table 2.3.1: Blueprint Areas and Their Watershed Impairments. Many of the Blueprint areas are located in multiple watersheds. There is a WAU for each watershed that is identified by 12-digit Hydrologic Unit Codes (HUCs). Each HUC is evaluated according to the WQS four use assessments. Then a WAU summary is developed to determine if the watershed is impaired and the sources of impairment.

All of the Blueprint area watersheds are not meeting attainment for the aquatic life use assessment and the recreational use assessment. Since there are no public drinking water intakes in the Blueprint area watersheds, they were not assessed for the public drinking water supply assessment. The use attainment for the fish tissue assessment is unknown because no fish tissue data has been collected. To view the actual data collected and used in the assessments, see the Ohio EPA's 2014 Integrated Water Quality Monitoring and Assessment Report. Also on the Ohio EPA website, there is an Interactive Map of Assessment Unit Summaries containing all of the data.

Through an assessment of all the WAUs in the Columbus FPA, it was determined that approximately 64% of the area within the Columbus FPA is impaired due to stormwater. The following sources of impairment were considered influenced by stormwater:

- Urban runoff/storm sewers (NPS): Runoff from an urbanized area as a result of a wet-weather event.
- Municipal (urbanized high density area): High density ("ultra-urban") areas in cities and towns (e.g., central business districts) with high percentages of impervious surfaces.
- Residential Districts: Areas where zoning laws may limit high density building or commercial centers, but where residential housing can still create significant amounts of impervious surfaces.
- CSO: Discharges combined stormwater and raw sewage, during wet weather, from any overflow and/or outfall identified as a combined sewer overflow, which relieves the combined sewer system.
- SSO (collection system failures): Overflows in sanitary sewer lines can be related to poor maintenance in collection system interceptor lines (infiltration and inflow [I/I] or line clogging).

Exhibit 2.3.1 below breaks down the percentage of area in the Columbus FPA per stormwater source listed above.

EXHIBIT 2.3.1 » PERCENTAGE OF COLUMBUS FPA IMPAIRED BY STORMWATER SOURCE

Stormwater Impairment Source	Percentage of Columbus FPA Impaired
Urban runoff/storm sewers (NPS)	58.7%
Residential Districts and Municipal (urbanized high density areas)	5.8%
Combined Sewer Overflows	0.1%
Sanitary Sewer Overflows	0.08%

This stormwater impairment analysis shows how significant the sources of urban runoff/storm sewers (NPS) are to the water quality of surface waters in the Columbus FPA. This analysis is based off of the area of each WAU with the impairment source divided by the total area in the FPA. So while CSOs and SSOs are sources of water quality impairment, these sources are not as widespread across the Columbus FPA.

2.3.2 New Data

Water quality data is collected by the city of Columbus from four different points in the Scioto River as part of the requirements of the NPDES permits for the city's two WWTPs. The locations where the city regularly takes samples that are included in this section are:

1. Upstream of Jackson Pike at State Route 104
2. Downstream of Jackson Pike at Shelly Quarry
3. Upstream of Southerly at State Route 665
4. Downstream of Southerly at State Route 762

The water quality parameters sampled at these sites and included in this report are:

1. E. Coli
2. Nitrate/Nitrite
3. Ammonia
4. Total Phosphorus

The data included in this analysis were restricted to January 1, 2012-December 31, 2014. The date range for the data was selected to provide three full calendar years of data. The data evaluation was confined to the most recent years to make sure they were representative of the most current conditions. Full calendar years were used since conditions in the river differ by season. The inclusion of fractions of a year in the data analysis could over-represent particular times of the year and not give a clear picture of overall water quality of the river.

E. COLI

E. Coli data was collected from four different locations in the Scioto River. These locations are the upstream and downstream monitoring locations of JPWWTP and SWWTP. They are monitored on a monthly basis as part of the city's NPDES permits. Summary statistics of the data can be found in Exhibit 2.3.2.

EXHIBIT 2.3.2 » E. COLI DATA (#cfu/100 mL)

Location	Max	Min	Seasonal Geometric Mean
Scioto River at Route 104	2200	13	189
Scioto River at Shelly Quarry	7600	36	332
Scioto River at Route 665	6450	20	246
Scioto River at Route 762	6400	33	227

The state standard for Class A primary contact recreation waters is 235 cfu/100 mL for a single sample maximum and 126 cfu/100 mL for a seasonal geometric mean. Exhibit 2.3.2 includes a geometric mean for the data instead of an average in order to be consistent with the WQS for E. Coli.

The four locations listed above show concentrations of concern. None of the locations meets the seasonal geometric mean for Class A primary contact recreation waters. The WWTPs are not the only source contributing to bacteria impairments, given the upstream sampling point, State Route 104, also exceeds the geometric mean for E. Coli.

NITRATE/NITRITE

Nitrate/Nitrite data is collected by the city of Columbus from different points in the Columbus area receiving streams. This data collection is undertaken as part of the city's normal sampling. Summary statistics of the data can be found in Exhibit 2.3.3.

EXHIBIT 2.3.3 » NITRATE/NITRITE DATA (mg/L)

Location	Max	Min	Seasonal Geometric Mean
Scioto River at Route 104	4.50	0.06	1.84
Scioto River at Shelly Quarry	7.00	0.94	3.40
Scioto River at Route 665	6.30	0.94	3.23
Scioto River at Route 762	5.90	1.10	3.42

According to the fact sheet for the SWWTP 2010 NPDES permit, the only water quality criteria in the area are the agriculture standard for nitrate-nitrite, which is 100 mg/L. According to the data collected above, there were no samples collected that were in excess of the WQS.

AMMONIA

Ammonia data is collected by the city of Columbus from different points in the Columbus area receiving streams. This data collection is undertaken as part of the city's normal sampling. Summary statistics of the data can be found in Exhibit 2.3.4.

EXHIBIT 2.3.4 » AMMONIA DATA (mg/L)

Location	Max	Min	Seasonal Geometric Mean
Scioto River at Route 104	0.29	0.01	0.11
Scioto River at Shelly Quarry	0.35	0.01	0.14
Scioto River at Route 665	0.83	0.01	0.13
Scioto River at Route 762	0.80	0.02	0.15

According to the fact sheet for the SWWTP 2010 NPDES permit, the only water quality criteria in the area are the aquatic life standard for ammonia, which is 1.2 mg/L in the summer and 3.3 mg/L in the winter. According to the data collected above, there were no samples collected that were in excess of the WQS.

TOTAL PHOSPHORUS

Total Phosphorus data is collected by the city of Columbus from different points in the Columbus area receiving streams. This data collection is undertaken as part of the city's normal sampling. Summary statistics of the data can be found in Exhibit 2.3.5.

EXHIBIT 2.3.5 » TOTAL PHOSPHORUS (mg/L)

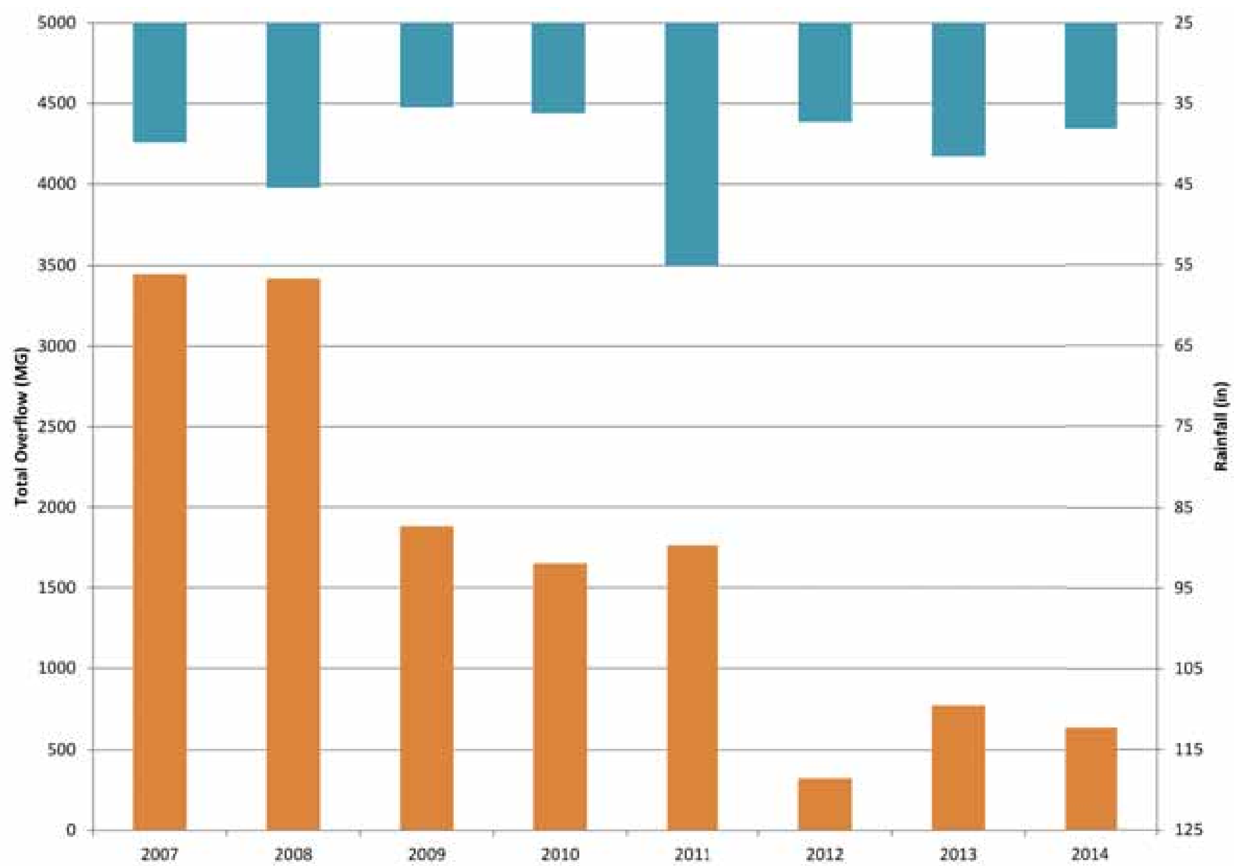
Location	Max	Min	Seasonal Geometric Mean
Scioto River at Route 104	0.61	0.04	0.22
Scioto River at Shelly Quarry	2.30	0.22	0.74
Scioto River at Route 665	1.70	0.27	0.69
Scioto River at Route 762	1.70	0.20	0.64

At the time of this writing, there was not a WQS for total phosphorus for this stretch of the Scioto River.

2.4 Levels of Service

Specific LOSs (LOSs) were defined in the 2005 WWMP and in correspondence with the Ohio EPA as projects were implemented over the last 10 years. The LOSs are quantified for regulatory purposes using a collection system model. However, the city's progress in reducing overflows can be observed in actual overflow reductions realized over the last several years. See Exhibit 2.4.1.

EXHIBIT 2.4.1 » TOTAL OVERFLOW WWTP BYPASS AND OVERFLOW FROM THE LARGEST SSO AND CSO



As discussed in Section 5, the city used two scenarios to model results. First, 20 years of continuous rainfall, and second, the same typical year that was developed for the 2005 plan. The 20-Year scenario was used primarily to determine SSO, WIB and WWTP bypass compliance, while the typical year is used for CSO. Exhibits 2.4.2 and 2.4.3 summarize the LOSs used in the model.

EXHIBIT 2.4.2 » TYPICAL YEAR MODEL RUN TARGETED LEVELS OF SERVICE

Location in the Collection System	Overflows Allowed in a Typical Year Run	Targeted Level of Service
OARS Overflow	4	4/TY
Whittier Street Storm Tanks	0	TY
Alum Creek Storm Tanks	0	TY
Non-Downtown CSOs*	0	TY

* Downtown CSOs are the following: Henry Street, Chestnut Street, Broad Street, Long Street, Spring Street, Capital Street, State Street, Town Street, Rich Street (abandoned), Peters Run, Whittier Street and Moler Street.

EXHIBIT 2.4.3 » 20-YEAR MODEL RUN TARGETED LEVELS OF SERVICE

Location in the Collection System	Overflows Allowed in a 20-Year Run	Targeted Level of Service
CSOs		
Downtown CSOs*	2	10-Year
SSOs and Manholes		
All SSOs	2	10-Year
All Manholes	2	10-Year
WIBs		
All WIBs**	2	10-Year
WWTPs		
Jackson Pike	0	10-Year
Southerly	12	1.4 Year

* Downtown CSOs are the following: Henry Street, Chestnut Street, Broad Street, Long Street, Spring Street, Capital Street, State Street, Town Street, Rich Street (abandoned), Peters Run, Whittier Street and Moler Street.

**Generally, local WIBs may be handled by Project Dry Basement, ejector pumps or by clusters of WIBs by local pump stations.

TABLE 2.3.1 » BLUEPRINT AREAS AND THEIR WATERSHED IMPAIRMENTS

Blueprint Areas	Watershed HUC	AQUATIC LIFE USE ASSESSMENT		Recreational Use Assessment (Designation)	Public Drinking Water Supply Assessment	Fish Tissue Assessment
		CAUSES OF IMPAIRMENT	SOURCES OF IMPAIRMENT			
Clintonville 1, 2 & 3 Fifth by Northwest Near East* North Linden 2*	50600011103	• Direct habitat alterations • Nutrients • Siltation • Flow alteration	• Onsite wastewater systems (septic tanks) • Flow regulations/modifications • Sanitary sewer overflow • Urban runoff/storm sewers (NPS) • Dam or impoundment • Combined sewer overflows	Bacteria (unknown)	No assessment	Unknown
Fifth by Northwest* Hilltop 1, 2 & 3*	50600011205	• Other flow regime alterations • Particle distribution (embedment) • Organic enrichment (sewage) biological indicators	• Residential districts • Sanitary sewer overflows • On-site treatment systems (septic systems)	Bacteria (Primary Class B)	No assessment	Unknown
James Livingston 1*, 2*, 3*, 4, 5 Plum Ridge	50600011505	• Direct habitat alterations • Unionized ammonia • Nutrients • Cause unknown • Organic enrichment • Siltation • Flow alteration • Thermal modifications • Metals	• Land development/ suburbanization • Source unknown • Minor municipal point source • Onsite wastewater systems (septic tanks) • Channelization (development) • Removal of riparian vegetation (development) • Contaminated Sediments • Industrial site runoff • Urban runoff/storm sewers (NPS) • Upstream impoundment	Bacteria (unknown)	No assessment	Unknown
James Livingston 1, 2 & 3 Miller Kelton Near East North Linden 1 & 2 South Linden	50600011602	• Direct habitat alterations • Sedimentation/siltation • Organic enrichment (sewage) biological indicators	• Urban runoff/storm sewers (NPS) • Municipal (urbanized high density area) • Channelization	Bacteria (unknown)	No assessment	Unknown
Hilltop 1*, 3 & 4	50600012301	• Impairment unknown • Particle distribution (embedment) • Sedimentation/siltation • Other flow regime alterations • High flow regime • Organic enrichment (sewage) biological indicators	• Urban runoff/storm sewers (NPS) • Source unknown • On-site treatment systems (septic systems) • Municipal (urbanized high density area)	Bacteria (Primary Class B)	No assessment	Unknown
Hilltop 1, 2* & 3* Miller Kelton Near East* Near South West Franklin	50600012302	• Sedimentation/siltation • Sediment screening value (excess) • Direct habitat alterations	• Channelization • Stream bank modifications/ destabilization • Industrial point source discharge	Bacteria (Primary Class B)	No assessment	Unknown

3

DESCRIPTION OF CURRENT PERFORMANCE

(2015 SYSTEM)

SECTION 3

THE CITY OF COLUMBUS
MICHAEL B. COLEMAN, MAYOR

DEPARTMENT OF PUBLIC UTILITIES

The Integrated Plan and 2015 WWMP Update Report

BLUE PRINT COLUMBUS

Clean streams.
Strong neighborhoods.

Clean streams. Strong neighborhoods.

3 DESCRIPTION OF CURRENT PERFORMANCE (2015 SYSTEM)

3.1 Collection System

The city of Columbus' collection system is divided into three types of sewers: combined sewers, storm sewers and sanitary sewers. Combined sewers are designed to carry both stormwater and wastewater, storm sewers are designed to only carry stormwater and sanitary sewers are designed to convey only wastewater. Both combined and sanitary sewers convey wastewater to one of two treatment plants the city operates: Southerly Wastewater Treatment Plant (SWWTP) and Jackson Pike Wastewater Treatment Plant (JPWWTP). The storm sewers convey stormwater to nearby streams and rivers in accordance with the Municipal Separate Storm Sewer System (MS4) permit.

3.1.1 Combined Sewer System

The combined sewer system is the oldest part of the collection system. It is runs from downtown Columbus to The Ohio State University, spanning 167 miles in pipe length. See Figure 3.1.1. It is designed to carry both stormwater and wastewater from this area. There are two storage tanks that provide extra capacity during storms to store the excess combined stormwater and wastewater. The Whittier Street Storm Tanks (WSSTs) can store up to 4.1 million gallons (MG) and the Alum Creek Storm Tanks can store up to 1.31 MG. However, even with that additional storage, the combined system does become overloaded during heavy rainfall. To relieve this, the system has overflows built into it to discharge the excess combined stormwater and wastewater. These overflows are called combined sewer overflows (CSOs) and discharge the combined sewage directly to the surface waters without treatment.

When the Wet Weather Management Plan (WWMP) was written in 2005, the city had 32 CSOs in its system. Since then, three CSOs have been eliminated completely: Cozzins Street CSO #68, Rich Street CSO #28, and Mound Street east of I-71 CSO #126. Table 3.1.1 below lists all of the currently permitted CSO locations in the combined sewer system. In Table 3.1.1, the relief location indicates where the flow leaves the combined sewer system, and the discharge location is where the flow is released into the environment.

To increase storage capacity and reduce CSOs, the city is currently constructing the Olentangy Scioto Interceptor Sewer Augmentation and Relief Sewer (OARS). The OARS is a deep tunnel designed to be capable of storing 60 MG of combined wastewater. The OARS tunnel will reduce the downtown CSOs from currently overflowing multiple times a year to only overflowing once every 10 years. See Section 2. The project is scheduled for completion by September 1, 2017. The location of the combined sewer system, CSOs and the OARS tunnel is displayed below in Figure 3.1.1.

3.1.2 Storm Sewer System

The city's storm sewer system spans 1,757 miles in pipe length. Storm sewers often run parallel to separate sanitary sewers and collect rain from streets, driveways, parking lots, etc. The stormwater sewers convey stormwater directly to nearby surface waters.

3.1.3 Sanitary Sewer System

The sanitary sewer system spans 2,782 miles in pipe length. This length does not include privately owned lateral lines, which connect houses to the city's main sewer line that runs down the street. It is the responsibility of the homeowner to maintain their lateral line and replace it when necessary.

While sanitary sewers are not intended to carry stormwater, some does infiltrate sanitary sewers. In some cases it flows directly in through illegal connections. These two sources of stormwater in the sanitary sewer are commonly referred to as infiltration and inflow (I/I). During large storms I/I causes high flows in the sanitary sewers. To prevent overloading and sewage backups into basements, there are designed sanitary relief structures (DSRs) that allow flow to leave the sanitary system. When flow leaves the system through a DSR, it is classified as a sanitary sewer overflow (SSO). However, this only happens if flows are high from I/I from a rain event. More information on SSO flow data will be given in this section.

Table 3.1.2 provides a listing of all DSR structures by the city of Columbus reference numbers. This list has been updated and matches the 2014 Annual SSO and WIB Report and the city of Columbus' collection system model with the exception of DSRs outside of Columbus' jurisdiction. When the WWMP was created in 2005 there were 90 DSR locations in the collection system. That number has now been reduced to 69. Figure 3.1.2 and Figure 3.1.3 show the location of the DSRs in relation to their sewer shed and to the combined collection system, respectively.

Table 3.1.3 lists the 21 DSRs that have been eliminated since the WWMP was developed in 2005. These DSRs were eliminated through the Priority Area solutions, Large Scale System Strategy (LSSS) solutions and capital improvement projects (CIPs).

Another project the city built since the WWMP was the Big Walnut Augmentation/Rickenbacker Inceptor (BWARI) tunnel to relieve the Big Walnut Outfall sanitary sewer trunk during periods of high flows. The BWARI is approximately 7 miles long and divided into two parts: Part 1 with a diameter of 14 feet and Part 2 with a diameter of 12 feet. The total storage capacity is approximately 36 MG. The BWARI tunnel is used both as a conveying sewer and a storage facility, which drains to the SWWTP.

The city of Columbus has contracts with 25 communities allowing them to convey their wastewater to the city's collection system and WWTPs. Most of these communities own and maintain their own sanitary sewer systems. These communities are referred to as contract service areas (CSAs) and are displayed in Figure 3.1.4 below. Their physical descriptions were not included in the size of the city of Columbus' sanitary system mentioned above, but are outlined below in Table 3.1.4.

3.1.4 Wastewater Treatment Plants

The city of Columbus owns and operates two WWTPs. Jackson Pike was built 1935 and was the city's only WWTP until Southerly became operational in 1967. Together, these two plants are responsible for treating all the flows from the combined and separate sanitary sewer systems. SWWTP and JPWWTP use physical, chemical and biological treatment processes to remove pollutants from the wastewater. Both plants have primary treatment, biological treatment and disinfection processes prior to discharge into the Scioto River. The last major modification made to each WWTP was in 2010 when their treatment capacities were expanded as part of the city's 2005 WWMP. Southerly is capable of biologically treating up to 330 million gallons per day (MGD) while Jackson Pike is capable of treating 150 MGD.

3.2 Identification and Characterization of City and Regional Wastewater Flows

3.2.1 Wastewater Treatment Plant Flows

The vast majority of wastewater that enters the city's collection system is fully treated at one of the two WWTPs before being discharged to the environment. Table 3.2.1 below characterizes the flow from both of the city's WWTPs. It displays the amount of flow treated, the pollutants removal rates and the pollutant percent removal achieved annually from 2005 through 2014.

During 2009 and 2010 both WWTPs were undergoing major renovations to reduce hydraulic bottlenecking and increase peak treatment capacities. The renovation construction limited treatment capacity during those two years. However, the improvements increased Southerly's treatment capacity from 200 MGD to 330 MGD. Jackson Pike increased from 102 MGD to 150 MGD. The 178 MGD treatment capacity increase has resulted in the city being able to treat more wastewater during wet weather events when flows are high. The three years prior to the construction an average of 62,663 MG was treated annually compared to an annual average of 65,296 MG in the three years after, which is an increase of 2,633 MG.

3.2.2 Overflows: Bypasses, CSOs and SSOs

Since 2008 there has been a significant reduction in overflows to the environment. In Exhibit 2.4.1, which shows the combined annual overflows from the largest CSO, the largest SSO and the plant bypasses, their combined annual overflow in the last three years is one half of their combined annual overflow in 2008. Even during the wettest year on record, 2011, there was only a little over one half of the overflow amount in 2008. And post 2009-2010 WWTP expansion construction, excluding 2011, there has been decreased overflow.

The overflow decreases are the result of the 178 MGD net treatment capacity increase between the two WWTPs as well as the increased storage capacity in the combined system through 14 CSO weir raises and the completetion of the BWARI. The CSO consent order requirement of a substantial reduction at Whittier Street CSO by July 1, 2010 was achieved through the treatment capacity increase and the increased storage in the collection system. This can be explicitly seen in Exhibit 3.2.1 below.

3.2.3 Combined Sewer Overflows

Exhibit 3.2.1 shows the CSO volumes of the WSST CSO and total overflows from all the CSOs in the system (including the WSST CSO). Notice the decrease after the year 2009 and significantly after 2011.

EXHIBIT 3.2.1 » CSO VOLUMES PER YEAR

Year	Whittier Street CSO Volume, MG	Total CSO Volume, MG
2005	3,078.8	3,308
2006	1,476.3	1,557
2007	1,864.1	2,032
2008	2,398.4	2,678
2009	1,283.9	1,420
2010	1,159.7	1,230
2011	1,592.3	1,776
2012	290.4	316
2013	624.5	745
2014	630.8	771

3.2.4 Sanitary Sewer Overflows

Historically, SSO volumes have been much less than CSO volumes. Given this, and the greater number of DSR locations, the city only monitors flow volumes from four SSOs. The rest are monitored by events, which are whether or not overflows occurred without measuring the volumes. An event is defined as a 24-hour period from midnight to midnight. Multiple SSOs in a single 24-hour period are considered one event. Exhibit 3.2.2 displays the total events per year for all the SSOs in the collection system.

EXHIBIT 3.2.2 » TOTAL SSO ACTIVATIONS PER YEAR SINCE 2005

Year	Wet	Dry	Total
2005	398	37	435
2006	305	31	336
2007	341	22	363
2008	390	172	562
2009	164	102	266
2010	152	29	181
2011	344	24	368
2012	109	24	133
2013	199	28	227
2014	212	19	231

There are two sources that cause SSOs, and they are commonly referred to as wet SSOs and dry SSOs. Wet SSOs occur from I/I into the sanitary system that overloads it. The LSSS plan is focused on reducing wet SSOs. Dry SSOs are when an overflow occurs because of a blockage in the sanitary sewer. Common blockages are grease, debris or plant roots. In order to reduce dry

SSOs, the city utilizes two programs to proactively clean the sewers to prevent clogging: the Fats, Oil and Grease Program as well as the Condition Assessment and Cleaning Prioritization Plan. These two programs combined with the LSSS plan to reduce SSOs are the reason why the number of events overall has decreased since 2005. The reason for higher numbers of dry SSOs during 2008 and 2009 was due to a leak discovered on the Beulah Road trunk sewer in August 2008. The sewer was put on a fast track rehab but work was not completed until April 2009. In 2008, 133 of the 172 dry SSOs were attributed to this leak along with 85 of the 102 overflows observed in 2009.

3.2.5 Wastewater Treatment Plant Bypasses

Wastewater is only bypassed when there are no other feasible alternatives. A no feasible alternative (NFA) analysis has be done to explore all other options the WWTP operators can utilize before having to bypass wastewater. Each WWTP has two bypasses: a mechanical bypass that allows raw wastewater to pass through the screening process before being bypassed, and one that bypasses raw sewage completely. While bypassing wastewater is never preferred, when there are NFAs, the WWTPs utilize the mechanical bypass first and only activate the raw sewage bypass once the mechanical is fully utilized. Exhibit 3.2.3 has the total annual bypassed amount per WWTP. The volumes decreased significantly after 2009 once the plants underwent expansion.

EXHIBIT 3.2.3 » WASTEWATER BYPASSED

Year	Jackson Pike, MG	Southerly, MG
2005	497.1	451.8
2006	19.3	233.9
2007	664.1	246.5
2008	142.8	693.7
2009	19.1	606.8
2010	45.6	371.0
2011	79.3	63.4
2012	13.8	0.0
2013	0.0	152.1
2014	7.6	0.0

3.2.6 Regional Flows

Regional flows come from the city's CSAs. These communities have an agreement with the city to convey their wastewater flows to the city's collection system and WWTPs. The CSAs own, operate and maintain their collection systems. The two exceptions are Franklin County and the village of Valleyview whose contracts provide for the city of Columbus to maintain their collection systems. The city does not measure or keep records of the flows they receive from their CSAs.

The Ohio EPA and the CSAs entered into Director's Final Findings and Orders (DFFO), which required the CSAs to develop their own sewer system evaluation study (SSES) reports.

The purpose of the SSES reports was to identify if excessive I/I was present and to make recommendations to address it or any other issues found. Table 3.2.2 below summaries the SSES report findings of each CSA and indicates if they are addressing their I/I or sending it to the city of Columbus' collection system.

As seen in Table 3.2.2, five CSAs are currently planning on conveying additional flows to the city of Columbus' collection system. Ten CSAs have plans to address their I/I sources. Eight CSAs determined they did not have excessive I/I, although there was not a standard definition used between reports for what defines excessive I/I. Another four of the CSAs have SSES report conclusions that are not known. In conclusion, there is a significant variance in each CSA's approach to I/I, with some conveying significant amounts of I/I to Columbus' collection system. However, the collection system modeling described later in this report takes this into account.

TABLE 3.1.1 » CSOs IN THE 2015 COLUMBUS COLLECTION SYSTEM

	CSO Name	Relief Location	Discharge Location	Overflow Type	NPDES Permit CSO Discharge Point	COC Ref. Number
1	Hudson Street	Alley north of Hudson St. on Olentangy River	Olentangy River west of regulator	Regulator	4PF00000004	259
2	Frambes Avenue	South side of Neil (Frambes), east of Tuttle Park	Olentangy River at 84" storm sewer west of regulator	Regulator	4PF00000005	231
3	Indianola Avenue	Beneath 1791 Neil Ave., Biology Annex	Olentangy River at 108" storm sewer south of John Herrick Dr.	Regulator	4PF00000006	233
4	King Avenue	On King Ave., 300 feet west of Perry St.	Olentangy River below Fifth Ave. Dam	Regulator	4PF00000007	162
5	Chestnut Street	On Marconi Blvd., 100 feet north of Chestnut St.	Scioto River at 126" storm sewer rear of Federal Bldg.	Regulator	4PF00000010	69
6	Spring Street	Marconi and Long	Scioto River at 126" storm sewer rear of Federal Bldg.	Regulator	4PF00000011	54
7	Long Street	Marconi and Long	Scioto River at 126" storm sewer rear of Federal Bldg.	Regulator	4PF00000012	59
8	State Street	Capital St. (extended), 200 feet west of Front St.	Scioto River 48" sewer west of overflow	Manhole	4PF00000013	36

TABLE 3.1.1 » CSOs IN THE 2015 COLUMBUS COLLECTION SYSTEM

	CSO Name	Relief Location	Discharge Location	Overflow Type	NPDES Permit CSO Discharge Point	COC Ref. Number
9	Capital Street	State St. (extended), 150 feet west of Front St.	Scioto River 24" sewer west of overflow	Manhole	4PF00000014	33
10	Town Street	Civic Center and Town	Scioto River at west of regulator	Regulator	4PF00000015	27
11	Broad Street	Broad and Civic Center	Scioto River at west of regulator	Regulator	4PF00000017	42
12	Whittier Street Storm Stand-by Tanks	Whittier Street Storm Stand-by Tanks	Scioto River at Greenlawn Dam	Storage tanks	4PF00000018	86
13	Whittier Street Storm Stand-by Tanks Bypass	Whittier Street Storm Stand-by Tanks	Scioto River at Greenlawn Dam	Storage tanks	4PF00000019	N/A
14	Moler Street	Moler and Front	Scioto River at 66" storm sewer west of regulator	Regulator	4PF00000020	138
15	Third Avenue	Perry and Third	Olentangy River at 84" storm sewer west of regulator	Regulator	4PF00000027	102
16	Henry Street	On Spruce St. between Harrison and Neil	Scioto River at 96" storm sewer at Cozzins St.	Regulator	4PF00000028	61
17	Markison Avenue	Markison and Wilson	Scioto River at 122" storm sewer north of S.R. 104, 2500 feet west of Barthman and High	Regulator	4PF00000029	136
18	Doe Alley	East side of Tuttle Park and Neil (Frambes)	Olentangy River at 84" storm sewer west of regulator	Regulator	4PF00000031	237
19	First Avenue	First Ave. and alley east of Perry	Olentangy River at 24" storm sewer west of regulator	Regulator	4PF00000032	98
20	Whittier Street	West of Front St. on Whittier St.	Scioto River at 84" and 96" storm sewers west of Deshler and Front	Regulator	4PF00000033	84

TABLE 3.1.1 » CSOs IN THE 2015 COLUMBUS COLLECTION SYSTEM

	CSO Name	Relief Location	Discharge Location	Overflow Type	NPDES Permit CSO Discharge Point	COC Ref. Number
21	Mound Street and Grant Avenue	Manhole Grant and Mound	Scioto River at 136 x 87" storm sewer in Bicentennial Park	Manhole	4PF00000041	77
22	Noble Street and Grant Avenue	Manhole Grant and Noble	Scioto River at 136 x 87" storm sewer in Bicentennial Park	Manhole	4PF00000043	393
23	Peters Run	Liberty St. east of Short St.	Scioto River at 84" and 96" storm sewers west of Deshler and Front	Regulator	4PF00000044	508
24	Cherry Street and 4th Avenue	Manhole Cherry and 4th	Scioto River 136 x 87" storm sewer in Bicentennial Park	Manhole	4PF00000045	509
25	Noble Street and 4th Avenue	Manhole Noble & 4th	Scioto River at 136 x 87" storm sewer in Bicentennial Park	Manhole	4PF00000046	510
27	Town Street and 4th Avenue	Manhole 4th and Town	Scioto River at 136 x 87" storm sewer in Bicentennial Park	Manhole	4PF00000047	511
27	Dodge Park combined Pump Station	Dodge Park Combined Pump Station (SA-13)	Scioto River at 72" storm sewer via the Dodge Park Storm Pump Station ST-26	Pump station	4PF00000048	864
28	Kerr Street and Russell Street	Manhole Kerr south of Russell	Scioto River at 126" storm sewer rear of Federal Bldg.	Manhole	4PF00000049	871
29	Alum Creek Storm Tanks	SE corner of Main St. and Harlow St.	Alum Creek at 144 x 90" sewer east of tank	Storage tanks	4PF00001006	243
30	OARS*	Not yet constructed	Scioto River	Storage tunnel	Not yet permitted	n/a

*OARS tunnel is currently being constructed but scheduled to be fully operational by September 1st, 2017

TABLE 3.1.2 » CURRENT DSR STRUCTURES

Reference Number	Location	Sewer Sub-Basin	DSR Mitigated	Date
83	East of Whittier St. Storm Tanks	OSIS	x	7/2011
95	Manhole Sullivant Ave. and east of Dana Ave.	Scioto Main		
103	Manhole south side of Third Ave., 290 ft. west of Olentangy River Rd.	OSIS		
105	Manhole Third Ave. and Oxley (west)	OSIS		
107	Manhole front of 814 W. Third Ave.	OSIS		
109	Manhole south side of Third Ave., 490 ft. west of Olentangy River Rd.	OSIS		
110	Manhole Third Ave. and Oxley (east)	OSIS		
111	Manhole south side of Third Ave., 690 ft. west of Olentangy River Rd.	OSIS		
146	Manhole Third and Morning	OSIS		
147	Manhole alley north of King and west of Starr Ave.	OSIS		
148	Manhole King Ave. and alley east of Virginia	OSIS		
149	Manhole Fifth Ave. and North Star	OSIS		
150	Manhole King and North Star	OSIS		
151	Manhole Meadow Rd. and Third Ave.	OSIS		
154	Manhole Third Ave. and Virginia	OSIS		
156	Manhole alley north of Hill Ave. east of Perry St.	OSIS		
157	Manhole Fifth Ave. and Eastview/Kenny	OSIS		
177	Manhole Cole St. and alley west of Seymour	Alum Creek		
179	Manhole Cole and Seymour	Alum Creek		
181	Manhole Cole and alley east of Seymour	Alum Creek		
185	Manhole Gault and alley west of Kelton	Alum Creek		
188	Manhole 2nd alley west of Seymour, 80' north of Gault	Alum Creek		

TABLE 3.1.2 » CURRENT DSR STRUCTURES

Reference Number	Location	Sewer Sub-Basin	DSR Mitigated	Date
189	Manhole Cole and Bulen	Alum Creek	x	Meets LOS as Built
190	Manhole n/s Gault and alley west of Lilley	Alum Creek		
193	Manhole Gault and alley east of Kimball	Alum Creek		
199	Manhole Gault and alley west of Miller	Alum Creek		
201	Manhole Oakwood and Lawrence	OSIS		
203	Manhole Lockbourne and Lawrence	OSIS		
205	Manhole Bruck and alley north of Hosack	OSIS	x	11/2012
206	Manhole Bruck and Reeb	OSIS		
207	Manhole Parsons and Kian Ave.	OSIS		
208	Manhole Ninth and alley north of Hosack	OSIS	x	11/2012
210	Manhole Bruck and Woodrow	OSIS		
211	Manhole e/s of Parsons, front of 1954 Parsons	OSIS		
213	Manhole Hosack and Fourth	OSIS		
244	Regulator at Roads End	Alum Creek		
246	Castle Rd. Pump Station (SA 2)	OSIS		
250	Manhole Hague Ave. north of Mound St.	Big Run		
252	Manhole Wicklow and alley west of Powell Ave.	Scioto Main		
254	Manhole alley north of Sullivant Ave. east of Roys Ave.	Scioto Main		
256	Manhole Binns Blvd. and alley Palmetto St.	Big Run		
284	Manhole north of Pacemont at Olentangy River on 8" sanitary	OSIS		
285	Manhole Midgard and alley east of Indianola	OSIS		
305	Manhole Lakeview and alley west of Cleveland Ave.	Alum Creek		
306	Manhole Bremen and alley north of Melrose	Alum Creek	x	8/2009
307	Manhole Bremen and alley north of Weber	Alum Creek	x	9/2009

TABLE 3.1.2 » CURRENT DSR STRUCTURES

Reference Number	Location	Sewer Sub-Basin	DSR Mitigated	Date
312	Manhole alley east of Bremen and Brighton Rd.	Alum Creek		
314	Manhole south side Weber, alley west of Cleveland	Alum Creek	x	9/2009
315	Manhole Eddystone and Suwanee	Alum Creek		
322	Williams Rd. Pump Station (SA 1)	OSIS		
323	Manhole Webster Pk. and Olentangy Blvd.	OSIS		
326	Manhole Olentangy Blvd. and Montrose Way	OSIS		
328	Manhole Como and High	OSIS		
329	Manhole e/s Indianola and alley north of East North Broadway	OSIS		
335	Gauging station in Park of Roses	OSIS		
337	Manhole Richards and Granden	OSIS		
339	Manhole alley west of Cleveland and north of Ferris	Alum Creek		
346	Manhole 200' west of Rustic Pl. and Olentangy Blvd.	OSIS		
349	Manhole alley east of High and south of Schreyer Pl.	OSIS		
351	Manhole r/o 4895 Olentangy Blvd., west of Olentangy Blvd. and north of	OSIS		
352	Manhole n/s of Weisheimer and Starrett	OSIS		
360	Manhole s/o Rathbone, east of Delawanda	OSIS		
364	Manhole Plum Ridge north of Lornaberry	Big Walnut		
368	Manhole alley east of High, south of Lincoln	OSIS		
399	Structure r/o 2250 McKinley	Scioto Main		
873	Manhole S.R. 315 N.B. off ramp to Henderson	OSIS		
898	Manhole California and High	OSIS		
915	Manhole in North Star, north of Presidential	OSIS		
952	Hudson and alley West of Parkwood	Alum Creek	x	10/2009

Note: Mitigated does not mean the SSO has been eliminated, only structurally improved to reduce frequency of overflows

TABLE 3.1.3 ELIMINATED DSR RELIEF LOCATIONS SINCE THE WWMP

Reference Number	Location	Sewer Sub-Basin	DSR Eliminated	Date
96	MH alley north of Broad St. and east of Glenwood	Scioto Main	x	10/2013
132	MH Columbus and Studer	OSIS	x	7/2006
133	MH Columbus and Linwood	OSIS	x	7/2006
192	MH Columbus and alley west of Kelton	OSIS	x	7/2006
194	MH Columbus and Miller	OSIS	x	7/2006
241	MH Preston Rd. and Fair Ave.	Alum Creek	x	1/2007
279	MH Hudson and Parkwood	Alum Creek	x	10/2009
288	MH east of Olentangy St. and Indianola	OSIS	x	4/2008
291	MH Osceola and alley south of Weber	OSIS	x	8/2005
304	MH Alamo and alley west of Pontiac	OSIS	x	8/2005
308	MH Minnesota and Hamilton	OSIS	x	8/2005
310	MH east of McGuffey and Aberdeen	OSIS	x	8/2005
317	MH Aberdeen and Parkwood	Alum Creek	x	11/2013
330	MH Pauline and Atwood Terrace	OSIS	x	1/2007
338	MH Northridge and Atwood Terrace	OSIS	x	1/2007
350	MH Wetmore and alley east of High St.	OSIS	x	7/2007
380	MH Lexington and alley north of Hudson	OSIS	x	2005
532	MH front of 2145 Winslow	Alum Creek	x	10/2009
576	MH front of 320 Kanawha	OSIS	x	6/2008
655	MH Seymour and Livingston	OSIS	x	7/2006
948	Right of 3511 Penfield	Big Walnut	x	5/2010

TABLE 3.1.4 SIZES OF CONTRACT SERVICE AREAS

Contract Service Area	Size of Area, Acres	Sewer Length, Miles	Tributary to:
Bexley	1,566	41.5	Alum Creek Trunk Sewer
Brice	51	0.7	Blacklick Creek Main Trunk Sewer
Dublin	16,923	191.5	Scioto Main Trunk Sewer, Upper Scioto West Interceptor Sewer
Franklin County	Unknown	284.9	Various
Gahanna	11,839	127.2	Big Walnut Trunk Sewer
Grandview Heights	852	22.7	Franklin No. 1 Trunk Sewer
Grove City	16,788	136.5	Interconnecting Trunk Sewer
Groveport	8,158	34.0	Blacklick Creek Main Trunk Sewer, Big Walnut Outfall,
Groveport/Obetz Overlap Area	384	4.8	Big Walnut Outfall
Hilliard	11,476	131.8	Upper Scioto West Interceptor Sewer
Lockbourne	67	1.9	Rickenbacker/Big Walnut Augmentation Rickenbacker Interceptor
Marble Cliff	178	3.8	Franklin No. 1 Trunk Sewer
Minerva Park	419	5.5	Alum Creek Area Trunk Sewer
New Albany	8,079	70.2	Big Walnut Sanitary Trunk Sewer
Obetz	5,147	33.3	Big Walnut Outfall Sewer,
Reynoldsburg	10,179	76.0	Blacklick Creek Main Trunk Sewer
Rickenbacker	4,135	23.3	Big Walnut Augmentation Rickenbacker Interceptor
Riverlea	100	2.6	Worthington / Clintonville Main Trunk Sewer
Shawnee Hills	427	5.8	Seems completely isolated, small portion shared w/ Dublin
Upper Arlington	6,296	82.4	Scioto Main Trunk Sewer, Franklin No. 1 Trunk Sewer, Kinnear Road Trunk Sewer
Urban Crest	272	2.2	Grove City / Interconnecting Sanitary Trunk Sewer
Valleyview	95	2.3	Scioto Main Trunk Sewer
Westerville	10,352	102.8	Alum Creek Area Trunk Sewer, Big Walnut Sanitary Trunk Sewer
Whitehall	3,632	60.2	Big Walnut Sanitary Trunk Sewer
Worthington	3,498	71.3	Olentangy Main Trunk Sanitary Sewer, Clintonville Main Trunk Sewer

TABLE 3.2.1 » COLUMBUS WASTEWATER TREATMENT SUMMARY

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013
Total Gallons Treated, MG	64,203	62,422	61,637	63,932	55,951	57,284	76,235	56,140	63,517
Average Gallons Treated Per Day, MG	176	171	169	175	153	157	209	154	174
CBOD, Removed	98.2%	98.2%	98.2%	97.6%	97.6%	97.9%	97.6%	97.9%	98.0%
Suspended Solids Removed	97.7%	97.7%	97.8%	97.5%	97.5%	97.1%	97.3%	97.1%	97.2%
Dry Tons Bio-Solids Handled	44,852	44,064	46,345	46,345	31,524	36,941	40,840	43,889	40,953
Central Ohio Precipitation, In/Yr	40.3	43.6	39.9	45.4	35.5	36.2	54.9	37.3	40.8

TABLE 3.2.2 » CONTRACT SERVICE AREAS PLANS FOR ADDRESSING I/I

Contract Service Area	SSES Report Status	CSA Reported Excessive I/I	CSA Planning on Reducing I/I	CSA Planning New Sewers to Convey Additional Flow to Columbus
Bexley	Submitted	x	x	
Brice	Unknown			
Dublin	SSES not required, other requirements		x	x
Franklin County	In Progress	Unknown – In Progress		
Gahanna	Submitted			
Grandview Heights	Submitted	x	x	x
Grove City	Submitted	x	x	x
Groveport	SSES not required, other requirements			
Hilliard	Submitted	x	x	
Lockbourne	Unknown			
Marble Cliff	Submitted			
Minerva Park	In Progress	x	x	
New Albany	Submitted			
Obetz	Submitted			
Reynoldsburg	Submitted	x	x	
Riverlea	Submitted	x	x	
Shawnee Hills	Unknown	Dublin SSES didn’t report excessive I/I for Shawnee Hills		
Upper Arlington	In Progress	x	Unknown – In Progress	
Urbancrest	In Progress	Grove City SSES reported low I/I from Urbancrest		
Valleyview	Unknown			
Westerville	Submitted	x	x	x
Whitehall	Submitted	x	x	
Worthington	SSES not required, other requirements			x

FIGURE 3.1.1 » MAP OF THE COMBINED SEWER SYSTEM

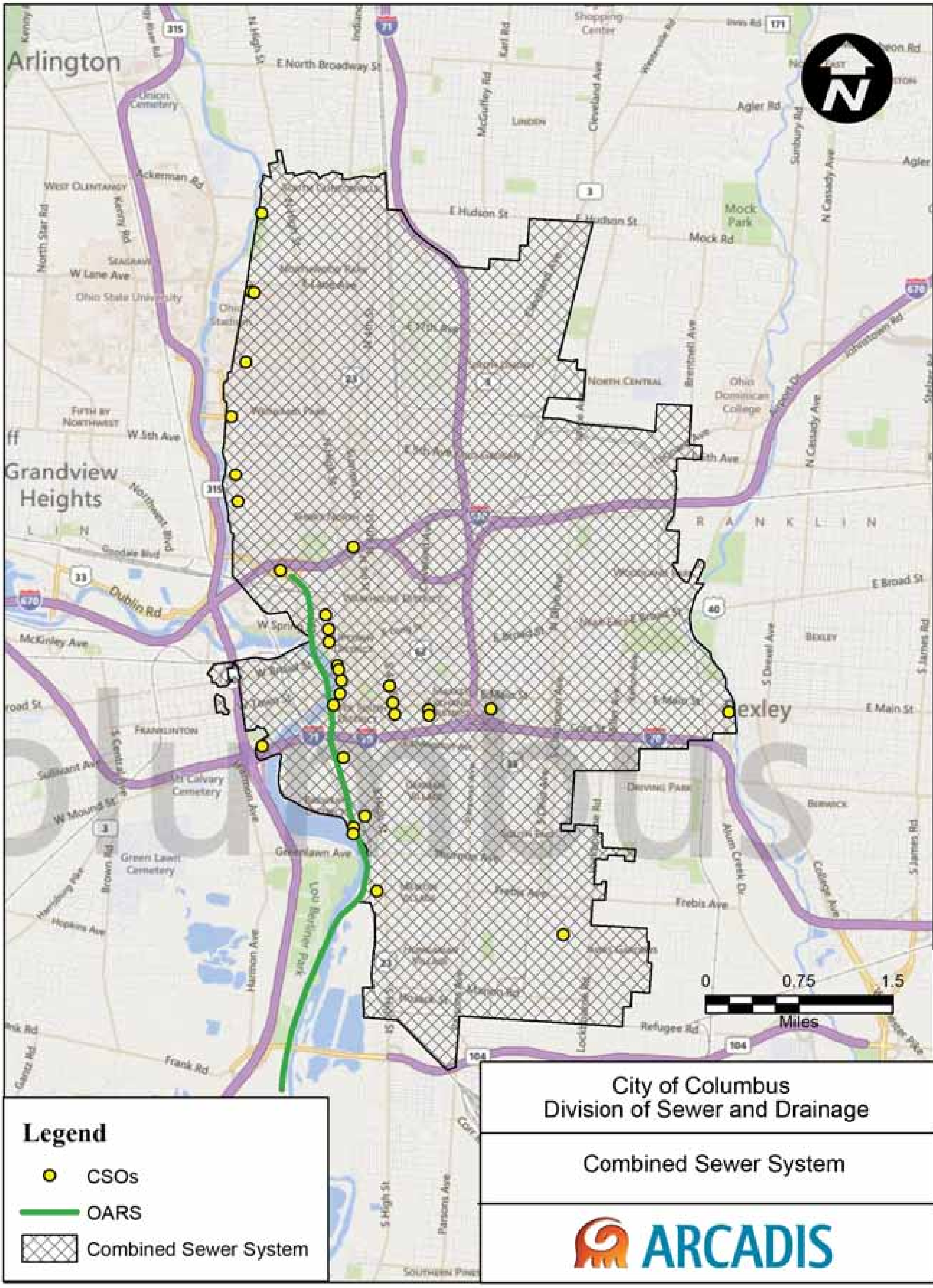


FIGURE 3.1.2 » SEWER BASINS WITH DSRs

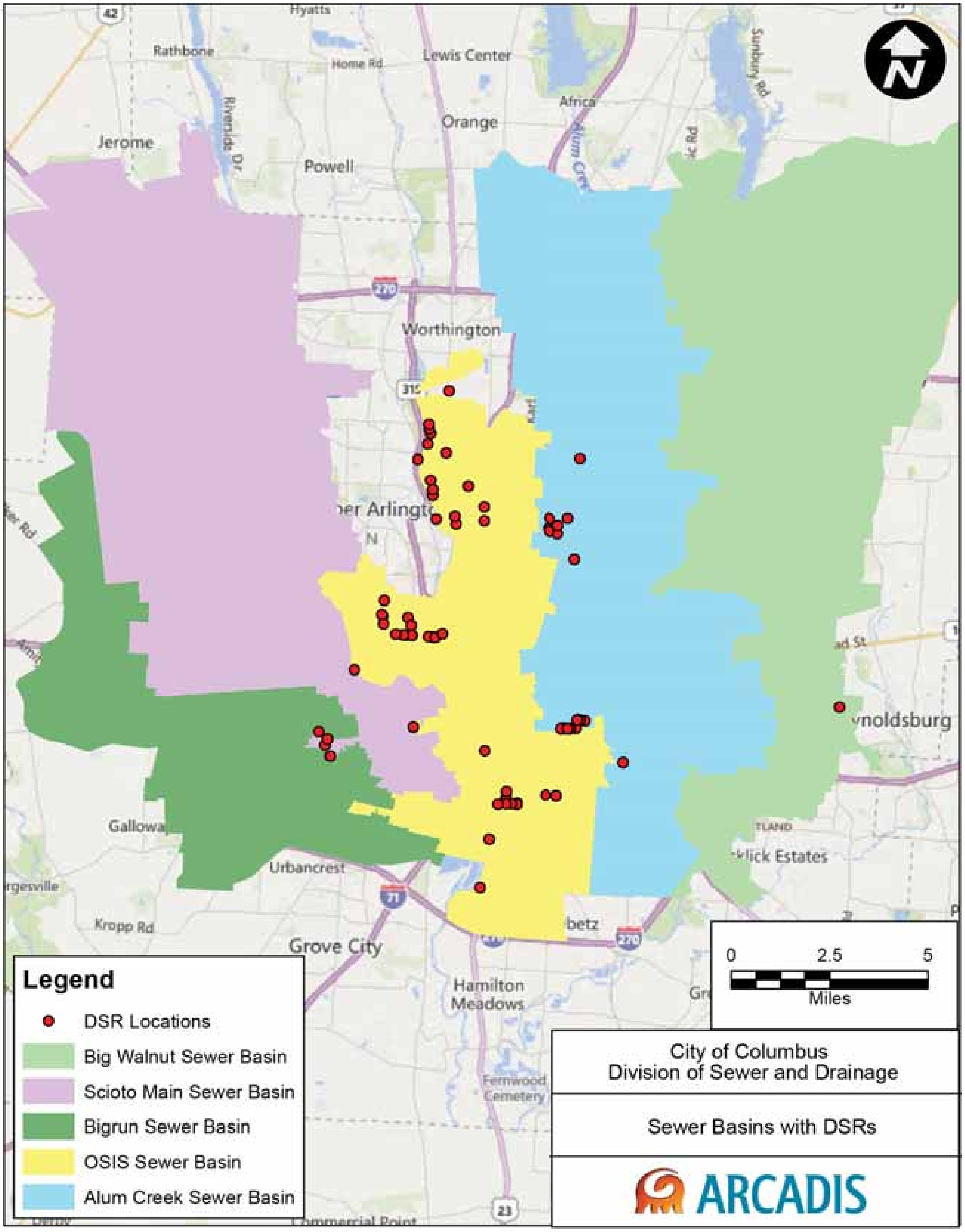


FIGURE 3.1.3 » MAP OF THE COLUMBUS SANITARY SEWER SYSTEM WITH DSR LOCATIONS IN RELATION TO THE COMBINED SEWER SYSTEM

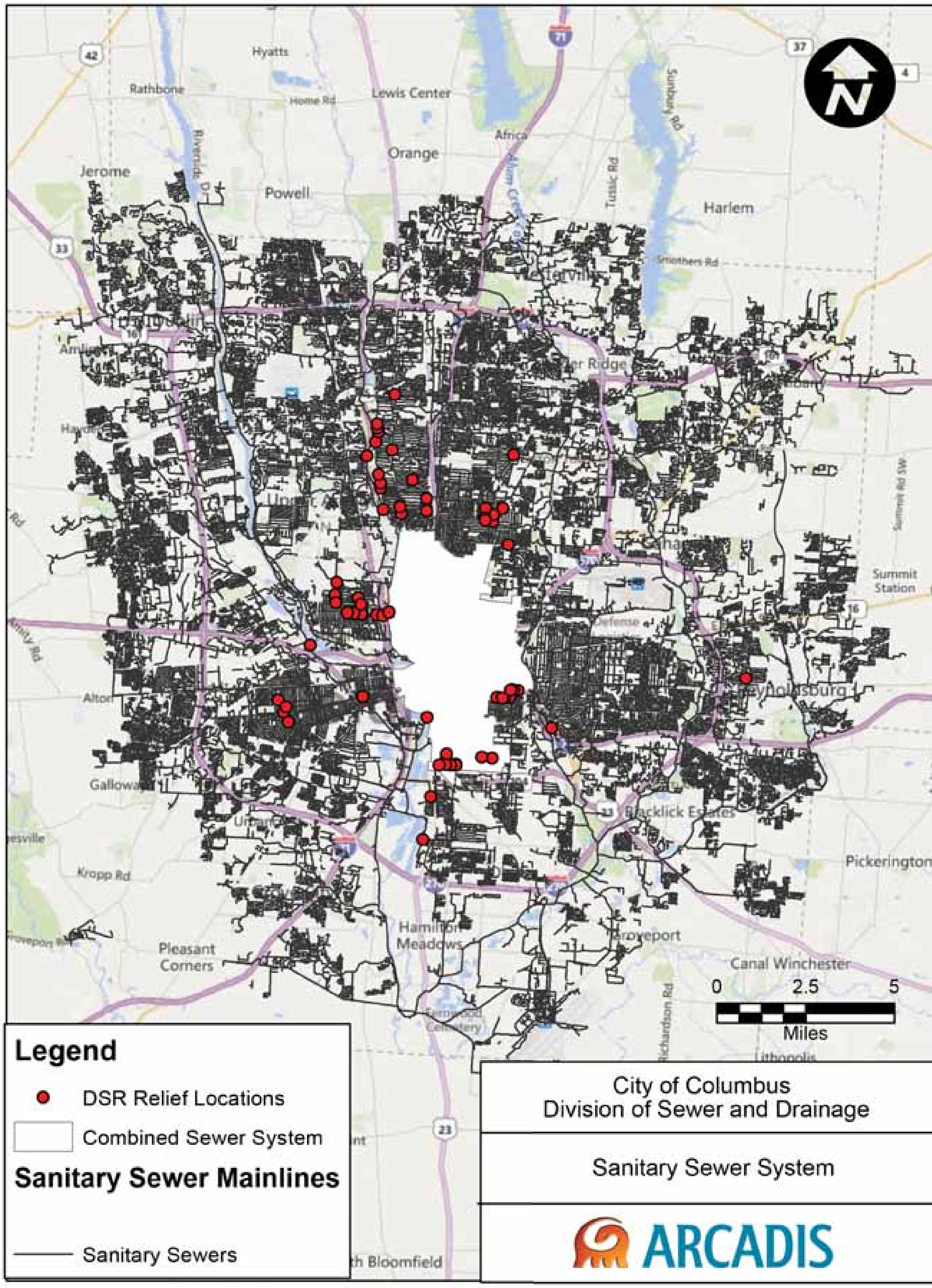
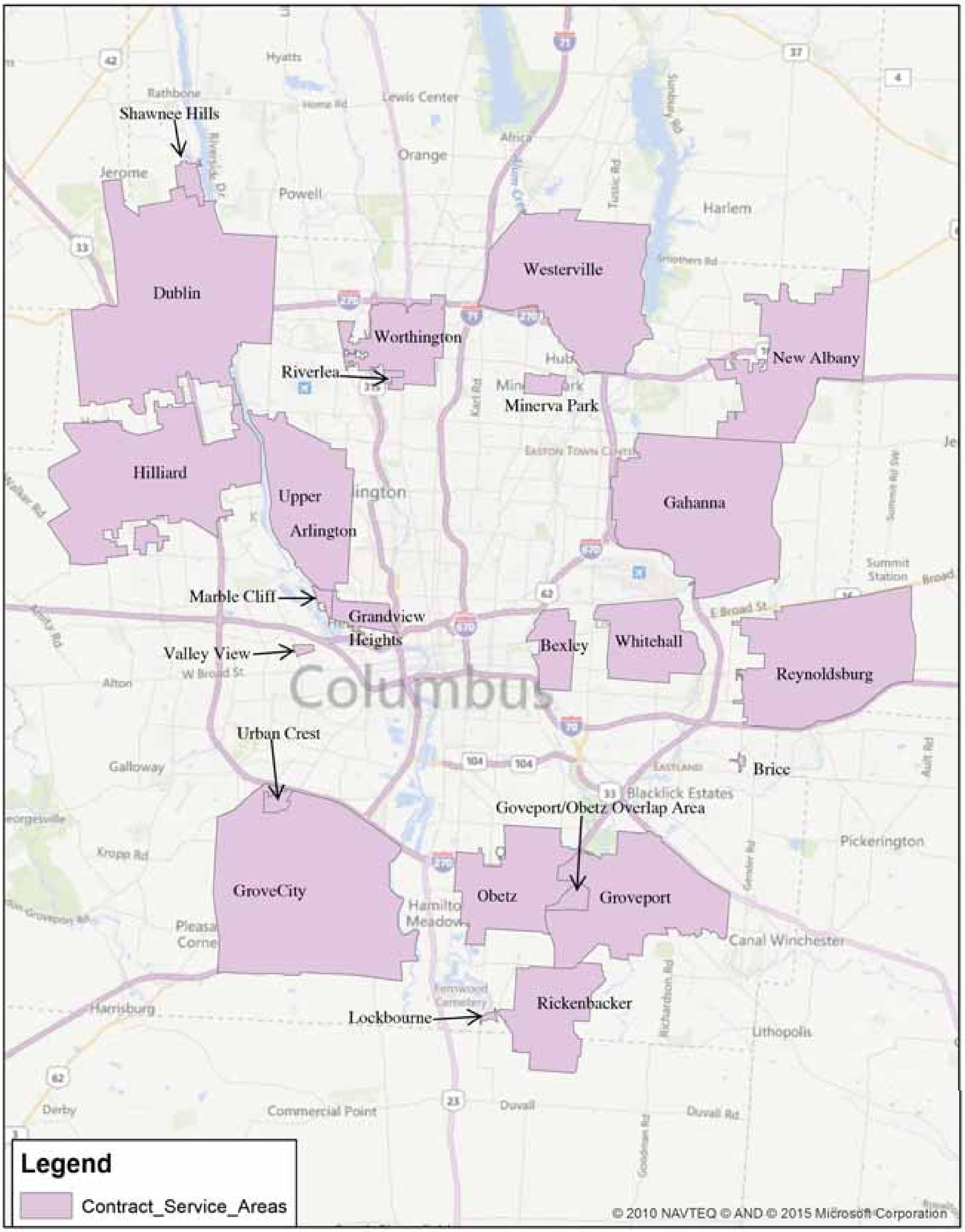


FIGURE 3.1.4 » CONTRACT SERVICE AREAS MAP



Note: Franklin County Sewer area not pictured.

4

PUBLIC PARTICIPATION

THE CITY OF
COLUMBUS
MICHAEL B. COLEMAN, MAYOR

DEPARTMENT OF
PUBLIC UTILITIES

The Integrated Plan and
2015 WWMP Update Report

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SECTION 4

BLUE PRINT
COLUMBUS
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4 PUBLIC PARTICIPATION

This section outlines public outreach activities initiated during the development of Blueprint Columbus.

The United States Environmental Protection Agency (USEPA) Integrated Municipal Storm Water and Wastewater Planning Approach Framework Element 3 states that while developing an integrated plan, municipalities should provide the opportunity for meaningful input from relevant community stakeholders. The city of Columbus developed a two-pronged approach to meet this requirement.

First, the city undertook a community-wide engagement process to determine the acceptability of the integrated planning approach. The community engagement process started with branding and an analysis of the community to determine how to reach a representative community sample. Once this preparation was done, the city then performed a massive engagement effort.

The second major component of the outreach effort was to convene an external advisory group, known as the Community Advisory Panel (CAP). CAP met numerous times and provided valuable input to the development of the integrated plan.

In addition, the city began public outreach in Clintonville as part of that pilot program. The lessons learned from this effort will benefit future outreach efforts. The city also created an internal stakeholder group that included other city departments, City Council, the mayor's office, the city attorney's office and the city auditor's office. This group met periodically and provided valuable assistance to the development of the integrated plan.

4.1 Community-Wide Engagement

4.1.1 Branding Development

A professional public relations firm completed market research and worked with city staff to develop branding. The firm presented research findings to the group and produced several options for them to review. The final selection is shown in Exhibit 4.1.1.

EXHIBIT 4.1.1 » BLUEPRINT COLUMBUS BRAND

The brand has been incorporated into all communications and outreach about the project as well as all aspects of public involvement.

4.1.2 Engagement Research and Design

GAINING A REPRESENTATIVE SAMPLE

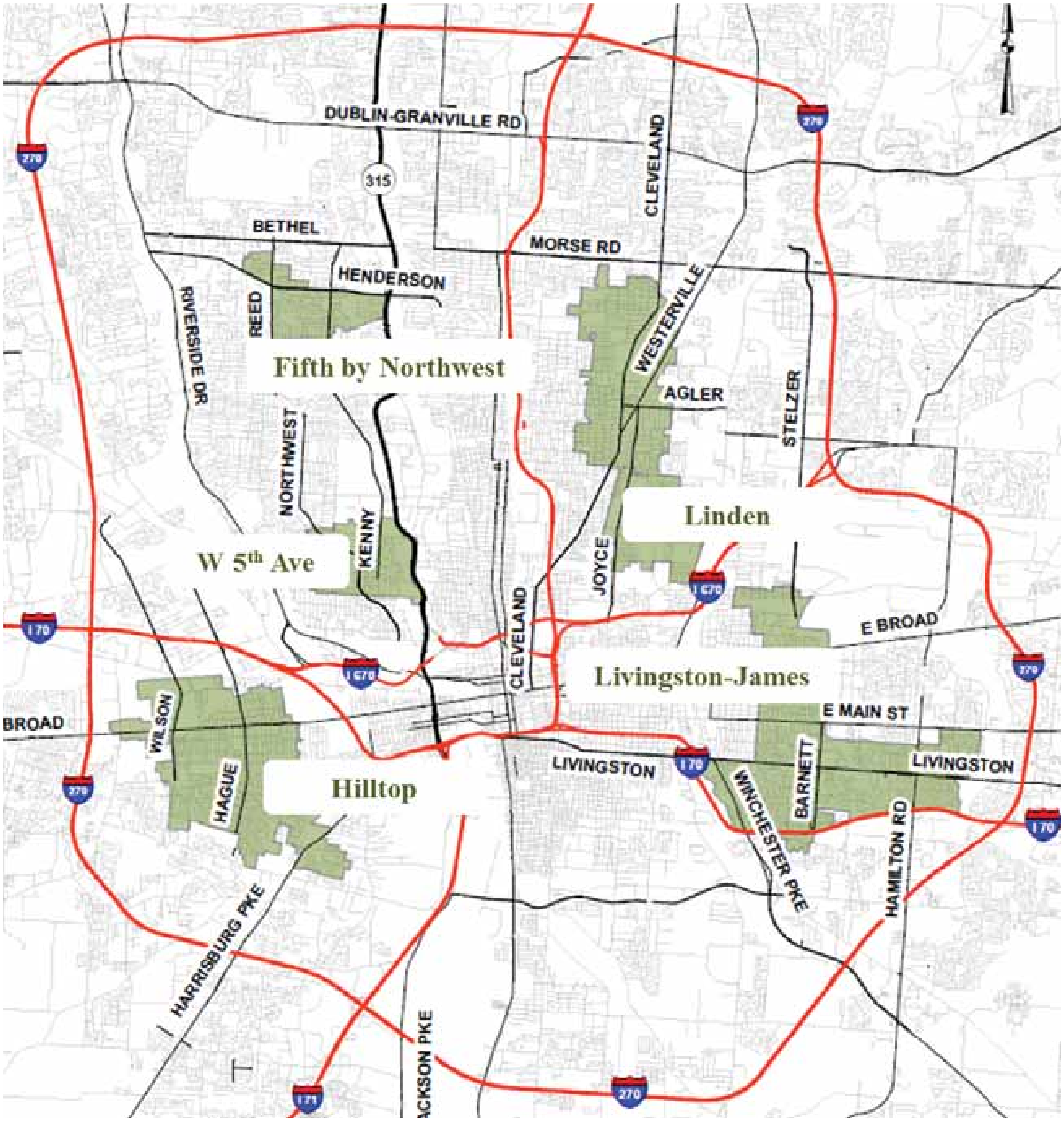
The first challenge in designing a robust community engagement plan was determining how to make sure all populations were included, as Columbus is a large and diverse city. Gaining resident and small business perspectives about this new approach came with some challenges. The city had to ensure diversity among the involved residents to ensure a representative sample of all Columbus residents.

The team started with the areas identified by the city as the Blueprint areas. A cluster sampling approach was used to select four representative neighborhoods from the initial pool of nine. This approach allowed for manageable engagement efforts and provided a generalization of perspectives and results in the broader Columbus community. These potential target clusters spanned 45 square miles and varied in size, demographics and geography. The city used the following demographic, socioeconomic and neighborhood characteristics to develop profiles for each potential engagement area and for Columbus overall:

- Total area in square miles
- Population size
- Gender
- Race/ethnicity
- Age of residents
- Educational attainment
- Income
- Age of housing stock, density and occupancy
- Homeownership versus renting
- Small business characteristics
- Median home value

The city developed primary filters for the selection of representative neighborhoods, such as locations where residents are more likely to be affected by Blueprint Columbus in the short term and areas where one-third of the housing stock was built before 1960. The team then used secondary selection criteria to assess the actual size of the clusters, the percentage of owner-occupied housing and the percentage of neighborhood businesses. In the last stage of the selection process, the project team maintained a balance of underrepresented demographics to ensure the appropriate mix of race, education levels and home values. From this data analysis, the city identified four target Blueprint representative neighborhoods for intensive community engagement efforts as the following: Hilltop, Linden, Livingston /James and Fifth by Northwest. See Exhibit 4.1.2.

EXHIBIT 4.1.2 » REPRESENTATIVE NEIGHBORHOODS SELECTED FOR COMMUNITY ENGAGEMENT



4.1.3 A Robust Community Engagement Effort

The amount of community engagement conducted for Blueprint Columbus is among the most extensive in the history of Columbus. Exhibit 4.1.3 outlines the materials, events and surveys that were a part of the engagement effort.

EXHIBIT 4.1.3 » ENGAGEMENT EFFORTS AT-A-GLANCE

Collateral and Residential Canvassing	Roadshows and Events	Business and Civic Outreach	Surveys and Acceptance Polling
Homes that received literature drops: 28,269	In the four Blueprint areas (libraries, community centers, civic groups, etc.): 55	Businesses canvassed in the four target areas: 291	Pre-engagement surveys: 476
Active canvassing to homes with additional literature: 9,965	City-wide events (fairs & neighborhood festivals, community events, etc.): 31	Civic associations, area commissions and faith-based organizations: 18	Acceptance polling: 417
Overall collateral materials distributed, including bill inserts: 672,966			

The engagement strategy featured a variety of educational tools and engagement methods designed to have mass appeal while also targeting hard-to-reach populations. The team sought educated feedback from residents through baseline and reinforcement educational materials, neighborhood educational events and residential polling and surveying on the Blueprint and traditional Wet Weather Management Plan (WWMP) approaches to reduce sanitary sewer overflows (SSOs) in Columbus.

EDUCATIONAL COLLATERAL MATERIALS: The city developed a video to explain Blueprint Columbus, which has been used in many venues and has been viewed over 2300 times. Fliers, handouts and water bill inserts introduced residents to the topic and steadily increased awareness, knowledge and understanding about the approach. www.columbus.gov/blueprint includes information on Blueprint and a link to the video.

PRE-ENGAGEMENT SURVEYS AND KEY INFORMANT INTERVIEWS: Early in the engagement process, the city administered in-person surveys to residents and business proprietors in the four target areas to assess awareness of and knowledge about the issue of sewer overflows, including topics such as the perceived major contributions of sewer overflows, their overall familiarity with Blueprint Columbus and the level of information and notice typically received when the city implements capital improvement projects within its neighborhoods.

To determine perceptions and readiness to accept change associated with implementing Blueprint Columbus strategies, the city conducted key informant interviews in accordance with the Community Readiness Model (CRM). Highly involved leaders emerged from various community sectors to provide a snapshot of attitudes and knowledge within their respective constituencies. Community members from business, health care, education and civic sectors were interviewed from Clintonville and the four Blueprint representative neighborhoods. The structured CRM interview process identified the existing efforts in addressing the issue, community knowledge of these efforts, leadership and community climate and available resources for the community.

RESIDENTIAL AND BUSINESS CANVASSING: The city conducted both passive engagement through door-to-door dissemination of collateral materials, and active, one-on-one engagement through conversations with residents and canvassing campaigns to all occupied and accessible homes and local businesses in the four representative neighborhoods. The purpose of these strategies was to raise awareness about sewer overflows and increase knowledge of the Blueprint Columbus approach.

ROAD SHOWS AND COMMUNITY EVENTS: Road shows, or traveling education programs, provided tangible, visual teaching aides to engage residents in conversations in places where they naturally occur. Venues such as libraries, community and civic centers, area festivals and other key events were ideal to distribute program collateral materials, display green and gray infrastructure exhibits and conduct active demonstrations using a model house to illustrate "before" and "after" Blueprint Columbus homes.

FOCUS GROUPS: The city conducted focus groups with Clintonville residents who participated in a pilot lateral lining project in 2009. The purpose of these discussions was to gain insights on motivations and key messaging that resonated with homeowners to improve future outreach in other neighborhoods. The communication team also facilitated additional focus groups with residents and local contractors to learn about the attitudes, beliefs and behaviors relative to a voluntary sump pump program.

COMMUNITY ENGAGEMENT SURVEY AND FEEDBACK PROCESS: To solicit feedback and gain insights on perceptions and acceptability of the Blueprint approach, the city polled residents at community events and via door-to-door canvassing. When residents were not home or unavailable, a mail-back survey was left for them to complete at their convenience.

OUTREACH LIMITATIONS: The Blueprint communication team has made every effort throughout the community engagement and polling process to ensure that the target neighborhoods are representative of all of Columbus. While there is no way to fully predict the attitudes and behaviors of all residents, the communication team designed an engagement and polling process to ensure that an adequate sample of Columbus residents became informed and engaged through a participatory method that actively sought their feedback. Ongoing efforts to educate and engage the community will be an essential element of the Blueprint effort for many years to come.

4.1.4 What Was Learned

The engagement process produced a rich portrait of stakeholder views regarding sewer overflows and the Blueprint Columbus approach.

Generally, residents found the proposed Blueprint solutions to be interesting and thought provoking, and they were pleasantly surprised that the city took the time to inform them and ask for their input. Polled residents responded overwhelmingly positive or neutral to Blueprint Columbus. This finding remained consistent across the four representative neighborhoods, as well as the city at large. Over 70% of all survey participants support the Blueprint Columbus approach; less than 3% do not support the plan.

GENERAL THEMES: The following themes emerged from the information and feedback collected during the engagement process from the various tools and activities.

- Over 70% of respondents to the pre-engagement survey which was administered early in the outreach and education process believed that Columbus had a problem with sewer overflows. However, most of those respondents believed that the cause of sewer overflows was trash and leaves that clogged the storm sewer drains.
- During focus groups and surveying, residents repeatedly voiced a desire to be informed about what was happening in their neighborhoods — both before and after project implementation. More than two-thirds of survey respondents who were unsure or were not in favor of Blueprint stated that more information and education about the strategies could change their minds.
- Residents recognized the benefits of the proposed Blueprint Columbus strategies to the overall community and to their individual homes.
- Over three-quarters of the positive survey respondents particularly liked the green infrastructure component. They perceived job creation as the second highest benefit, followed by property enhancements and neighborhood beautification.
- Respondents rated costs and/or rate increases as the second largest concern (following the need for more information on the Blueprint technologies). Lack of trust in the city to implement the Blueprint strategies effectively was the third highest rated concern.

REACTIONS TO BLUEPRINT: Residents cited the following favorable features while having face-to-face conversations and responding to the acceptance survey:

- GREEN INFRASTRUCTURE. Green infrastructure by far ranked as the most appealing feature, with over 60% of survey respondents selecting green infrastructure as something they particularly liked about the Blueprint approach. Most residents perceived rain gardens as a way to beautify neighborhoods, and particularly liked how building and maintaining the green infrastructure will benefit the local economy.
- LATERAL LINING. Among homeowners, lateral lining was the most popular feature (62%). This level of property enhancement motivated many individuals to support the plan.
- DOWNSPOUT REDIRECTION. Over 50% of those who responded favorably identified downspout redirection as a positive aspect of the program – especially in relation to how it can tie into rain gardens and keep water away from home foundations. People were not enthused about the possibility of having their yards dug up.
- SUMP PUMPS. Thirty-nine percent of homeowners who completed the acceptance survey cited sump pumps as one of their favorite aspects of the Blueprint program.

During presentations in the community, this feature of the program elicited a strong positive reaction.

ENGAGEMENT CHALLENGES: As the city surveyed residents, they identified a lack of information about the program as their greatest concern about Blueprint Columbus. People did indicate that more education and demonstrations of success in other areas would help alleviate this concern. Hearing these perspectives early in the community outreach phases has allowed the city and communication team to develop new educational materials to further explain the pillars of Blueprint, including FAQ brochures on each pillar, and the creation of companion videos.

Another challenge is the subject matter, which many people have very little interest in. The city conducted nine public meetings in Clintonville to explain the pilot program and relatively few residents attended. As outreach continues in areas where construction is imminent, the city will need to be more creative about ensuring residents are fully informed.

Focus group findings indicated that positive word-of-mouth is the best method of gaining acceptance from other residents.

4.2 Community Advisory Panel

The city established a CAP to advise the city of Columbus on the development of its integrated plan. Representatives from Columbus' diverse neighborhoods, the business community, environmental interests, construction and homebuilding firms, academia, other governmental agencies, senior citizen advocacy groups and ratepayers served on the CAP. The objectives of the panel were to:

- Increase stakeholder knowledge and dialogue
- Open a channel of communication to residents
- Gain a better understanding of solutions that could be implemented
- Explore the various pros and cons of possible solutions
- Provide advice on communication and engagement tools
- Review data collected from neighborhoods to help draw conclusions about the public's response to various choices and approaches
- Advise on key policy questions

Mayor Michael B. Coleman and his staff identified representatives to serve on the advisory panel. The Ohio State University, John Glenn College of Public Affairs and the Consensus Building Institute conducted interviews with potential members in June and July 2013 to provide background on the project and to gauge residents' knowledge of the issues. Mayor Coleman sent a formal letter of invitation to potential CAP members on July 5, 2013. The panel met eight times between July 2013 and August 2015.

CAP meeting agendas and summaries are available on the city's Blueprint Columbus website at www.blueprint.columbus.gov.

In addition to the eight CAP meetings, the Blueprint communication team invited panel members to participate in a September 2013 tour of Columbus green infrastructure and to attend an April 2014 show and tell demonstration at a Columbus residence. During the green infrastructure tour, panel members viewed examples of green infrastructure across the city, including the Grange Insurance Audubon Center, downtown rain gardens, Clintonville rain gardens and a green roof at Griggs Reservoir. The show and tell demonstration took place at a Columbus home where members viewed first-hand the proposed approaches to address inflow and infiltration (I/I), including lining laterals and rainwater redirection.

Through a series of presentations and demonstrations, the communication team educated CAP members on the existing sewer system and the impact of large storm events on the system, potential solutions to address stormwater runoff and SSOs and the city's progress on technical modeling to test possible solutions. CAP members also learned about project financing, affordability analyses, anticipated workforce and economic development impacts and proposed work schedules and implementation plans. Members were updated on the progress of community engagement efforts at each of the eight meetings.

The CAP provided feedback to the city on the various approaches and solutions. Members shared concerns and raised questions that helped the city to clarify its message and to communicate more effectively. The panel also offered feedback on videos and educational materials used in community outreach and identified neighborhood events ideal for educating residents about Blueprint Columbus.

One of the most valuable functions CAP performed for the city was providing input as to how the city should prioritize future Blueprint areas. As described in more detail in Section 6.6, the city provided CAP with the various options regarding which areas to focus on first. The city found the input from CAP to be excellent and adopted that input as the final prioritization methodology.

At its last meeting on August 26, 2015, the city asked CAP to endorse the Blueprint plan presented in this report. To date, 4 members have done so. Only one CAP member declined to endorse the plan. Appendix C includes those endorsement letters.

4.3 Continuation of Public Outreach Efforts

Among residents polled, the Blueprint Columbus approach has solid support. The SSO problem and solutions historically have been and will continue to be a topic residents rarely think about without being prompted and informed. The integrated planning process has laid a solid foundation to this end, but much more can be done moving forward. The city's plan to execute focused community engagement activity in each target area will go a long way to increase residents' knowledge and acceptance once the work is being done in their front yards. Over time, as more neighborhoods reap the benefits of the Blueprint approach, the synergy of these efforts will gain increasing traction and success.

The city will continue to implement the public participation plan in the proposed incremental manner, focusing on key areas where the sewer overflow issue is pressing and then conducting focused community engagement prior to entry into each neighborhood.

5

MODELING

THE CITY OF
COLUMBUS
MICHAEL B. COLEMAN, MAYOR

DEPARTMENT OF
PUBLIC UTILITIES

The Integrated Plan and
2015 WWMP Update Report

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SECTION 5

5 MODELING

The primary goal of the collection system modeling is to determine the improvements needed to provide the desired level of service in the city of Columbus' wastewater conveyance and treatment facilities.

The first step in developing the required improvements is to identify the portions of the wastewater system that currently have limited capacity or are anticipated to experience capacity problems in the future. The capacity limitations may cause several issues, such as sanitary sewer overflows (SSOs), water in basements (WIBs), combined sewer overflows (CSOs) and treatment plant bypasses. Identifying these problems allows for the development and evaluation of improvements that restore adequate capacity.

This section details the efforts that went into collection system modeling in order to reflect the collection system's base condition which is defined as the 2025 physical collection system condition with the 2050 future population and land development condition. Improvements to address the capacity limitations are discussed in Section 6 and Section 7.

5.1 Updated Collection System Modeling

The following improvements were made to the existing collection system model in order to provide a better foundation for the analysis:

- Extended the modeled pipe network
- Updated representation of the hydrology within both the separate sewer and combined sewer portions of the system
- Updated future population and new development projections through 2050
- Reviewed and applied 20 years (1995-2014) of spatially distributed, 5-minute rainfall data
- Updated the calibration of the model

5.1.1 Extent of Modeled Pipe Network

In order to facilitate the analysis, the modeled pipe network was extended to include the following:

- All designed sanitary reliefs (DSRs) within the boundaries of the city
- All pipes of diameter 8-inches and greater for the city's Blueprint areas
- All pipes of diameter 12-inches and greater for the remainder of the city network, as well as for each contract service area (CSA)
- All historical flow monitoring locations with usable data

5.1.2 Hydrologic Model Configuration

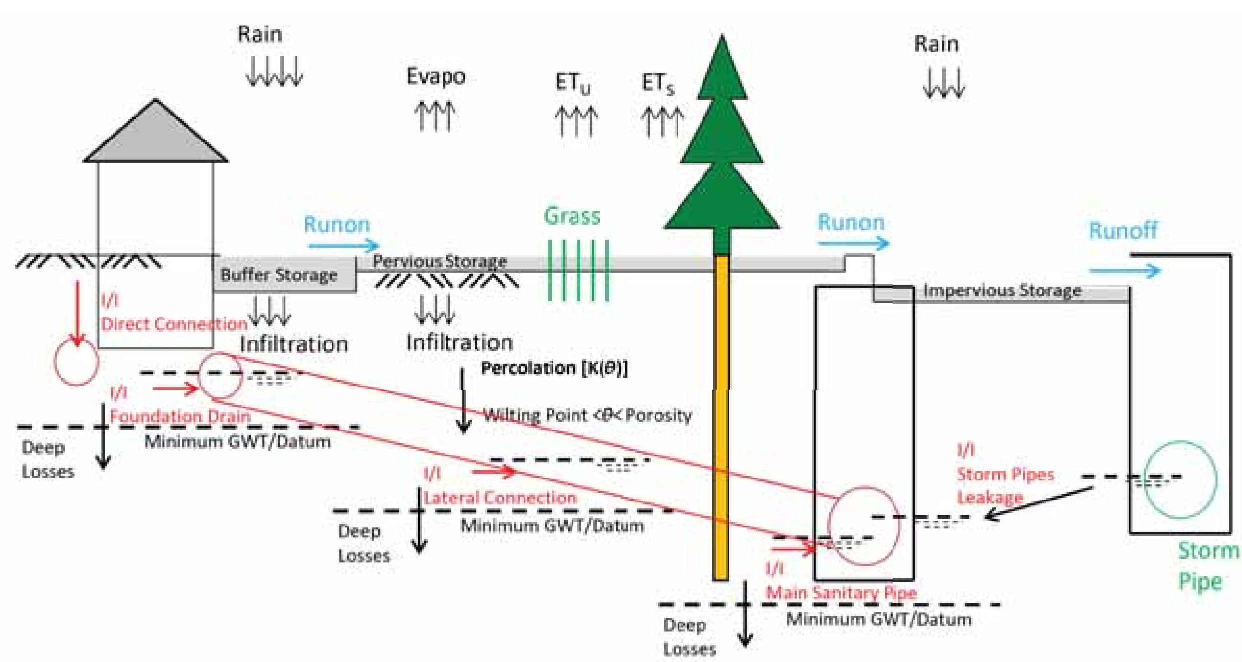
5.1.2.1 Configuration of Separate Sewer Areas

The updated collection system model consists of a high-resolution United States Environmental Protection Agency (USEPA) (Storm Water Management Model, Version 5) (SWMM5) that captures detailed hydrologic and hydraulic information at the parcel level. The model allows for a high level of confidence in the predicted flow calculations, collection system runoff and inflow and infiltration (I/I) at the source. This is a key enhancement to traditional urban collection system model approaches: traditionally, parameters are lumped together and contributing areas are represented cumulatively.

The chosen modeling technique utilizes the USEPA SWMM5 groundwater module to predict I/I from different sources including direct downspout connections, foundation drains from splashed roofs and building buffers, lateral service connections, manhole lids and castings and sewer mains. This physically based setup for groundwater recharge and its impact on the collection system represents the complex hydrological cycle, including filling depression storage, evapotranspiration, runoff generation and groundwater infiltration into aquifers.

An innovative approach was developed to generate I/I using the USEPA SWMM5 groundwater module by splitting the serviced area into sub-catchment features that correspond to the various I/I sources. Each I/I source is set to contribute to a subsurface aquifer in the model. These aquifers represent the different manmade trenches within the serviced area. When each of these I/I sources are represented as aquifers and the groundwater recharge is accurately represented, it allows the user to model the entire hydrological cycle and more accurately represent back-to-back storms affecting the collection system. Each component of the hydrologic cycle (surface runoff, evapotranspiration, surface infiltration, deep percolation and I/I processes) is appropriately configured for each I/I source using the Storm Water Management Model's (SWMM's) runoff, aquifer and groundwater modules as represented in Exhibit 5.1.1. This exhibit illustrates the various interactions in the water cycle. Note that due to limitations in the SWMM software, the groundwater aquifers represented in the model do not interact with each other.

EXHIBIT 5.1.1 » HYDROLOGIC CYCLE REPRESENTED IN THE SWMM MODEL

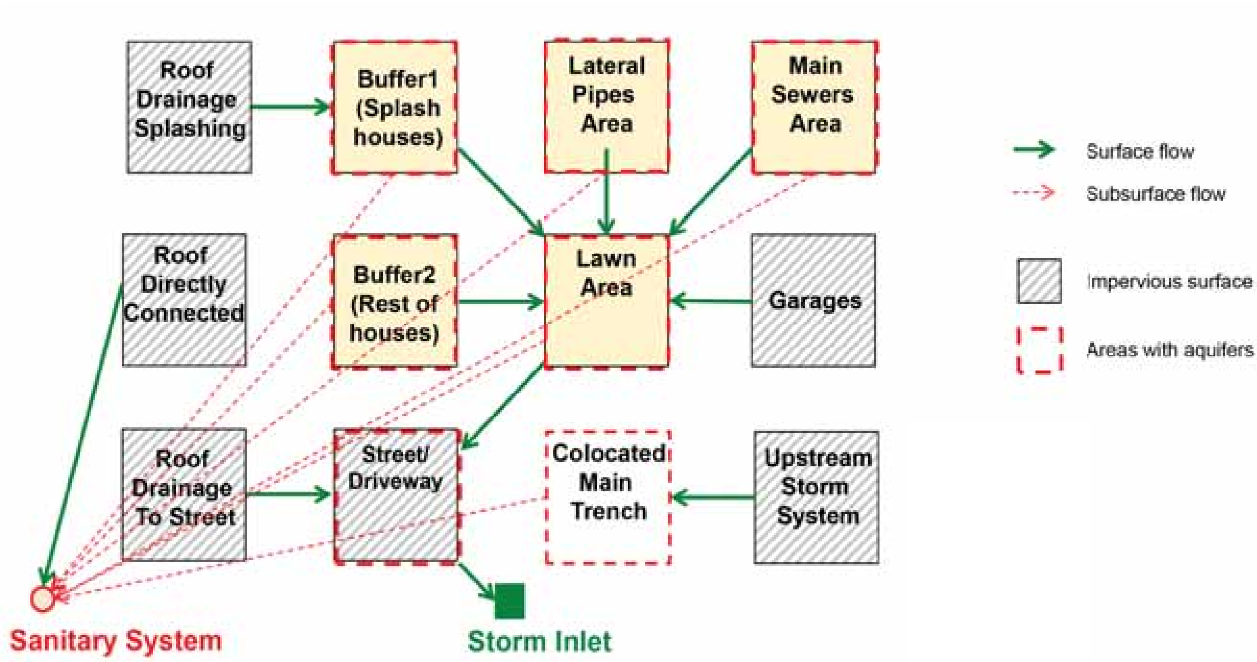


The I/I contribution into the sanitary system can be broken down into three distinctive stages. The Stage I response represents fast inflow, usually from foundation drains. In this stage, subsurface flow collected in the buffer area around old buildings that have no sump pumps fills the aquifer around the building before it passes into foundation drains which flow into the private sanitary lateral and then into the sanitary collection system.

The Stage II response represents delayed inflow from the manmade trenches of private sanitary laterals and sewer mains. In this stage, groundwater filling these trenches leaks through the lateral service connections and the main sewer lines.

The Stage III response represents infiltration from the long-term groundwater table in the non-disturbed remaining pervious area. Exhibit 5.1.2 shows I/I sources as represented in the SWMM model. As presented in Exhibit 5.1.2, additional potential sources of I/I include co-located storm pipe trenches and sanitary trenches. Stormwater from pressured storm pipes could seep into nearby parallel sanitary pipes, especially when the storm pipes cross lateral connections.

EXHIBIT 5.1.2 » I/I SOURCES IN GROUNDWATER MODULE



5.1.2.2 Configuration of Combined Sewer Areas

There are two different approaches used to represent the runoff response from the combined sewer areas within the Columbus collection system: the detailed surfacing approach and the standard sub-catchment approach.

DETAILED SURFACE APPROACH

This approach was applied to areas that have been identified as potential candidates for green infrastructure or inflow redirection projects. The detailed surface approach facilitates the representation of green infrastructure projects within the model, and was applied within the following combined sewer sheds (Figure 5.1.1 at end):

- Alum Creek storm tank
- Dodge Park
- Doe Alley
- Frambes Avenue
- Hudson Street
- Indianola Avenue
- Kerr/Russell
- King Avenue
- Markison Avenue
- Noble/Fourth
- Third Avenue

First, within each sewer shed, catchment areas were defined based on each public storm inlet receiving flow. All the area that flows to a certain storm inlet was defined as a catchment. The inlet catchments were further broken out into various sub-areas based on surface type, including roofs, parking lots, streets, lawns and alleys. These sub-areas provided more accurate flow path modeling.

The total area of roofs within an inlet catchment was geoprocessed from the city of Columbus' building graphic information systems (GIS) layer. Roofs were further divided into four categories based on review of the building and orthophoto GIS layers:

- RoofCon: Residential roofs directly connected to the combined sewer system
- RoofCom: Commercial roofs directly connected to the combined sewer system
- RoofDis: Roofs disconnected from the combined sewer system and routed to the lawn
- RoofStrt: Roofs disconnected from the combined sewer system and routed to the street

For the residential roof sub-area, a surface slope of 33% was assumed. For the commercial roof sub-area, a surface slope of 1% was assumed.

The streets sub-area was assumed to encompass streets, driveways and street-adjacent sidewalks. For the streets portion, the area was determined by geoprocessing the roads GIS layer. For the driveways and street-adjacent sidewalks portion, the area was calculated from the orthophoto. The slope of the streets sub-area was estimated from the contours GIS layer.

The lawns sub-area was approximated by visually estimating from the orthophoto what fraction of the non-geoprocessed portion of the inlet catchment was composed of the area. The percentage of the lawns sub-area consisting of impervious areas (sidewalks, porches, others) was visually estimated from the orthophoto. The slope of the sub-area was estimated from the contours GIS layer. The model Green-Ampt parameter values were used to define infiltration losses within the pervious portion of the lawns sub-area and were based on the calibration activity.

The alleys sub-area included alleys and backyard parking. The size of this sub-area was visually estimated from the orthophotos. Any alley or backyard observed in the non-geoprocessed portion of the inlet catchment was assigned to this sub-area. The slope of the sub-area was estimated from the contours GIS layer.

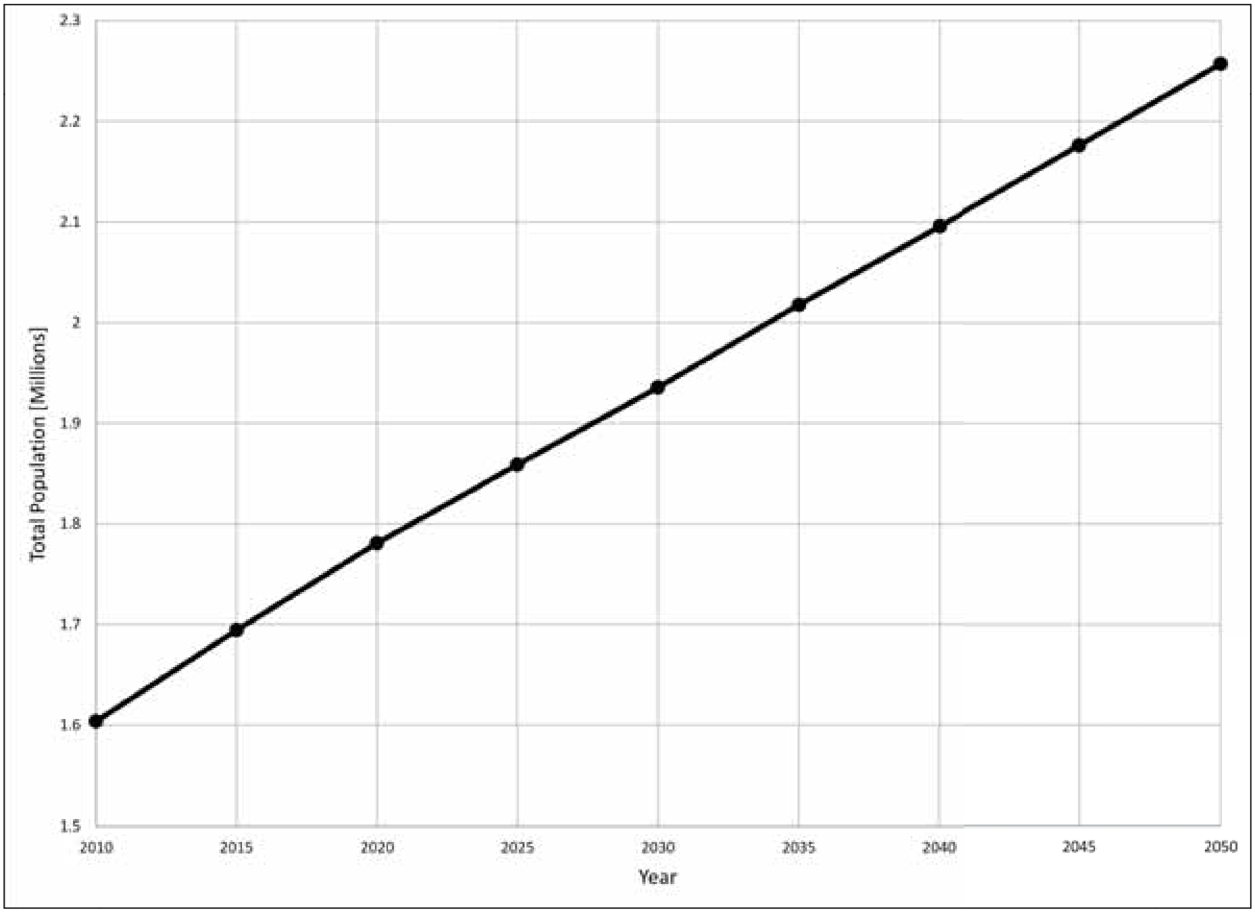
STANDARD SUB-CATCHMENTS APPROACH

For other combined areas that did not utilize the detailed surface approach, the runoff catchment boundaries usually followed contour ridgelines, center of roads or parking lot edges. For much of the combined areas, there were clearly defined and consistent slopes, which aided delineation. Parking lots with inlets were considered to be self-contained and were limited to the structure or parcel extent.

5.1.3 Population and New Development Area Assumptions

Population growth in Columbus was obtained from the Mid-Ohio Regional Planning Commission (MORPC). The projected equivalent population used in the model for years beyond 2010 was calculated by adding growth in the MORPC equivalent population to the equivalent population in the model for year 2010. Equivalent population is a figure that accounts for the employment of an area, in addition to the residential population. The MORPC population and employment forecasts were converted to equivalent population by multiplying employment by a factor of 0.5 and adding it to the population. Exhibit 5.1.3 shows the population growth between year 2010 and year 2050. For more discussion of the population projections, please refer to Appendix D.

EXHIBIT 5.1.3 » EQUIVALENT POPULATION FORECAST



The growth in the equivalent population was converted to growth in the serviced area. In general, density of existing capita per acre in each sub-basin was assumed to remain constant in the future. Portions of non-developed areas in each basin were converted to serviced areas based on the additional equivalent population in future years. It should be noted that growth in the sub-basins' served areas was not allowed to exceed total available developable areas.

5.1.4 Rainfall Application

The city of Columbus began collecting continuous 5-minute rainfall data records in 1995. A total of 42 rain gauges (RGs) have been installed to date with data records spanning from two to 20 years per gauge. The city also has access to an additional 12 years of 5-minute rainfall records (starting in 2003) from 30 state of Ohio rain monitoring systems (STORMS) RGs that were spatially distributed across Franklin County. These 72 RGs are distributed over Columbus' 430,000 acres facilities planning area and provide a good resolution for the rainfall spatial variability.

A systematic approach was developed to review the data quality. The data review process was implemented by comparing each RG to the five closest surrounding gauges to screen and flag questionable RG events.

The inverse distance weighted method was used to calculate the spatially distributed weighted rainfall. A rainfall grid covering the city of Columbus was populated with the weighted rainfall. For each grid, the six closest rain gauges were used, excluding the ones with questionable data.

For example, if two of the six closest rain gauges had questionable data, only the closest four rain gauges were used.

The weighted rainfall was calculated for a continuous 20-Year period (1995 through 2014). This distributed rainfall was used in the multiple-year model calibration and in the 20-Year integrated modeling simulations to predict the return frequency of hydraulic deficiencies in the collection system.

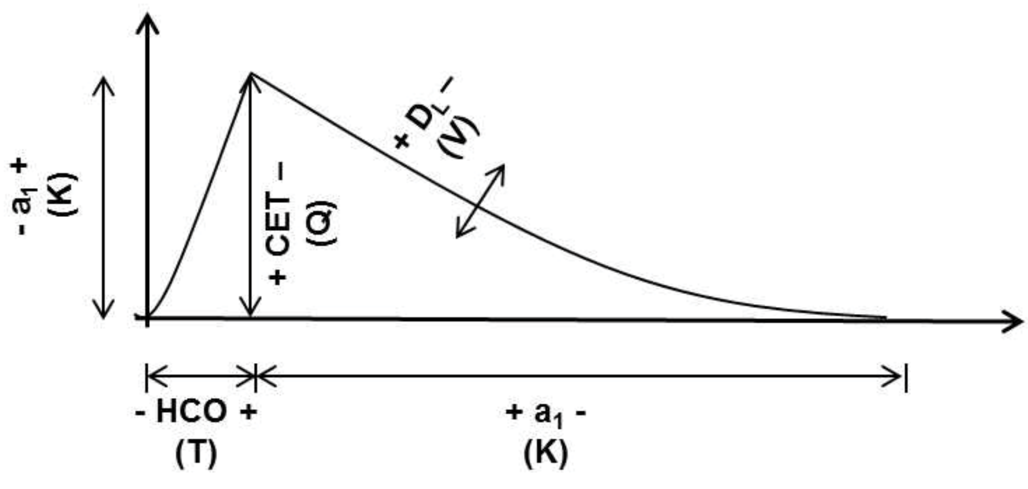
5.1.5 Model Calibration

A total of 147 flow meters were used to calibrate the Columbus collection system model. See Figure 5.1.2. The model required a continuous simulation approach to calibration in order to ensure that a continuous series of wet weather events would be modeled accurately. As a result, if sufficient data was available, meters were calibrated using two to three years of continuous flow data. When selecting data periods to use for calibration, the most recent available data were preferred. Once the calibration period was defined, wet weather response event periods were defined to use as a basis of comparison. Typically, 20 to 30 wet weather response events were defined for each year within the calibration period.

5.1.5.1 Calibration of Separate Sewer Areas

During the model calibration of the separate sewer areas, Stage I, II, and III response hydrographs were independently calibrated until an acceptable match was achieved between the modeled and observed hydrographs.

EXHIBIT 5.1.4 » FOUR PRIMARY CALIBRATION PARAMETERS ADJUSTMENTS



The key calibration parameters for the separate sewer areas shown in Exhibit 5.1.4 are defined as follows:

- I/I Coefficient (a1): I/I coefficient or groundwater flow coefficient determines the quantity of inflow that gets into the sewer system from the trench represented by the aquifer.
- Conductivity Gradient (HCO): Conductivity gradient (or slope) is the average slope of log (hydraulic conductivity) versus soil moisture deficit (porosity minus moisture content) curve.

- Deep Loss Coefficient (DL): Deep loss coefficient or lower groundwater loss rate is the rate of percolation from the saturated zone to the deep groundwater.
- Upper Zone Evapotranspiration Factor % (CET): Monthly varying factor to be multiplied by the evaporation values.

5.1.5.2 Calibration of Combined Sewer Areas

For the areas where the standard sub-catchment approach was used, the following key calibration parameters were adjusted:

- Percentage of Runoff Routed to Pervious: Defines how much of the runoff from the impervious areas is routed over pervious surfaces available for infiltration.
- Depression Storage for Pervious Areas (in): Represents the storage that needs to be filled before runoff occurs from the pervious areas.
- Depression Storage for Impervious Areas (in): Represents the storage (ponding and wilting) that needs to be filled before runoff occurs from the impervious areas.
- Percent of Impervious Area with No Depression Storage: Represents the percentage of the impervious area where runoff starts immediately during a rain event.

For the areas where the detailed surface approach was used, the following key calibration parameters were adjusted:

- Depression Storage for Pervious Areas (in): This was only adjusted for the lawn detailed surfaces (the only surfaces containing pervious area).
- Depression Storage for Impervious Areas (in): This was adjusted for all surfaces.

5.2 Base Model

Once the updates to the existing collection system model were complete, the system model was updated to reflect base conditions. As previously noted, base conditions for the analysis were defined as the 2025 network condition and the 2050 future population and land development condition. For the 2025 network condition, it was assumed that all projects planned in order to attain the desired levels of service for all of the system's CSOs would be complete by 2025 and thus were included in the model. That list of projects includes projects that are currently under construction (Olentangy Scioto Interceptor Sewer Augmentation and Relief Sewer [OARS]), those that are going to be constructed (Chemically Enhanced Primary Treatment facility [CEPT]) and those that will be needed to meet the 2025 CSO consent order deadline (Lower Olentangy Tunnel [LOT1]). In addition, any local projects within the separate sewer areas that had already been planned and are scheduled to be complete by 2025 were included in the model.

5.2.1 System-wide Large-Scale Solutions

System-wide deficiencies require large-scale solutions. These solutions solve hydraulic deficiencies in the main trunk sewers and provide free outfall for the local areas. The following sections provide an overview of several large-scale solutions that were included in the base model.

5.2.1.1 OARS

The OARS is currently under construction. OARS is a 20-foot-diameter tunnel that starts east of the flow diversion structure (FDS) located upstream of the Jackson Pike Wastewater Treatment Plant (JPWWTP) and ends southwest of the intersection of Spruce Street and Neil Avenue. See Figure 5.2.1. The total length of OARS (as proposed) is 23,300 feet.

The OARS captures all overflow from the following downtown CSO regulators:

- Moler Street
- Peters Run
- Whittier Street

OARS also provides hydraulic relief to the Olentangy Scioto Interceptor Sewer (OSIS) at the following three locations:

- Near the Whittier Street Storm Tanks (WSSTs)
- North of the intersection of Short Street and Liberty Street
- Southwest of the intersection of Spruce Street and Neil Avenue
- OARS provides the following benefits:
- Reduces the peak hydraulic grade line (HGL) along OSIS for large storm events.
- Assists in the attainment of the 10-year level of service (LOS) for the downtown CSOs by either capturing all overflow from the regulator structure, or by reducing the activations of the regulator structure by reducing the HGL within the OSIS.

5.2.1.2 Lower Olentangy Tunnel Phase 1

Phase 1 of LOT (LOT1), pictured in Figure 5.2.2, is a proposed 9-foot-diameter tunnel planned to start at the upstream termination point of OARS and end near the site of the existing Second Avenue pump station. The proposed alignment is along Goodale Street, Michigan Avenue and Second Avenue with a total length of 5,250 ft. LOT1 provides hydraulic relief to the collection system at two points:

- Franklin Main Interceptor Sewer (FMI) near Second Avenue
- OSIS near intersection of Second Avenue and Perry Street

LOT1 provides the following benefits:

- Reduces the peak HGL along the FMI, Kinnear sub-trunk sewer and OSIS during large events.
- Assists with the attainment of the 10-year level of service for DSR 156, a mainline DSR on the FMI.
- Assists with the attainment of the typical year level of service for the upper Olentangy CSO regulators.

5.2.1.3 Chemically-Enhanced Primary Treatment Facility

As part of the base model, a proposed CEPT is included. CEPT will be located at the Southerly Wastewater Treatment Plant (SWWTP), and will provide 110 million gallons per day (MGD) of enhanced primary treatment and disinfection capacity beyond the 330 MGD of secondary treatment that SWWTP can provide. The purpose of CEPT is to provide primary treatment and disinfection for flows that would otherwise bypass SWWTP during large events. This project is a quick hit as described further in Section 6.

5.2.2 Local Solutions for Combined Sewer Overflow Areas

For those CSO regulators not addressed by the described system-wide solutions, a series of local solutions were incorporated into the base model in order to ensure that the target level of service for each location is achieved by 2025.

5.2.2.1 Inflow Redirection Projects

- Dodge Park (Figure 5.2.3): The analysis and design of infrastructure renewal for the Dodge Park pump station tributary area showed that a 50% reduction in wet weather flows for the area tributary to the Dodge Park wet weather combined pump station was necessary in order to achieve the typical year level of service for the Dodge Park CSO. An assumed 50% reduction of the surface runoff was incorporated into the base model. Concurrently, the city of Columbus is under contract for surface runoff detention and attenuation design activities to meet the typical year LOS at Dodge Park CSO. Proposed area improvements from this analysis and design will be evaluated upon completion to ensure that the proposed runoff reduction metric is achieved in order to meet the consent decree level of service requirement.
- Kerr/Russell (Figure 5.2.4): Redirection of public sources of inflow was incorporated for 19.7 ac of the area tributary to the Kerr/Russell CSO manhole. To facilitate the redirection project, a total of 1807 ft. of new storm sewer is needed. These new storm sewers will tie into the existing 48" overflow storm sewer downstream of the Kerr/Russell CSO manhole and an existing 15" storm sewer east of the intersection of 4th Street and Warren Street.
- Markison (Figure 5.2.5): Redirection of public sources of inflow was incorporated for 147 ac of the area tributary to the Markison Avenue CSO regulator. To facilitate the redirection project, a total of 8090 ft. of new storm sewer is needed. These new storm sewers will tie into an existing 72" storm sewer near the intersection of Markison Avenue and Wilson Avenue.
- Noble/Fourth (Figure 5.2.6): Redirection of public sources of inflow was incorporated for six ac of the area tributary to the Noble/Fourth CSO manhole. To facilitate the redirection project, a total of 525 ft. of new 24" storm sewer is needed, running parallel to the combined sewer on Noble Street from Fifth to Fourth Street. These new storm sewers will tie into the existing 72" storm sewer on Fourth Street.

In addition, the base model included representations of the following projects redirecting public sources of inflow (Figure 5.2.7):

- Fulton/Grant (overflow was eliminated as part of the project)
- Grant/Mound
- Grant/Noble
- Mound east of I-71

5.2.2.2 Modifications to Regulator Structures

The base model included representations of the following proposed and recently completed modifications to regulator structures:

- Alum Creek Storm Tank: Fully opened downstream 4' x 4' sluice gate (proposed)
- Cherry/Fourth: Incorporated upsized capture pipe and new bending weir (recently completed)

- Markison: Fully opened downstream 4' x 4' underflow gate, upsized the conduit between the regulator and manhole 0017S0499 from 4' x 4' (rectangular) to 5.5' (circular), removed the weir located between manhole 0017S0499 and the Markison relief sewer and raised the regulator weir by 1.13' (proposed)
- Town/Fourth: Incorporated upsized capture pipe and raised weir (recently completed)

5.2.2.3 Third Avenue Green Infrastructure Projects

Within the Third Avenue CSO basin, the following green infrastructure projects were incorporated into the base model:

- Clark Place silva cells
- Euclid Avenue silva cells
- Harrison Avenue pervious pavers
- Hunter Avenue silva cells
- McMillen Avenue pervious pavers
- Pennsylvania Avenue pervious pavers

Silva cells are tree boxes where rainfall can be directed, and pervious pavers are a type of permeable pavement that will divert rainfall underground.

For the largest storm event during the typical year, the model analysis showed that these green infrastructure projects generated a reduction in peak flow at the Third Avenue regulator equivalent to that achieved by 20 acres of inflow redirection. This project is a quick hit as described further in Section 6.

5.2.2.4 Modification of Weir Structure at 18th and Long

In order to attain the typical year level of service for the Alum Creek storm tank, the weir located near the intersection of 18th Street and Long Avenue was modified within the base model by reducing the height of the weir from 2.42' to 1.75'. The location of this structure is shown in Figure 5.2.8. Flow that reached this flow split was either routed toward the Alum Creek storm tank (flow through the underflow) or toward the Chestnut Street regulator (flow over the weir). Reducing the height of the weir resulted in more flow being routed toward the Chestnut Street regulator and less flow being routed toward the Alum Creek storm tank during large events. Analysis showed that the 10-year level of service was still achieved at the Chestnut Street regulator when the additional flow was routed toward it.

5.2.2.5 Regulator Cleaning

An assumption made in the collection system modeling is that deposition in the regulator chambers would be removed so that additional capacity in the system could be realized. This effort would become a part of the city's ongoing maintenance program. This project is not included in the capital projects associated with this plan as it is a separate operations and maintenance budget item.

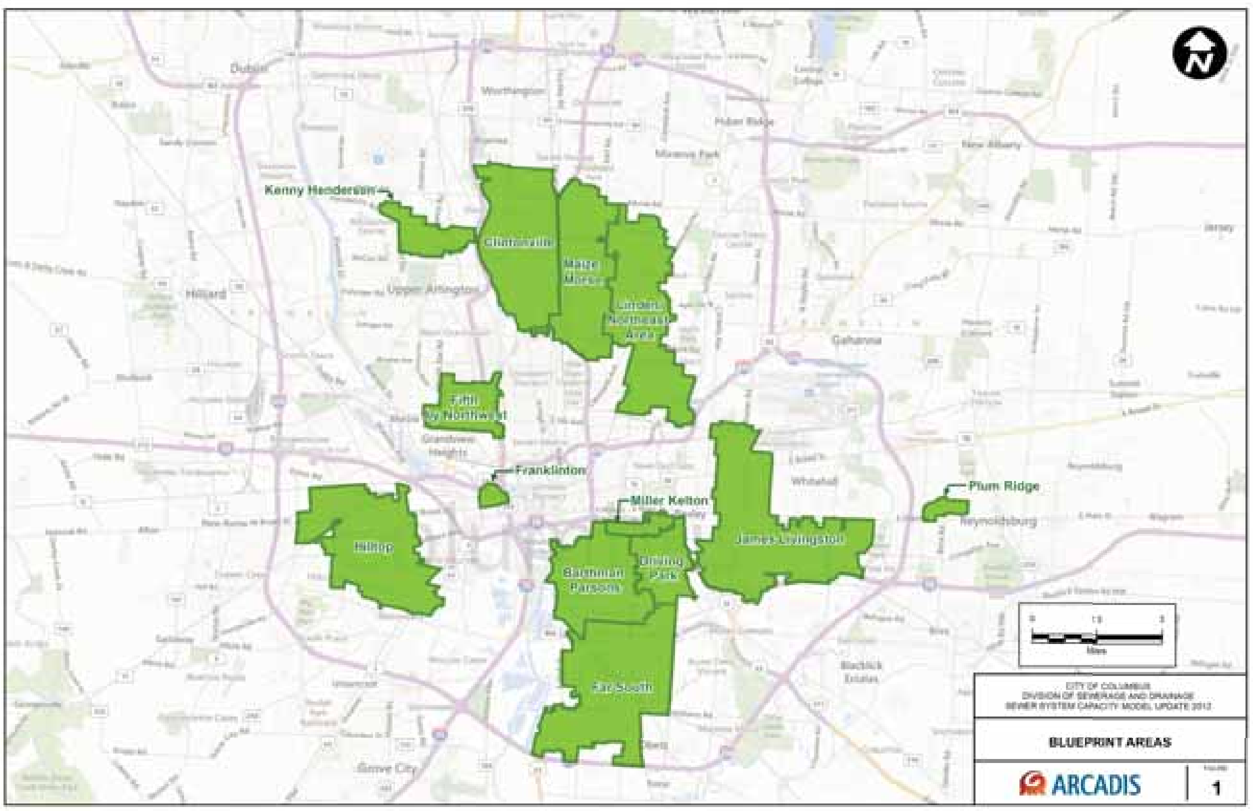
5.2.3 DSR 83 Weir Raise

The modeling included raising DSR 83 weir elevation to 705 ft. Raising the DSR 83 weir is a quick hit which is described further in Section 6.

5.2.4 Blueprint Areas

For 20 years the city of Columbus has been investigating inflow and infiltration (I/I) in the collection system. These areas were discussed in numerous reports, including the 2005 Wet Weather Management Plan (WWMP). In those 20 years, 13 areas were identified and studied due to the hydraulic deficiencies in those areas such as SSOs and WIBs. These 13 areas are shown in Exhibit 5.2.1 below. These 13 areas encompassed approximately 30,000 acres. These areas were used as a starting point for the Blueprint analysis.

EXHIBIT 5.2.1 » AREAS OF STUDY IN COLUMBUS' COLLECTION SYSTEM



In the course of adding detail to the model, calibrating the model and analyzing model and historical information, it was determined that several of these areas could be eliminated. Maize Morse, Driving Park, Far South, Kenny Henderson and Franklinton areas were all eliminated from further consideration through this modeling and study process. These areas were removed because recent improvements constructed in the areas were providing sufficient benefits and the hydraulic deficiencies were no longer present. In addition, areas not in the city of Columbus were also eliminated, as the city has no jurisdiction to make improvements in those areas.

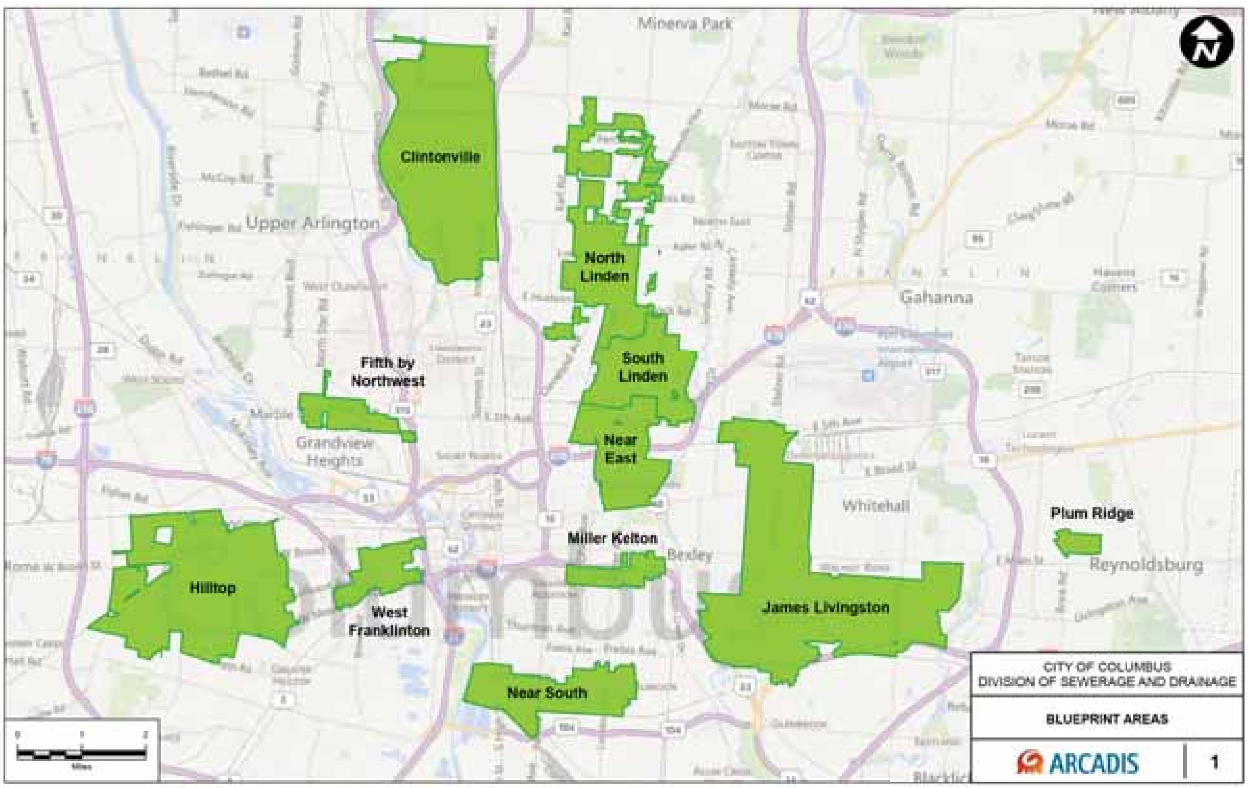
Also through the course of the investigation several areas were reduced or increased in size. In the Fifth by Northwest area the large northern portion of the area was eliminated because it didn't directly impact the southern portion of the area where numerous DSRs are located.

A downstream portion of the Plum Ridge area was eliminated because it didn't have any hydraulic deficiencies. The northern portion of Barthman Parsons was eliminated because this area is a combined sewer area (the southern portion of Barthman Parsons was then re-named Near South). And the Hilltop area was modified, as some area on the east side of the study area was eliminated and a portion to the west was added because of the presence and absence of hydraulic deficiencies in those areas.

New areas were also identified based on examination of recent data and the detailed collection system modeling. West Franklinton, Near East and two additional areas west of Linden were added.

Following these changes, 18,400 acres were identified as areas where improvements were needed in order to address hydraulic deficiencies. See Exhibit 5.2.2. These areas became known as the Blueprint areas as their identification was during the investigation into the Blueprint concept.

EXHIBIT 5.2.2 » FINAL BLUEPRINT AREAS



These Blueprint areas, described in more detail in the sections below, are areas where there are numerous WIBs and local DSRs. In addition to the system-wide improvements, improvements in these areas will be necessary to stop and mitigate WIBs and DSRs in the city. This section outlines the current condition of these areas, so that improvements, whether from the Blueprint alternative or the gray alternative can be assessed.

This section describes the Blueprint areas and the 2025 base conditions for each Blueprint area. The description of each Blueprint area includes the location of the area and the extent of the sewer network, as well as the locations of any DSRs and high-density clusters of reported WIBs. The description of base conditions includes DSR and WIB results for the 20-Year model simulation, as well as a description of all projects included. It is key to note that though some of the Blueprint pilot areas are under design, construction on these projects will not move forward until approval is received from the Ohio EPA. Therefore, in the 2025 base model, no Blueprint implementation will assume to be constructed.

5.2.4.1 Clintonville

AREA DESCRIPTION

LOCATION: The Clintonville Blueprint area located in north-central Columbus includes both the Clintonville main basin and Franklin main Walhalla basin for a total coverage of 3,551.7 acres within the city boundaries. The area is bordered by Worthington to the north and by Glen Echo Park to the South. The western boundary of Clintonville is the Olentangy River, and the eastern is railroad tracks and Interstate I-71. The entire length of the area is crossed by North High Street, which connects US 23 to downtown Columbus. Overbrook Ravine, Whetstone Park and Park of Roses are located in the central portion of the basin.

SEWER NETWORK: The main interceptor in the Clintonville area is the north-south Clintonville Main Interceptor Sewer (CVM). It is located on the west side of the area along the Olentangy River. From the north, the area collects sanitary flow from two CSAs – the city of Worthington and the city of Riverlea - at the intersection of Broad Meadows Blvd. and Highfield Drive. A third CSA, Clinton #2, is located near the northwest corner of the basin. The Clintonville sanitary system discharges into two main trunks, the FMI and the OSIS. Flow discharges into the FMI through a couple of weirs at Orchard Lane; it discharges into the OSIS at Orchard Lane and at a second downstream location close to the intersection between West Tulane Road and Sunset Drive.

DSRs AND WIBs: The Clintonville basin has 14 DSRs within the Blueprint boundaries that can be divided into three groups based on their location:

1. There are nine DSRs in the Clintonville main basin. Seven of those relieve the Clintonville main trunk sewer (city of Columbus reference numbers: 360, 351, 346, 352, 335, 323 and 326). Two DSRs are located within the basin. DSR 349 is located along North High Street and DSR 337 is located at the intersection between Richards Road and Granden Road.
2. Four DSRs are within the Franklin Main (FMN) Walhalla basin. On the southwest side, DSRs 328 and 898 are located along the sewer running parallel to North High Street. On the southeast side, DSRs 329 and 285 are in proximity of Indianola Avenue.
3. In the north, close to North High Street, DSR 368 is located outside the Blueprint area, but within the city boundaries. The sanitary flow collected in this area is discharged into the Olentangy Main Interceptor Sewer (OMI) through the relief at Broad Meadows Boulevard.

High-density clusters of reported WIBs are found along the main trunks upstream of the Overbrook Ravine, upstream of the intersection of Dunedin Road and West Torrence Road (central area), in proximity of DSRs 328 and 898 and in the southeast corner of the Blueprint basin.

BASE CONDITIONS

The base conditions used to evaluate the deficiencies in the collection system are based on the 2025 sewer network, along with the anticipated 2050 population and area development conditions.

By 2025, one roadway improvements project is expected to be complete along Richards Road running east-west in the central portion of the basin perpendicular to Indianola Avenue and North High Street. The project involves the replacement of the sanitary sewer with approximately 0.5 miles of new sewer ranging between one and two feet in diameter. The project also involves the installation of new storm sewer and roadway rehabilitation.

Base conditions were assessed over 20 years by tracking both DSR activations and WIBs. Figure 5.2.9 shows the location of the Richards Road project and the distribution of the houses potentially not meeting the 10-year LOS for WIBs. The base model indicates 1547 potential WIBs.

Table 5.2.1 reports the number of potential DSR activations and corresponding LOS for base conditions. Eleven DSRs out of 14 would not meet the 10-year LOS. Several of these DSR activations are due to insufficient capacity in the Clintonville main trunk to convey the flow.

5.2.4.2 Hilltop

AREA DESCRIPTION

LOCATION: The Hilltop Blueprint area is located in west-central Columbus, including 3,302.5 acres within city boundaries. The basin is bordered on all sides by the road system: Interstate I-70 to the north and northeast, Harrisburg Pike to the southeast, Clime Road to the south and interstate I-270 to the west. The area is crossed by US 40 and railroad tracks from west to east, and by US 62 from south to east.

SEWER NETWORK: There are three main interceptors in the Hilltop area. The west side sanitary sewer and west side relief sewer run west to east in the lower portion of the Blueprint area. On the south side, the Big Run trunk sewer conveys flow from the west side of the city to the north-south interconnecting trunk sewer. The Hilltop sanitary system receives flow from two CSAs: from Franklin County that extends upstream of the west boundary of the Blueprint area, and from the city of Valleyview in the northeast corner of the basin. The sanitary flow leaving the Blueprint area from the east is conveyed to the west side trunks. Both of the trunks discharge into the north-south Scioto main trunk sewer, which conveys flow to the JPWWTP. The sanitary flow leaving the Blueprint area from the south discharges into the Big Run trunk sewer, which conveys flow to the interconnecting trunk sewer, then to the SWWTP.

DSRs and WIBs: There are four DSRs (city of Columbus reference numbers: 250, 252, 254 and 256) within the Hilltop, and all of them are located in the central portion of the basin. DSR 256 can be found along Binns Boulevard between Palmetto and Fremont Street. DSR 252 is located along Wicklow Road and DSR 254 is close to Parkside Road. Toward the southern boundary of the Blueprint area, DSR 250 is in proximity of the intersection between Mound Street and Hague Avenue. Reported WIBs are distributed across the entire basin with higher concentrations in the central and central-east areas.

BASE CONDITIONS

The base conditions used to evaluate the deficiencies in the collection system are based on the 2025 sewer network, along with the anticipated 2050 population and area development conditions. In the Hilltop basin, no projects are currently planned for the sanitary system before 2025 besides future Blueprint projects.

Base conditions were assessed over 20 years by tracking both DSR activations and WIB events. Figure 5.2.10 shows the distribution of the houses potentially not meeting the 10-year LOS for WIBs. The base model indicates 1,819 potential WIBs.

The number of potential activations and corresponding LOS for Hilltop DSRs are reported in Exhibit 5.2.3. Only DSR 252 (one out of four) would meet the 10-year LOS.

EXHIBIT 5.2.3 » HILLTOP BLUEPRINT AREA DSR BASE CONDITIONS

DSR ID >	250	254	252	256
Number of Activations in 20-Year Simulation	29	18	1	6
Level of Service (LOS)	0.7	1.1	33.2	3.6

5.2.4.3 Linden (North and South)

AREA DESCRIPTION

LOCATION: The Linden Blueprint area is 3,094.8 acres in size, located in north-central Columbus. It extends from north to south from Morse Road and Eden Avenue to Fifth Avenue. On the east and west the basin is bounded by those roads; the western boundary runs from Karl Road to Billiter Boulevard; and the eastern boundary runs from Westerville Road to Sunbury Road. The basin is generally divided between North and South Linden, by 23rd Avenue and by Woodland Avenue. A smaller area, 87.1 acres, located on the southwest side of Linden has been included in the Linden Blueprint area. The smaller area is delimited by Cleveland Avenue to the east and south, and by Interstate I-71 to the west. The northern boundary follows the road from 26th Avenue and Duxeberry Avenue to Medina Avenue and Tompkins Street.

SEWER NETWORK: Two main trunks collect the sanitary flow from the Linden Blueprint area. The East Main trunk sewer runs from west to east, south of Linden, and the Alum Creek trunk sewer runs from north to southeast of Linden. Additional contribution to the sanitary system comes from the CSA of Mifflin (Franklin County), with 793.5 acres mainly in the north and northeast portion of the basin. In the smaller basin, located on the southwest side of the Linden Blueprint area, flow is conveyed to the sanitary system, discharging into the OSIS on the west side of the city.

DSRs AND WIBs: Linden has eight DSRs within its boundaries. Six of them are located in the central portion of the basin delimited by East North Broadway to the north, by Weber Road to the south and by Westerville Road to the west (city of Columbus reference numbers: 305, 306, 307, 312, 314 and 315). DSR 952, the southern-most one in the basin, is located at the intersection between Hudson Avenue and the sanitary sewer that conveys the flow from North to South Linden. DSR 339, the northernmost one in the basin, is on the border of the Mifflin (Franklin County) CSA near the intersection of Ferris Road and Cleveland Avenue.

Reported WIBs are diffused across the entire basin with high density clusters in the central portion of the basin, on the west side of North Linden and on the east side of South Linden.

BASE CONDITIONS

The base conditions used to evaluate the deficiencies in the collection system are based on the 2025 sewer network, along with the anticipated 2050 population and area development conditions. In the Linden basin, no projects are planned for the sanitary system before 2025.

Base conditions are assessed over 20 years by tracking both DSR activations and WIBs. Houses potentially not meeting the 10-year LOS for WIBs are shown in Figure 5.2.11. The base model indicates 1,260 potential WIBs.

Potential DSR activations and corresponding LOS are summarized in Exhibit 5.2.4. Four out of eight DSRs would not meet the 10-year LOS under base conditions.

EXHIBIT 5.2.4 » LINDEN BLUEPRINT AREA DSR BASE CONDITIONS

DSR ID >	314	307	305	306	312	315	339	952
Number of Activations in 20-Year Simulation	-	-	39	7	-	17	9	-
Level of Service (LOS)	-	-	0.5	3.0	-	1.2	2.3	-

5.2.4.4 Miller Kelton

AREA DESCRIPTION

LOCATION: The Miller Kelton basin consists of 341.7 acres located in central Columbus. The basin's northern boundary is Interstate I-70 and East Main Street; its southern boundary is Livingston Avenue. South 18th Street and Livingston Park define the basin's western boundary, and Nelson Road and Rhoads Avenue make up the eastern boundary. On the east side, Interstate I-70 crosses the basin east to west.

SEWER NETWORK: The Miller Kelton sanitary system conveys flow into the East Main trunk sewer, which runs parallel to the basin to the north and along East Main Street. The flow is then intercepted by the north-south Alum Creek Interceptor Sewer (AC). No CSAs contribute to the Miller Kelton basin. However, the sanitary system receives stormwater contributions from three areas of public source inflow with a total coverage of 3.3 acres.

DSRs and WIBs: There are nine DSRs within the Miller Kelton boundaries and all of them are located in the eastern portion of the basin. These DSRs can be divided into two groups based on their location with respect to Interstate I-70:

1. South of I-70, there are five DSRs (city of Columbus reference numbers: 193, 199, 185, 190 and 188) distributed along Gault Street.
2. North of I-70, there are four DSRs (city of Columbus reference numbers: 177, 179, 181 and 189) located close to Cole Street.

Reported WIBs are distributed across the entire basin without any high-density clusters.

BASE CONDITIONS

The base conditions used to evaluate the deficiencies in the collection system are based on the 2025 sewer network, along with the anticipated 2050 population and area development conditions. In the Miller Kelton basin, no projects are planned for the sanitary system before 2025.

The performance of the sanitary system under base conditions was assessed over 20 years by tracking both DSR activations and WIBs. Houses potentially not meeting the 10-year LOS for WIBs are shown in Figure 5.2.12. The base model indicates 59 potential WIBs.

Potential DSR activations and corresponding LOS are summarized in Exhibit 5.2.5. Five out of nine DSRs would not meet the 10-year LOS under base conditions. These include the four DSRs north of Interstate I-70 and DSR 185 south of the interstate.

EXHIBIT 5.2.5 » MILLER KELTON BLUEPRINT AREA DSR BASE CONDITONS

DSR ID >	177	181	189	179	188	190	185	199	193
Number of Activations in 20-Year Simulation	76	3	8	5	-	-	6	-	-
Level of Service (LOS)	0.3	7.7	2.6	4.3	-	-	3.6	-	-

5.2.4.5 Plum Ridge

AREA DESCRIPTION

LOCATION: The Plum Ridge Blueprint area is located in east Columbus with a total coverage of 139 acres within the city boundaries. The boundaries of the area are generally Rose Hill Road to the east, Portsmouth Road and Barberry Hollow to the south, Barberry Lane to the west and Cherry Hill Drive and Kings Charter Road to the north.

SEWER NETWORK: The main interceptor closest to the Plum Ridge area is the Big Walnut Interceptor Sewer (BWN). It is located on the west side of the Plum Ridge area along the Big Walnut River. The Plum Ridge sanitary sewer system discharges into the BWN via a 24-inch sanitary sewer under Big Walnut Creek.

The Blueprint area defined for the Plum Ridge area is the upstream portion of the overall study area. This area drains to the lower portion through a sewer that contains numerous 90-degree bends. This hydraulic configuration is a cause of some of the hydraulic deficiencies in this area.

DSRs and WIBs: There is one DSR (city of Columbus reference number 364) within the Plum Ridge Blueprint area, which is located in the vicinity of the intersection of Lornaberry Lane and Plum Ridge.

A few WIBs have been reported along Balsam Drive, Carriage Lane and Shenandoah Drive, which are mainly located on the east side of the Blueprint area.

BASE CONDITIONS

The base conditions used to evaluate the deficiencies in the collection system are based on the 2025 sewer network, along with the anticipated 2050 population and area development conditions. In the Plum Ridge Blueprint area no projects are planned for the sanitary system before 2025.

Base conditions were assessed over 20 years by tracking both DSR activations and WIB problems. Figure 5.2.13 shows the distribution of the houses potentially not meeting the 10-year LOS for WIBs. There are 152 WIBs potentially not meeting 10-year LOS, which are shown in purple in Figure 5.2.13.

Exhibit 5.2.6 shows the number of activations (49) and the corresponding LOS value from 20-Year simulations for DSR 364 under base conditions. These results demonstrate that additional mitigation technology is necessary to solve the DSR activations and WIB problems for the Plum Ridge Blueprint area.

EXHIBIT 5.2.6 » PLUM RIDGE BLUEPRINT AREA DSR BASE CONDITIONS

DSR ID >	364
Number of Activations in 20-Year Simulation	49
Level of Service (LOS)	0.41

5.2.4.6 Near South

AREA DESCRIPTION

LOCATION: The Near South Blueprint basin is located in central Columbus and includes 1,154.2 acres within the city boundaries. The area extends from Fairwood Avenue on the east to the Scioto River on the west. The northern basin boundary is East Markison Avenue and East Woodrow Avenue, the southern boundary is defined by railroad tracks and the eastern boundary marked by Refugee Road. The basin is crossed by Parsons Avenue on the center-west side, running north to south. Barack Park is located in the central portion of the basin.

SEWER NETWORK: The Near South sanitary system conveys flow into the South Side Interceptor Sewer that runs parallel to the north side of the basin from east to west along Markison Avenue. This main trunk collects not only the sanitary flow of Near South, but also combined flow from areas located upstream of the north boundary of the basin. The combined flow is intercepted near the north boundary of the basin at the Markison (east) and Moler (west) regulators. The flow is then conveyed into the OSIS and finally to the JPWWTP.

DSRs and WIBs: There are nine DSRs in the Near South basin. Seven of them are located on the west side of the basin. Moving from west to east, DSR 213 is located on Fourth Street; DSRs 205, 206 and 210 are along Bruck Street; DSR 208 can be found on Ninth Street; and finally, DSRs 207 and 211 are along Parsons Avenue. The remaining two DSRs, 201 and 203, are on the east side of the basin along Lawrence Drive.

BASE CONDITIONS

The base conditions used to evaluate the deficiencies in the collection system are based on the 2025 sewer network, along with the anticipated 2050 population and area development conditions. In the Near South basin, no projects are planned for the sanitary system before 2025.

The performance of the sanitary system under base conditions was assessed over 20 years by tracking both DSR activations and WIBs. Houses potentially not meeting the 10-year LOS for WIBs are shown in Figure 5.2.14. The base model indicates 392 potential WIBs.

Under the base conditions, six out of nine DSRs would not meet the 10-year LOS as summarized in Exhibit 5.2.7. The six DSRs include both the DSRs on the east side of the basin (DSRs 201 and 203) and four DSRs on the west side.

EXHIBIT 5.2.7 » NEAR SOUTH BLUEPRINT AREA DSR BASE CONDITIONS

DSR ID >	201	203	205	206	207	208	210	211	213
Number of Activations in 20-Year Simulation	92	17	17	10	-	-	43	17	-
Level of Service (LOS)	0.22	1.20	1.20	2.08	-	-	0.47	1.20	-

5.2.4.7 James Livingston

AREA DESCRIPTION

LOCATION: The James Livingston Blueprint area includes 4,701.2 acres located in central-east Columbus. The basin's northern boundary is East Broad Street and the southern boundary is Interstate I-70. The western boundary is South Gould Road until East Livingston Avenue and then Alum Creek. On the east side, the basin is defined by Big Walnut Creek, which crosses the park south of East Main Street. The area is crossed by both East Main Street and East Livingston Avenue for its entire length.

SEWER NETWORK: Two main trunks receive the sanitary flow of the James Livingston basin: the Deshler Tunnel that conveys flow from the east side of the city (Alum Creek interceptor and trunk sewers) to the west side (OSIS), and the Alum Creek trunk sewer that runs from north to south on the west side of the basin. The James Livingston collection system also serves two CSAs: Bexley CSA located on the west side of the basin along South Gould Road, and Whitehall CSA located on the north side of the basin from Maplewood Avenue to Fairway Boulevard. The flow is collected in most of the northwest portion of the basin and intercepted by the Deshler tunnel; for the remaining (larger) portion of the basin, the sanitary flow is conveyed to the Alum Creek trunk sewer.

DSRs and WIBs: The James Livingston basin does not have any DSRs. DSR 244 that appears on the maps is a mainline DSR and, therefore, its activations are addressed at the system-wide scale. High-density reported WIBs are distributed across the entire basin.

BASE CONDITIONS

The base conditions used to evaluate the deficiencies in the collection system are based on the 2025 sewer network, along with the anticipated 2050 population and area development conditions. No projects are planned for the sanitary system before 2025.

The performance of the sanitary system under base conditions is assessed over 20 years by tracking WIB occurrences. Figure 5.2.15 shows that houses potentially not meeting the 10-year LOS for WIBs are not diffused across the entire basin. The main cluster of WIBs is found on the northeast side of the basin between Livingston Avenue and East Main Street, extending south into the central portion of the basin. The sewer system in that area collects not only the sanitary flow from James Livingston basin, but also the contribution from Whitehall CSA. Clusters of WIBs are also identified on the northwest side of the basin between South Gould Road and Maplewood Avenue. A very high-density WIB cluster is located near the intersection of East Broad Street and Fifth Avenue. The base model indicates 1,849 potential WIBs.

5.2.4.8 Fifth by Northwest

AREA DESCRIPTION

LOCATION: The Fifth by Northwest Blueprint area is located in west central Columbus with a total coverage of 429 acres within the city boundaries. The general boundaries of the area are the Olentangy River to the east, the City of Grandview Heights to the south and west, the city of Upper Arlington to the west and Kinnear Road to the north.

SEWER NETWORK: The main interceptor that is closest to the Fifth by Northwest area is the Kinnear sub-trunk sewer. It is located on the east side of the area along the Olentangy River. The Fifth by Northwest area receives flow from two CSAs: Upper Arlington and Franklin County. A relief pipe discharges a portion of the Fifth by Northwest sanitary system (along Third Avenue) to Grandview Heights. The other portion of the system discharges into the Kinnear sub-trunk sewer to the east, which ultimately discharges into the FMI.

DSRs and WIBs: There are 15 DSRs within the area. The DSRs are divided into four groups that are hydraulically dependent:

1. Four DSRs are located at the downstream end of the Third Avenue trunk sewer close to the Kinnear sub-trunk sewer (city of Columbus reference numbers: 103, 109, 111 and 107).
2. Five DSRs are located along the Third Avenue trunk sewer around Oxley Road (city of Columbus reference numbers: 105, 146, 151, 110 and 154).
3. Four DSRs are located just downstream of the city of Upper Arlington (city of Columbus reference numbers: 149, 147, 150 and 915).
4. Two DSRs are located on Fifth Avenue/Kenny Road and King Avenue/East of Doten Avenue (city of Columbus reference numbers: 157 and 148, respectively).

Numerous WIBs have been reported within the Fifth by Northwest Blueprint area, mainly within the central and north side around Fifth, Sixth and Seventh Avenues, and on the west side near King Avenue, Westwood Avenue and Glenn Avenue.

BASE CONDITIONS

The base conditions used to evaluate the deficiencies in the collection system are based on the 2025 sewer network, along with the anticipated 2050 population and area development conditions.

By 2025, a few projects are expected to be finished along Third Avenue and Oxley Road. These projects include upsizing a portion of the Third Avenue sewers (approximately 1,100 feet) to 48-inch diameter pipes, replacing existing pipes with a set of new parallel pipes between DSR 107 and DSR 109 and closing the Oxley Road relief trunk to Grandview Heights.

Base conditions were assessed over 20 years by tracking both DSR activations and WIB problems. Figure 5.2.16 shows the location of projects and the distribution of the houses potentially not meeting the 10-year LOS for WIBs. There are 103 houses potentially not meeting 10-year WIB LOS, which are shown in purple in Figure 5.2.16.

Table 5.2.2 shows the number of activations and the corresponding LOS values from 20-Year simulations for all the 15 DSRs, which indicate that 10 out of 15 DSRs would not meet 10-year LOS. Additionally, DSRs 110 and 105 are observed to have high activations due to the project being associated with closing the Oxley Road relief trunk to Grandview Heights. These results indicate that there are numerous DSR and WIB problems for the Fifth by Northwest Blueprint area, and additional mitigation is needed.

5.2.4.9 West Franklinton

AREA DESCRIPTION

LOCATION: The West Franklinton Blueprint area is located in southwest-central Columbus with a total coverage of 500 acres within the city boundaries. The area is generally bounded by Ohio State Route 315 to the east, Mound Street to the south, Townsend Avenue to the west, and West Broad Street to the north.

SEWER NETWORK: There are two main interceptors within the West Franklinton Blueprint area: the Scioto main trunk sewer and the west side relief sewer. The west side of the West Franklinton sanitary system discharges into the Scioto main trunk sewer, while the central and east sides of the sewer system discharge to the west side relief sewer, which ultimately discharge into the Scioto main trunk sewer.

DSRs and WIBs: There are no local DSRs within the West Franklinton Blueprint area. DSR 95, physically located inside West Franklinton, is considered a trunk line DSR along the west side relief sewer. A large number of WIBs have been reported within the West Franklinton Blueprint area.

BASE CONDITIONS

The base conditions used to evaluate the deficiencies in the collection system are based on the 2025 sewer network, along with the anticipated 2050 population and area development conditions. In the West Franklinton Blueprint area no projects are planned for the sanitary system before 2025.

Base conditions were assessed over 20 years by tracking both DSR and WIB problems. Figure 5.2.17 shows the distribution of the houses potentially not meeting the 10-year LOS for WIBs. There are 1,292 such houses, shown in purple in Figure 5.2.17.

5.2.4.10 Near East

AREA DESCRIPTION

LOCATION: The Near East Blueprint area is located in east-central Columbus with a total coverage of 1,103 acres within the city boundaries. The area is generally bounded by Nelson Road to the east, East Broad Street to the south, Kessler Street to the west, and Woodward Avenue to the north.

SEWER NETWORK: There are two main interceptors that are close to the Near East area – the Alum Creek Interceptor Sewer along Alum Creek to the east, and the East Main trunk sewer to the south. The east portion of the sanitary system discharges into the Alum Creek interceptor, while the rest of the sanitary system discharges into the East Main trunk sewer, which ultimately discharges to the Alum Creek Interceptor Sewer.

DSRs and WIBs: There are no DSRs within the Near East Blueprint area.

BASE CONDITIONS

The base conditions used to evaluate the deficiencies in the collection system are based on the 2025 sewer network, along with the anticipated 2050 population and area development conditions. In the Near East Blueprint area no projects are planned for the sanitary system before 2025.

Base conditions were assessed over 20 years by tracking WIB problems. Figure 5.2.18 shows the distribution of the houses potentially not meeting the 10-year LOS for WIBs. There are 473 such houses, shown in purple in Figure 5.2.18. Additional mitigation technology is needed to solve the WIB problems for the Near East Blueprint area.

5.3 Base System-wide Model Summary

The overflow statistics from the system-wide model from 20-Year (1995–2014) and typical year scenarios are shown in Table 5.3.1 and Table 5.3.2, respectively.

An overflow event is defined as:

- Peak flow larger or equal to 0.1 MGD
- Total overflow volume larger than 0.01 MG
- Duration longer than 0.25 hours
- An event is counted when all three criteria are met.

These base condition results demonstrate attainment of all levels of service for CSOs that should be expected since the CSO consent order requires completion by July 1, 2025. The 20-Year modeling results show that the CSOs with a 10-year level of service meet their requirements. The 20-Year results also point out numerous DSRs and the plant bypasses that are not achieving approved levels of service. The aim of the Blueprint alternative and the gray alternative is to achieve required levels of service for all of these overflows.

The system-wide WIBs are shown in Figure 5.3.1. These are the houses that do not meet 10-year LOS. The WIBs are decided by the following criteria:

- Each house is assigned to a conduit based on location
- No WIBs were considered if a pipe is not surcharged
- Estimated basement elevation (BE) = Maximum ground elevation – seven feet
- If BE is below the pipe crown, then BE = pipe crown
- Interpolate HGL between upstream and downstream manholes
- Use 24 hours as the inter-event duration to calculate the number of potential WIB events

The WIB figure shows numerous WIBs in the Blueprint areas (shown in blue). These WIBs are the target of the Blueprint and gray alternatives. There are also numerous WIBs indicated in the CSO area; however, modeling investigations in this area indicated that the model is not accurately representing the surface runoff and ponding in the CSO area. Following submission of this report, ongoing efforts will continue to further the development of the modeling in the CSO area.

The system-wide flooding manholes that do not meet the 10-year LOS are shown in Figure 5.3.2. The results were from the reduced pipe model and more flooding manholes are expected in the detailed model. The flooding manhole figure shows numerous flooding manholes in the Blueprint and CSO areas. The Blueprint and gray alternatives will have to address these flooded manhole locations. Flooded manholes in the CSO area are also going to be further investigated as the model in that area continues to be refined.

TABLE 5.2.1 » CLINTONVILLE BLUEPRINT AREA DSR BASE CONDITIONS

DSR ID >	326	323	335	352	346	351	360	337	349	368	285	328	898	329
Number of Activations in 20-Year Simulation	127	26	75	26	68	16	16	-	7	-	-	59	19	22
Level of Service (LOS)	0.2	0.8	0.3	0.8	0.3	1.3	1.3	-	3.0	-	-	0.3	1.1	0.9

TABLE 5.2.2 » FIFTH BY NORTHWEST BLUEPRINT AREA DSR BASE CONDITIONS

DSR ID >	103	109	111	107	110	105	154	151	146	149	150	147	915	148	157
Number of Activations in 20-Year Simulation	-	7	-	-	479	364	-	76	20	27	17	10	-	25	70
Level of Service (LOS)	-	3.02	-	-	0.04	0.05	-	0.26	1.02	0.75	1.2	2.08	-	0.81	0.29

TABLE 5.3.1 » BASE CONDITION 20-YEAR MODEL RUN SUMMARY OF RESULTS, 2025 CONDITIONS

Category	Overall Summary				OARS/WWTP/ACST							
Description	Total SSO (MG)	Total CSO (MG)	Total Bypasses (MG)	Total System Overflow (MG)	OARS OF	WSST Weir OF	WSST Emergency Gates	ACST	JPWWTP Mech Bypass	JPWWTP Gravity Bypass	SWWTP Gravity Bypass	CEPT
Level of Service	N/A	N/A	N/A	N/A	4/TY	TY	TY	TY	10Y	10Y	1.4Y	N/A
20Y Total Overflow Volume (MG)					5714	7.51	3.77	96.8	4.83	0.28	702	5293
20Y Total Overflow Duration (Hrs)					796	62.5	50.5	69	9.5	3	182	1185
20Y Total Number of Activations	213	5962	707	6881	49	5	3	16	2	1	13	114
20Y LOS(in years)					N/A	N/A	N/A	N/A	12.5	33.2	N/A	N/A
10yr LOS Target Volume (MG)					N/A	N/A	N/A	N/A	Met	Met	N/A	N/A
10yr LOS Target Peak Flow (MGD)					N/A	N/A	N/A	N/A	Met	Met	N/A	N/A
Highest Volume (MG)					709.4	4.56	2.56	20.6	4.29	0.28	231.8	323.6
2nd Highest Volume (MG)					541.2	1.19	1.19	18.4	0.55		202.1	243.8
3rd Highest Volume (MG)					535.4	1.10	0.03	16.4			116.2	216.0
4th Highest Volume (MG)					291.1	0.60		11.2			32.8	160.8
5th Highest Volume (MG)					271.3	0.07		4.98			26.0	146.5
6th Highest Volume (MG)					270.2			4.59			23.1	133.5
7th Highest Volume (MG)					246.0			4.55			17.1	132.3
8th Highest Volume (MG)					183.1			4.14			16.4	124.4
9th Highest Volume (MG)					169.4			2.92			9.36	120.4
10th Highest Volume (MG)					166.2			2.29			8.58	118.7
11th Highest Volume (MG)					164.2			2.01			6.80	115.5
12th Highest Volume (MG)					159.7			1.55			6.49	107.5
13th Highest Volume (MG)					158.2			1.11			4.70	104.8
14th Highest Volume (MG)					149.4			0.96				104.4
15th Highest Volume (MG)					132.7			0.92				102.6
16th Highest Volume (MG)					127.5			0.31				100.4
17th Highest Volume (MG)					122.0							99.2
18th Highest Volume (MG)					109.9							96.6
19th Highest Volume (MG)					107.4							91.9
20th Highest Volume (MG)					105.2							90.6
Highest Peak Flow (MGD)					2655	98.6	47.3	125.9	20.3	3.79	252.21	110
2nd Peak Flow (MGD)					1251	92.5	24.60	100.0	10.3		229.99	110
3rd Peak Flow (MGD)					877.4	55.9	0.14	98.2			212.62	110
4th Peak Flow (MGD)					855.1	46.2		95.3			96.90	110
5th Peak Flow (MGD)					787.7	0.31		91.6			86.14	110
6th Peak Flow (MGD)					684.6			79.3			77.06	110
7th Peak Flow (MGD)					573.7			76.2			72.59	110
8th Peak Flow (MGD)					546.5			73.0			59.62	110
9th Peak Flow (MGD)					510.6			50.7			58.05	110
10th Peak Flow (MGD)					507.6			50.1			51.90	110
11th Peak Flow (MGD)					503.6			42.8			43.44	110
12th Peak Flow (MGD)					426.0			42.7			32.45	110
13th Peak Flow (MGD)					396.1			39.9			29.50	110
14th Peak Flow (MGD)					385.9			31.0				110
15th Peak Flow (MGD)					380.8			29.3				110
16th Peak Flow (MGD)					331.7			17.8				110
17th Peak Flow (MGD)					305.4							110
18th Peak Flow (MGD)					304.2							110
19th Peak Flow (MGD)					300.7							110
20th Peak Flow (MGD)					297.1							110

Category	Mainline DSRs									CSO Regulato	
Description	DSR 083 Deschler	DSR 095 West Side Sanitary	DSR 399 McKinley	DSR 873 Francisco Teteridge	DSR 284 FMN Pacemont Dr	DSR 156 FMN North of Hill Ave	DSR 244 Livingston James	DSR 246 Castle Rd PS	DSR 322 Williams Rd PS	Markison	Dodge Park
Level of Service	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	TY	TY
20Y Total Overflow Volume (MG)	0.11	9.31		10.8	15.6		5.47			10.2	2.86
20Y Total Overflow Duration (Hrs)	0.75	30.3		77.5	488		18.3			9	6.75
20Y Total Number of Activations	1	3		6	67		5			9	7
20Y LOS(in years)	33.2	7.7		3.6	0.3		4.3			N/A	N/A
10yr LOS Target Volume (MG)	Met	0.73	Met	2.37	0.84	Met	0.25	Met	Met	N/A	N/A
10yr LOS Target Peak Flow (MGD)	Met	5.35	Met	6.46	1.64	Met	3.15	Met	Met	N/A	N/A
Highest Volume (MG)	0.11	4.68		4.71	1.92		4.00			2.59	1.42
2nd Highest Volume (MG)		3.91		3.05	1.51		1.13			2.35	0.53
3rd Highest Volume (MG)		0.73		2.37	0.84		0.25			1.13	0.28
4th Highest Volume (MG)				0.43	0.75		0.05			1.12	0.20
5th Highest Volume (MG)				0.11	0.64		0.03			1.01	0.18
6th Highest Volume (MG)				0.10	0.59					0.88	0.17
7th Highest Volume (MG)					0.56					0.49	0.07
8th Highest Volume (MG)					0.56					0.42	
9th Highest Volume (MG)					0.47					0.19	
10th Highest Volume (MG)					0.47						
11th Highest Volume (MG)					0.37						
12th Highest Volume (MG)					0.36						
13th Highest Volume (MG)					0.34						
14th Highest Volume (MG)					0.32						
15th Highest Volume (MG)					0.32						
16th Highest Volume (MG)					0.31						
17th Highest Volume (MG)					0.31						
18th Highest Volume (MG)					0.28						
19th Highest Volume (MG)					0.28						
20th Highest Volume (MG)					0.27						
Highest Peak Flow (MGD)	4.35	17.2		8.17	1.99		21.5			99.7	42.1
2nd Peak Flow (MGD)		13.2		8.09	1.69		8.11			65.7	13.1
3rd Peak Flow (MGD)		5.35		6.46	1.64		3.15			58.9	12.2
4th Peak Flow (MGD)				2.75	1.63		2.88			51.0	11.2
5th Peak Flow (MGD)				1.53	1.57		0.92			39.8	9.98
6th Peak Flow (MGD)				1.32	1.39					35.8	8.40
7th Peak Flow (MGD)					1.37					33.8	3.29
8th Peak Flow (MGD)					1.30					19.9	
9th Peak Flow (MGD)					1.27					11.8	
10th Peak Flow (MGD)					1.24						
11th Peak Flow (MGD)					1.19						
12th Peak Flow (MGD)					1.10						
13th Peak Flow (MGD)					1.00						
14th Peak Flow (MGD)					0.99						
15th Peak Flow (MGD)					0.97						
16th Peak Flow (MGD)					0.94						
17th Peak Flow (MGD)					0.92						
18th Peak Flow (MGD)					0.92						
19th Peak Flow (MGD)					0.92						
20th Peak Flow (MGD)					0.88						

Category	Downtown CSO								Olentangy CSO Regulators						
Description	Town	State	Capital	Broad	Long	Spring	Chestnut	Henry	First	Third	King	Indianola	Frambes	Doe Alley	Hudson
Level of Service	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	TY	TY	TY	TY	TY	TY	TY
20Y Total Overflow Volume (MG)					0.40	0.94				1.99	1.39	64.6	17.0	15.9	6.86
20Y Total Overflow Duration (Hrs)					0.5	0.5				1.5	8	23.5	31.3	52.3	21
20Y Total Number of Activations					1	1				2	6	19	12	12	9
20Y LOS(in years)					33.2	33.2				N/A	N/A	N/A	N/A	N/A	N/A
10yr LOS Target Volume (MG)	Met	Met	Met	Met	Met	Met	Met	Met	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10yr LOS Target Peak Flow (MGD)	Met	Met	Met	Met	Met	Met	Met	Met	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Highest Volume (MG)					0.40	0.94				1.17	0.62	11.5	3.86	3.32	1.90
2nd Highest Volume (MG)										0.82	0.39	9.86	3.57	3.16	1.48
3rd Highest Volume (MG)											0.17	6.29	3.37	2.45	1.37
4th Highest Volume (MG)											0.13	6.20	2.48	2.07	0.82
5th Highest Volume (MG)											0.07	4.34	1.46	1.29	0.35
6th Highest Volume (MG)											0.01	3.60	0.53	0.87	0.29
7th Highest Volume (MG)												3.48	0.44	0.66	0.27
8th Highest Volume (MG)												3.44	0.43	0.62	0.20
9th Highest Volume (MG)												3.02	0.37	0.50	0.17
10th Highest Volume (MG)												2.48	0.29	0.46	
11th Highest Volume (MG)												1.89	0.17	0.40	
12th Highest Volume (MG)												1.78	0.06	0.08	
13th Highest Volume (MG)												1.73			
14th Highest Volume (MG)												1.64			
15th Highest Volume (MG)												1.54			
16th Highest Volume (MG)												0.84			
17th Highest Volume (MG)												0.48			
18th Highest Volume (MG)												0.25			
19th Highest Volume (MG)												0.18			
20th Highest Volume (MG)															
Highest Peak Flow (MGD)					32.1	52.2				85.0	12.6	216.5	78.7	30.7	68
2nd Peak Flow (MGD)										31.5	7.94	213.8	78.3	28.6	36
3rd Peak Flow (MGD)											5.97	204.4	61.7	24.0	32
4th Peak Flow (MGD)											4.02	195.0	36.7	16.0	25
5th Peak Flow (MGD)											3.22	179.6	26.5	15.7	19
6th Peak Flow (MGD)											0.91	179.0	22.5	15.2	12
7th Peak Flow (MGD)												126.1	22.0	13.6	11
8th Peak Flow (MGD)												125.3	21.0	11.5	11
9th Peak Flow (MGD)												122.3	20.5	11.0	4.77
10th Peak Flow (MGD)												117.3	14.0	10.0	
11th Peak Flow (MGD)												101.1	6.10	9.90	
12th Peak Flow (MGD)												97.3	5.27	5.30	
13th Peak Flow (MGD)												76.8			
14th Peak Flow (MGD)												73.7			
15th Peak Flow (MGD)												58.8			
16th Peak Flow (MGD)												46.0			
17th Peak Flow (MGD)												45.2			
18th Peak Flow (MGD)												21.6			
19th Peak Flow (MGD)												15.7			
20th Peak Flow (MGD)															

Category	CSO Manholes							
Description	Mound/Grant	Noble/Grant	Town/Fourth	Rich/Fifth	Cherry/Fourth	Noble/Fourth	Mound e/71	Kerr/Russel
Level of Service	TY	TY	TY	TY	TY	TY	TY	TY
20Y Total Overflow Volume (MG)			9.03	0.41	8.35	0.11		0.23
20Y Total Overflow Duration (Hrs)			10.5	0.5	4.75	1		0.5
20Y Total Number of Activations			18	1	7	2		1
20Y LOS(in years)			N/A	N/A	N/A	N/A		N/A
10yr LOS Target Volume (MG)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10yr LOS Target Peak Flow (MGD)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Highest Volume (MG)			3.50	0.41	2.99	0.08		0.23
2nd Highest Volume (MG)			0.92		1.70	0.03		
3rd Highest Volume (MG)			0.58		0.95			
4th Highest Volume (MG)			0.53		0.83			
5th Highest Volume (MG)			0.52		0.75			
6th Highest Volume (MG)			0.46		0.63			
7th Highest Volume (MG)			0.41		0.50			
8th Highest Volume (MG)			0.38					
9th Highest Volume (MG)			0.38					
10th Highest Volume (MG)			0.33					
11th Highest Volume (MG)			0.27					
12th Highest Volume (MG)			0.19					
13th Highest Volume (MG)			0.13					
14th Highest Volume (MG)			0.13					
15th Highest Volume (MG)			0.12					
16th Highest Volume (MG)			0.07					
17th Highest Volume (MG)			0.06					
18th Highest Volume (MG)			0.05					
19th Highest Volume (MG)								
20th Highest Volume (MG)								
Highest Peak Flow (MGD)			154.1	19.7	146.2	5.99		21.3
2nd Peak Flow (MGD)			54.9		88.9	1.60		
3rd Peak Flow (MGD)			54.6		85.2			
4th Peak Flow (MGD)			50.3		39.2			
5th Peak Flow (MGD)			38.8		37.9			
6th Peak Flow (MGD)			31.5		34.8			
7th Peak Flow (MGD)			29.0		34.4			
8th Peak Flow (MGD)			25.5					
9th Peak Flow (MGD)			25.3					
10th Peak Flow (MGD)			19.8					
11th Peak Flow (MGD)			16.2					
12th Peak Flow (MGD)			13.7					
13th Peak Flow (MGD)			7.84					
14th Peak Flow (MGD)			7.55					
15th Peak Flow (MGD)			6.59					
16th Peak Flow (MGD)			5.80					
17th Peak Flow (MGD)			4.60					
18th Peak Flow (MGD)			3.82					
19th Peak Flow (MGD)								
20th Peak Flow (MGD)								

Models: IP Models\BAS\SSCM12_RPM_BAS_woACISACTCleanup_woRamping_OptCEPT_1995-2014.inp
Cutoff Values: Volume: 0.01 MG; Peak: 0.1 MGD; Duration: 0.25 hours

TABLE 5.3.1 » BASE CONDITION 20-YEAR MODEL RUN SUMMARY OF RESULTS, 2025 CONDITIONS

Category	Blueprint DSRs - Fifth by Northwest														
Description	DSR 103 (West Fifth)	DSR 109 (West Fifth)	DSR 111 (West Fifth)	DSR 107 (West Fifth)	DSR 110 (West Fifth)	DSR 105 (West Fifth)	DSR 154 (West Fifth)	DSR 151 (West Fifth)	DSR 146 (West Fifth)	DSR 149 (West Fifth)	DSR 150 (West Fifth)	DSR 147 (West Fifth)	DSR 915 (West Fifth)	DSR 148 (West Fifth)	DSR 157 (West Fifth)
Level of Service	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y
20Y Total Overflow Volume (MG)	0.01	0.34				5.56		9.77	1.28	0.69	0.60	0.21		1.19	3.34
20Y Total Overflow Duration (Hrs)	1.25	12.3				388		275	81	33.8	60.8	21.8		82.3	246
20Y Total Number of Activations	1	7				96		84	27	15	19	10		28	63
20Y LOS(in years)	33.2	3.0				0.2		0.2	0.7	1.4	1.1	2.1		0.7	0.3
10yr LOS Target Volume (MG)	Met	0.06	Met	Met	Met	0.22	Met	0.55	0.10	0.08	0.05	0.02	Met	0.10	0.17
10yr LOS Target Peak Flow (MGD)	Met	1.22	Met	Met	Met	0.87	Met	24.38	0.99	1.08	0.46	0.36	Met	0.99	0.73
Highest Volume (MG)	0.01	0.08				0.33		0.82	0.12	0.11	0.08	0.05		0.14	0.18
2nd Highest Volume (MG)		0.06				0.26		0.69	0.10	0.08	0.06	0.03		0.13	0.17
3rd Highest Volume (MG)		0.06				0.22		0.55	0.10	0.08	0.05	0.02		0.10	0.17
4th Highest Volume (MG)		0.05				0.20		0.50	0.09	0.07	0.05	0.02		0.08	0.16
5th Highest Volume (MG)		0.04				0.16		0.50	0.07	0.06	0.05	0.02		0.07	0.14
6th Highest Volume (MG)		0.03				0.16		0.43	0.07	0.06	0.04	0.02		0.06	0.11
7th Highest Volume (MG)		0.03				0.16		0.34	0.06	0.04	0.03	0.02		0.06	0.10
8th Highest Volume (MG)						0.15		0.31	0.06	0.04	0.03	0.01		0.05	0.09
9th Highest Volume (MG)						0.13		0.27	0.06	0.03	0.03	0.01		0.05	0.09
10th Highest Volume (MG)						0.13		0.26	0.06	0.03	0.03	0.01		0.05	0.09
11th Highest Volume (MG)						0.12		0.22	0.05	0.02	0.02			0.05	0.09
12th Highest Volume (MG)						0.11		0.21	0.05	0.02	0.02			0.05	0.09
13th Highest Volume (MG)						0.10		0.21	0.05	0.02	0.02			0.04	0.09
14th Highest Volume (MG)						0.10		0.20	0.04	0.02	0.02			0.04	0.08
15th Highest Volume (MG)						0.10		0.19	0.04	0.01	0.02			0.03	0.08
16th Highest Volume (MG)						0.09		0.18	0.04		0.02			0.02	0.08
17th Highest Volume (MG)						0.08		0.17	0.04		0.01			0.02	0.08
18th Highest Volume (MG)						0.08		0.17	0.03		0.01			0.02	0.07
19th Highest Volume (MG)						0.08		0.14	0.03		0.01			0.02	0.06
20th Highest Volume (MG)						0.08		0.14	0.03					0.02	0.06
Highest Peak Flow (MGD)	0.29	4.23				0.92		29.7	1.18	1.37	0.56	0.52		1.25	0.85
2nd Peak Flow (MGD)		1.33				0.89		26.9	1.10	1.21	0.46	0.41		1.12	0.80
3rd Peak Flow (MGD)		1.22				0.87		24.4	0.99	1.08	0.46	0.36		0.99	0.73
4th Peak Flow (MGD)		1.11				0.86		20.4	0.98	1.03	0.46	0.36		0.89	0.67
5th Peak Flow (MGD)		1.02				0.85		15.4	0.94	0.91	0.42	0.32		0.82	0.65
6th Peak Flow (MGD)		0.74				0.77		10.7	0.78	0.87	0.39	0.32		0.69	0.64
7th Peak Flow (MGD)		0.40				0.72		10.5	0.72	0.86	0.38	0.29		0.68	0.64
8th Peak Flow (MGD)						0.69		5.50	0.68	0.79	0.34	0.22		0.68	0.63
9th Peak Flow (MGD)						0.69		5.39	0.66	0.69	0.32	0.18		0.65	0.61
10th Peak Flow (MGD)						0.69		4.23	0.62	0.67	0.30	0.17		0.58	0.60
11th Peak Flow (MGD)						0.67		4.21	0.58	0.65	0.29			0.56	0.60
12th Peak Flow (MGD)						0.66		3.94	0.57	0.64	0.28			0.55	0.59
13th Peak Flow (MGD)						0.65		2.98	0.56	0.64	0.28			0.55	0.58
14th Peak Flow (MGD)						0.64		2.73	0.56	0.53	0.26			0.53	0.53
15th Peak Flow (MGD)						0.63		2.69	0.55	0.49	0.25			0.50	0.53
16th Peak Flow (MGD)						0.63		2.59	0.55		0.24			0.49	0.47
17th Peak Flow (MGD)						0.59		2.36	0.51		0.21			0.39	0.45
18th Peak Flow (MGD)						0.58		2.09	0.49		0.20			0.32	0.44
19th Peak Flow (MGD)						0.56		1.91	0.47		0.15			0.31	0.43
20th Peak Flow (MGD)						0.52		1.81	0.44					0.30	0.43

Category	Blueprint DSRs - Miller Kelton									Blueprint DSRs - Barthman Parsons								
Description	DSR 177 (Miller Kelton)	DSR 181 (Miller Kelton)	DSR 189 (Miller Kelton)	DSR 179 (Miller Kelton)	DSR 188 (Miller Kelton)	DSR 190 (Miller Kelton)	DSR 185 (Miller Kelton)	DSR 199 (Miller Kelton)	DSR 193 (Miller Kelton)	DSR 203 (Barthman)	DSR 201 (Barthman)	DSR 211 (Barthman)	DSR 207 (Barthman)	DSR 208 (Barthman)	DSR 206 (Barthman)	DSR 205 (Barthman)	DSR 210 (Barthman)	DSR 213 (Barthman)
Level of Service	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y
20Y Total Overflow Volume (MG)	7.26	0.07	0.22	0.23			0.10			1.11	6.66	0.44		0.01	0.31	3.53	2.32	
20Y Total Overflow Duration (Hrs)	274	5	16.3	7.5			4.75			42	491	39.5		1.25	23.5	27	148	
20Y Total Number of Activations	87	3	8	5			6			19	97	15		1	12	18	42	
20Y LOS(in years)	0.2	7.7	2.6	4.3			3.6			1.1	0.2	1.4		33.2	1.7	1.1	0.5	
10yr LOS Target Volume (MG)	0.34	0.02	0.04	0.05	Met	Met	0.01	Met	Met	0.13	0.26	0.05	Met	Met	0.03	0.37	0.13	Met
10yr LOS Target Peak Flow (MGD)	2.98	0.38	0.60	0.97	Met	Met	0.62	Met	Met	1.54	1.06	0.67	Met	Met	0.48	6.77	1.29	Met
Highest Volume (MG)	0.39	0.03	0.05	0.08			0.03			0.20	0.42	0.05		0.01	0.04	0.57	0.16	
2nd Highest Volume (MG)	0.38	0.02	0.05	0.05			0.02			0.17	0.40	0.05			0.04	0.38	0.13	
3rd Highest Volume (MG)	0.34	0.02	0.04	0.05			0.01			0.13	0.26	0.05			0.03	0.37	0.13	
4th Highest Volume (MG)	0.34		0.02	0.04			0.01			0.10	0.24	0.05			0.03	0.37	0.12	
5th Highest Volume (MG)	0.32		0.02	0.02			0.01			0.07	0.19	0.04			0.03	0.32	0.11	
6th Highest Volume (MG)	0.29		0.02				0.01			0.07	0.19	0.03			0.03	0.27	0.11	
7th Highest Volume (MG)	0.28		0.01							0.06	0.17	0.03			0.02	0.26	0.10	
8th Highest Volume (MG)	0.27		0.01							0.05	0.16	0.02			0.02	0.17	0.10	
9th Highest Volume (MG)	0.26									0.05	0.16	0.02			0.02	0.15	0.10	
10th Highest Volume (MG)	0.24									0.05	0.15	0.02			0.01	0.14	0.08	
11th Highest Volume (MG)	0.21									0.04	0.15	0.02			0.01	0.12	0.08	
12th Highest Volume (MG)	0.20									0.02	0.15	0.02			0.01	0.11	0.08	
13th Highest Volume (MG)	0.20									0.02	0.15	0.02				0.09	0.07	
14th Highest Volume (MG)	0.19									0.02	0.14	0.01				0.08	0.07	
15th Highest Volume (MG)	0.19									0.02	0.14	0.01				0.06	0.06	
16th Highest Volume (MG)	0.14									0.01	0.13					0.04	0.06	
17th Highest Volume (MG)	0.14									0.01	0.13					0.03	0.06	
18th Highest Volume (MG)	0.13									0.01	0.11					0.02	0.06	
19th Highest Volume (MG)	0.13									0.01	0.11						0.05	
20th Highest Volume (MG)	0.12										0.11						0.05	
Highest Peak Flow (MGD)	3.24	0.68	0.85	1.66			1.86			1.91	1.20	0.74		0.44	0.53	7.49	1.45	
2nd Peak Flow (MGD)	3.11	0.44	0.76	1.22			0.92			1.90	1.07	0.69			0.53	7.15	1.34	
3rd Peak Flow (MGD)	2.98	0.38	0.60	0.97			0.62			1.54	1.06	0.67			0.48	6.77	1.29	
4th Peak Flow (MGD)	2.83		0.33	0.82			0.61			1.33	1.06	0.61			0.46	6.08	1.18	
5th Peak Flow (MGD)	2.46		0.32	0.64			0.54			1.22	1.05	0.61			0.46	6.01	1.17	
6th Peak Flow (MGD)	2.34		0.29				0.41			1.16	1.01	0.49			0.43	5.47	1.09	
7th Peak Flow (MGD)	2.33		0.29							0.99	0.87	0.47			0.40	5.09	1.02	
8th Peak Flow (MGD)	2.21		0.24							0.94	0.84	0.36			0.39	4.19	1.00	
9th Peak Flow (MGD)	2.17									0.79	0.83	0.29			0.32	3.98	0.96	
10th Peak Flow (MGD)	1.97									0.65	0.81	0.29			0.32	3.44	0.95	
11th Peak Flow (MGD)	1.86									0.59	0.80	0.23			0.26	3.14	0.90	
12th Peak Flow (MGD)	1.81									0.51	0.78	0.21			0.25	2.81	0.86	
13th Peak Flow (MGD)	1.80									0.49	0.76	0.20				2.75	0.82	
14th Peak Flow (MGD)	1.79									0.47	0.73	0.20				2.34	0.78	
15th Peak Flow (MGD)	1.75									0.46	0.73	0.15				2.08	0.77	
16th Peak Flow (MGD)	1.73									0.41	0.73					1.72	0.70	
17th Peak Flow (MGD)	1.73									0.40	0.72					1.56	0.67	
18th Peak Flow (MGD)	1.72									0.32	0.69					1.05	0.55	
19th Peak Flow (MGD)	1.68									0.23	0.68						0.51	
20th Peak Flow (MGD)	1.60										0.66						0.46	

Category	Blueprint DSRs - Hilltop				Blueprint DSRs - Linden/Northeast Area							
Description	DSR 250 (Early Ditch)	DSR 254 (Early Ditch)	DSR 252 (Early Ditch)	DSR 256 (Early Ditch)	DSR 314 (NWAC)	DSR 307 (NWAC)	DSR 305 (NWAC)	DSR 306 (NWAC)	DSR 312 (NWAC)	DSR 315 (NWAC)	DSR 339 (NWAC)	DSR 952 (NWAC)
Level of Service	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y
20Y Total Overflow Volume (MG)	6.30	0.22	0.02	0.88			1.95	0.25		0.81	1.73	
20Y Total Overflow Duration (Hrs)	101	23.3	1.25	20.5			222	32.8		100	63.3	
20Y Total Number of Activations	24	8	1	7			34	6		21	11	
20Y LOS(in years)	0.8	2.6	33.2	3.0			0.6	3.6		1.0	1.9	
10yr LOS Target Volume (MG)	0.58	0.02	Met	0.11	Met	Met	0.15	0.04	Met	0.07	0.32	Met
10yr LOS Target Peak Flow (MGD)	5.32	0.32	Met	1.36	Met	Met	0.43	0.28	Met	0.33	1.54	Met
Highest Volume (MG)	0.64	0.09	0.02	0.39			0.28	0.06		0.11	0.45	
2nd Highest Volume (MG)	0.58	0.03		0.19			0.18	0.06		0.11	0.40	
3rd Highest Volume (MG)	0.58	0.02		0.11			0.15	0.04		0.07	0.32	
4th Highest Volume (MG)	0.53	0.02		0.08			0.11	0.04		0.06	0.20	
5th Highest Volume (MG)	0.48	0.02		0.07			0.11	0.03		0.05	0.13	
6th Highest Volume (MG)	0.46	0.01		0.03			0.10	0.02		0.05	0.07	
7th Highest Volume (MG)	0.41	0.01		0.01			0.09			0.04	0.06	
8th Highest Volume (MG)	0.40	0.01					0.09			0.04	0.05	
9th Highest Volume (MG)	0.36						0.06			0.04	0.04	
10th Highest Volume (MG)	0.33						0.06			0.03	0.01	
11th Highest Volume (MG)	0.31						0.06			0.03	0.01	
12th Highest Volume (MG)	0.30						0.06			0.03		
13th Highest Volume (MG)	0.26						0.06			0.03		
14th Highest Volume (MG)	0.18						0.05			0.02		
15th Highest Volume (MG)	0.09						0.05			0.02		
16th Highest Volume (MG)	0.08						0.04			0.02		
17th Highest Volume (MG)	0.08						0.04			0.02		
18th Highest Volume (MG)	0.05						0.04			0.01		
19th Highest Volume (MG)	0.05						0.03			0.01		
20th Highest Volume (MG)	0.03						0.03			0.01		
Highest Peak Flow (MGD)	6.10	0.60	0.53	2.91			0.66	0.48		0.57	2.62	
2nd Peak Flow (MGD)	6.06	0.45		2.49			0.51	0.39		0.42	1.97	
3rd Peak Flow (MGD)	5.32	0.32		1.36			0.43	0.28		0.33	1.54	
4th Peak Flow (MGD)	4.09	0.27		1.35			0.39	0.25		0.30	1.38	
5th Peak Flow (MGD)	3.91	0.22		1.31			0.38	0.22		0.28	1.07	
6th Peak Flow (MGD)	3.71	0.18		0.61			0.38	0.19		0.28	0.99	
7th Peak Flow (MGD)	3.17	0.17		0.42			0.38			0.27	0.92	
8th Peak Flow (MGD)	3.12	0.16					0.35			0.24	0.70	
9th Peak Flow (MGD)	2.76						0.35			0.23	0.55	
10th Peak Flow (MGD)	2.65						0.34			0.22	0.36	
11th Peak Flow (MGD)	2.27						0.33			0.22	0.24	
12th Peak Flow (MGD)	2.21						0.32			0.22		
13th Peak Flow (MGD)	2.18						0.32			0.21		
14th Peak Flow (MGD)	2.17						0.30			0.19		
15th Peak Flow (MGD)	1.51						0.29			0.18		
16th Peak Flow (MGD)	1.30						0.28			0.16		
17th Peak Flow (MGD)	1.04						0.27			0.16		
18th Peak Flow (MGD)	0.84						0.27			0.16		
19th Peak Flow (MGD)	0.76						0.25			0.15		
20th Peak Flow (MGD)	0.70						0.24			0.14		

Category	Blueprint DSRs - Clintonville														PR DSRs
Description	DSR 326 (CVM)	DSR 323 (CVM)	DSR 335 (CVM)	DSR 352 (CVM)	DSR 346 (CVM)	DSR 351 (CVM)	DSR 360 (CVM)	DSR 337 (CVM)	DSR 349 (CVM)	DSR 368 (CVM)	DSR 285 (Walhalla)	DSR 328 (Walhalla)	DSR 898 (Walhalla)	DSR 329 (Walhalla)	DSR 364 (Plum Ridge)
Level of Service	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y
20Y Total Overflow Volume (MG)	27.0	9.38	37.50	4.69	13.5	1.78	3.28		0.57			7.12	1.08	0.77	7.35
20Y Total Overflow Duration (Hrs)	676	144	330	129	347	56.5	69.3		18.5			396	78.8	77.5	442
20Y Total Number of Activations	116	23	72	24	66	15	16		7			60	16	22	49
20Y LOS(in years)	0.2	0.9	0.3	0.8	0.3	1.4	1.3		3.0			0.3	1.3	0.9	0.4
10yr LOS Target Volume (MG)	1.25	1.01	2.14	0.35	0.81	0.25	0.44	Met	0.08	Met	Met	0.38	0.09	0.05	0.53
10yr LOS Target Peak Flow (MGD)	2.73	4.42	8.85	2.09	2.31	2.26	2.46	Met	1.19	Met	Met	1.13	1.41	0.49	1.16
Highest Volume (MG)	2.39	3.16	5.04	0.77	1.59	0.39	1.25		0.25			0.71	0.26	0.09	0.94
2nd Highest Volume (MG)	2.05	1.69	4.14	0.71	1.42	0.27	0.68		0.09			0.70	0.14	0.05	0.78
3rd Highest Volume (MG)	1.25	1.01	2.14	0.35	0.81	0.25	0.44		0.08			0.38	0.09	0.05	0.53
4th Highest Volume (MG)	1.17	0.85	2.11	0.33	0.71	0.23	0.19		0.06			0.36	0.09	0.05	0.49
5th Highest Volume (MG)	1.11	0.65	1.98	0.32	0.70	0.16	0.17		0.05			0.32	0.07	0.05	0.41
6th Highest Volume (MG)	0.96	0.40	1.69	0.29	0.65	0.09	0.09		0.03			0.31	0.06	0.04	0.37
7th Highest Volume (MG)	0.85	0.33	1.50	0.28	0.56	0.09	0.09		0.01			0.26	0.06	0.04	0.34
8th Highest Volume (MG)	0.81	0.26	1.50	0.25	0.48	0.06	0.08					0.26	0.06	0.04	0.28
9th Highest Volume (MG)	0.68	0.20	1.50	0.20	0.43	0.06	0.06					0.24	0.05	0.04	0.24
10th Highest Volume (MG)	0.57	0.18	1.41	0.16	0.41	0.05	0.05					0.24	0.05	0.04	0.24
11th Highest Volume (MG)	0.51	0.16	1.08	0.16	0.39	0.04	0.04					0.24	0.04	0.04	0.20
12th Highest Volume (MG)	0.50	0.11	0.94	0.15	0.35	0.03	0.04					0.23	0.03	0.04	0.17
13th Highest Volume (MG)	0.50	0.07	0.93	0.13	0.27	0.03	0.03					0.21	0.02	0.03	0.15
14th Highest Volume (MG)	0.44	0.06	0.86	0.12	0.27	0.02	0.03					0.19	0.02	0.03	0.13
15th Highest Volume (MG)	0.41	0.05	0.73	0.08	0.26	0.01	0.03					0.15	0.02	0.03	0.13
16th Highest Volume (MG)	0.38	0.05	0.65	0.07	0.25		0.01					0.13	0.01	0.02	0.13
17th Highest Volume (MG)	0.38	0.04	0.63	0.06	0.24							0.13		0.02	0.13
18th Highest Volume (MG)	0.37	0.03	0.61	0.06	0.22							0.13		0.01	0.13
19th Highest Volume (MG)	0.37	0.02	0.54	0.06	0.22							0.12		0.01	0.12
20th Highest Volume (MG)	0.35	0.02	0.49	0.05	0.22							0.11		0.01	0.12
Highest Peak Flow (MGD)	3.10	5.31	12.14	3.45	2.38	4.18	4.27		3.71			1.49	1.59	0.63	1.36
2nd Peak Flow (MGD)	3.04	4.64	9.02	2.12	2.36	3.03	3.15		1.53			1.49	1.45	0.52	1.20
3rd Peak Flow (MGD)	2.73	4.42	8.85	2.09	2.31	2.26	2.46		1.19			1.13	1.41	0.49	1.16
4th Peak Flow (MGD)	2.71	4.18	8.79	2.08	2.29	2.02	2.37		1.04			1.06	1.13	0.45	0.99
5th Peak Flow (MGD)	2.60	3.49	8.35	1.82	2.26	1.71	2.33		1.03			1.02	0.76	0.45	0.97
6th Peak Flow (MGD)	2.55	2.60	7.48	1.73	2.24	1.36	2.32		0.95			1.01	0.71	0.45	0.95
7th Peak Flow (MGD)	2.53	2.44	7.45	1.56	2.20	1.33	1.36		0.36			1.00	0.70	0.41	0.90
8th Peak Flow (MGD)	2.40	2.08	6.80	1.55	2.13	1.23	1.30					1.00	0.53	0.39	0.82
9th Peak Flow (MGD)	2.36	1.93	6.59	1.49	2.12	1.17	1.09					0.99	0.51	0.37	0.78
10th Peak Flow (MGD)	2.12	1.93	6.53	1.48	2.11	0.70	1.00					0.98	0.43	0.36	0.74
11th Peak Flow (MGD)	1.97	1.25	6.07	1.45	2.11	0.68	0.77					0.92	0.41	0.30	0.73
12th Peak Flow (MGD)	1.87	1.07	5.99	1.26	2.11	0.67	0.67					0.92	0.35	0.28	0.71
13th Peak Flow (MGD)	1.86	1.01	5.63	1.20	2.10	0.52	0.66					0.91	0.34	0.28	0.71
14th Peak Flow (MGD)	1.64	0.88	5.00	1.18	2.09	0.35	0.33					0.89	0.29	0.27	0.69
15th Peak Flow (MGD)	1.59	0.76	4.95	1.15	1.92	0.20	0.27					0.88	0.26	0.27	0.68
16th Peak Flow (MGD)	1.56	0.66	4.81	1.00	1.91		0.25					0.88	0.24	0.27	0.67
17th Peak Flow (MGD)	1.56	0.54	4.73	0.87	1.84							0.83		0.26	0.67
18th Peak Flow (MGD)	1.54	0.41	4.71	0.86	1.78							0.81		0.22	0.65
19th Peak Flow (MGD)	1.52	0.38	4.67	0.82	1.77							0.79		0.21	0.62
20th Peak Flow (MGD)	1.50	0.31	4.42	0.77	1.77							0.77		0.21	0.61

Models: IP Models\BAS\SSCM12_RPM_BAS_woACISACTCleanup_woRamping_OptCEPT_1995-2014.inp
Cutoff Values: Volume: 0.01 MG; Peak: 0.1 MGD; Duration: 0.25 hours

TABLE 5.3.2 » BASE TYPICAL YEAR MODEL RUN SUMMARY OF RESULTS, 2025 CONDITIONS

Category	Overall Summary				OARS/WWTP/ACST							
Description	Total SSO (MG)	Total CSO (MG)	Total Bypasses (MG)	Total System Overflow (MG)	OARS OF	WSST Weir OF	WSST Emergency Gates	ACST	JPWWTP Mech Bypass	JPWWTP Gravity Bypass	SWWTP Gravity Bypass	CEPT
Level of Service	N/A	N/A	N/A	N/A	4/TY	TY	TY	TY	1.4Y	1.4Y	1.4Y	N/A
TY total overflow volume (MG)					15.9							126.7
TY total overflow duration (Hrs)					12							28.8
TY total number of activations	3.69	15.9		19.6	1							6
TY highest OF event volume (MG)					15.9							43.1
TY highest OF event peak flow (MGD)					82.2							110
Highest Volume (MG)					15.9							43.1
2nd Highest Volume (MG)												32.8
3rd Highest Volume (MG)												20.9
4th Highest Volume (MG)												19.3
5th Highest Volume (MG)												5.9
6th Highest Volume (MG)												4.6
7th Highest Volume (MG)												
8th Highest Volume (MG)												
9th Highest Volume (MG)												
10th Highest Volume (MG)												
11th Highest Volume (MG)												
12th Highest Volume (MG)												
13th Highest Volume (MG)												
Highest Peak Flow (MGD)					82.2							110
2nd Peak Flow (MGD)												110
3rd Peak Flow (MGD)												110
4th Peak Flow (MGD)												110
5th Peak Flow (MGD)												110
6th Peak Flow (MGD)												110
7th Peak Flow (MGD)												
8th Peak Flow (MGD)												
9th Peak Flow (MGD)												
10th Peak Flow (MGD)												
11th Peak Flow (MGD)												
12th Peak Flow (MGD)												
13th Peak Flow (MGD)												

Category	Mainline DSRs									CSO Regulator	
Description	DSR 083 Deschler	DSR 095 West Side Sanitary	DSR 399 McKinley	DSR 873 Francisco Teteridge	DSR 284 FMN Pacemont Dr	DSR 156 FMN North of Hill Ave	DSR 244 Livingston James	DSR 246 Castle Rd PS	DSR 322 Williams Rd PS	Markison	Dodge Park
Level of Service	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	TY	TY
TY total overflow volume (MG)					0.20						
TY total overflow duration (Hrs)					7.5						
TY total number of activations					2						
TY highest OF event volume (MG)					0.14						
TY highest OF event peak flow (MGD)					0.86						
Highest Volume (MG)					0.14						
2nd Highest Volume (MG)					0.06						
3rd Highest Volume (MG)											
4th Highest Volume (MG)											
5th Highest Volume (MG)											
6th Highest Volume (MG)											
7th Highest Volume (MG)											
8th Highest Volume (MG)											
9th Highest Volume (MG)											
10th Highest Volume (MG)											
11th Highest Volume (MG)											
12th Highest Volume (MG)											
13th Highest Volume (MG)											
Highest Peak Flow (MGD)					0.86						
2nd Peak Flow (MGD)					0.71						
3rd Peak Flow (MGD)											
4th Peak Flow (MGD)											
5th Peak Flow (MGD)											
6th Peak Flow (MGD)											
7th Peak Flow (MGD)											
8th Peak Flow (MGD)											
9th Peak Flow (MGD)											
10th Peak Flow (MGD)											
11th Peak Flow (MGD)											
12th Peak Flow (MGD)											
13th Peak Flow (MGD)											

Category	Downtown CSO								Olentangy CSO Regulators						
Description	Town	State	Capital	Broad	Long	Spring	Chestnut	Henry	First	Third	King	Indianola	Frambes	Doe Alley	Hudson
Level of Service	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	TY	TY	TY	TY	TY	TY	TY
TY total overflow volume (MG)															
TY total overflow duration (Hrs)															
TY total number of activations															
TY highest OF event volume (MG)															
TY highest OF event peak flow (MGD)															
Highest Volume (MG)															
2nd Highest Volume (MG)															
3rd Highest Volume (MG)															
4th Highest Volume (MG)															
5th Highest Volume (MG)															
6th Highest Volume (MG)															
7th Highest Volume (MG)															
8th Highest Volume (MG)															
9th Highest Volume (MG)															
10th Highest Volume (MG)															
11th Highest Volume (MG)															
12th Highest Volume (MG)															
13th Highest Volume (MG)															
Highest Peak Flow (MGD)															
2nd Peak Flow (MGD)															
3rd Peak Flow (MGD)															
4th Peak Flow (MGD)															
5th Peak Flow (MGD)															
6th Peak Flow (MGD)															
7th Peak Flow (MGD)															
8th Peak Flow (MGD)															
9th Peak Flow (MGD)															
10th Peak Flow (MGD)															
11th Peak Flow (MGD)															
12th Peak Flow (MGD)															
13th Peak Flow (MGD)															

Category	CSO Manholes							
Description	Mound/Grant	Noble/Grant	Town/Fourth	Rich/Fifth	Cherry/Fourth	Noble/Fourth	Mound e/71	Kerr/Russel
Level of Service	TY	TY	TY	TY	TY	TY	TY	TY
TY total overflow volume (MG)								
TY total overflow duration (Hrs)								
TY total number of activations								
TY highest OF event volume (MG)								
TY highest OF event peak flow (MGD)								
Highest Volume (MG)								
2nd Highest Volume (MG)								
3rd Highest Volume (MG)								
4th Highest Volume (MG)								
5th Highest Volume (MG)								
6th Highest Volume (MG)								
7th Highest Volume (MG)								
8th Highest Volume (MG)								
9th Highest Volume (MG)								
10th Highest Volume (MG)								
11th Highest Volume (MG)								
12th Highest Volume (MG)								
13th Highest Volume (MG)								
Highest Peak Flow (MGD)								
2nd Peak Flow (MGD)								
3rd Peak Flow (MGD)								
4th Peak Flow (MGD)								
5th Peak Flow (MGD)								
6th Peak Flow (MGD)								
7th Peak Flow (MGD)								
8th Peak Flow (MGD)								
9th Peak Flow (MGD)								
10th Peak Flow (MGD)								
11th Peak Flow (MGD)								
12th Peak Flow (MGD)								
13th Peak Flow (MGD)								

Model: IP Models\BAS\SSCM12_RPM_BAS_woACISACTCleanup_woRamping_OptCEPT_TY.inp
Cutoff Values: Volume: 0.01 MG; Peak: 0.1 MGD; Duration: 0.25 hours

Category	Blueprint DSRs - Fifth by Northwest														
Description	DSR 103 (West Fifth)	DSR 109 (West Fifth)	DSR 111 (West Fifth)	DSR 107 (West Fifth)	DSR 110 (West Fifth)	DSR 105 (West Fifth)	DSR 154 (West Fifth)	DSR 151 (West Fifth)	DSR 146 (West Fifth)	DSR 149 (West Fifth)	DSR 150 (West Fifth)	DSR 147 (West Fifth)	DSR 915 (West Fifth)	DSR 148 (West Fifth)	DSR 157 (West Fifth)
Level of Service	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y
TY total overflow volume (MG)						0.22		0.36	0.07	0.02	0.02			0.06	0.14
TY total overflow duration (Hrs)						15.5		11.8	5.75	1	1.75			6.25	10.5
TY total number of activations						6		6	3	1	1			3	4
TY highest OF event volume (MG)						0.07		0.13	0.03	0.02	0.02			0.03	0.06
TY highest OF event peak flow (MGD)						0.67		2.08	0.60	0.75	0.31			0.58	0.59
Highest Volume (MG)						0.07		0.13	0.03	0.02	0.02			0.03	0.06
2nd Highest Volume (MG)						0.06		0.12	0.03					0.01	0.04
3rd Highest Volume (MG)						0.03		0.06	0.01					0.01	0.02
4th Highest Volume (MG)						0.02		0.02							0.01
5th Highest Volume (MG)						0.02		0.02							
6th Highest Volume (MG)						0.02		0.01							
7th Highest Volume (MG)															
8th Highest Volume (MG)															
9th Highest Volume (MG)															
10th Highest Volume (MG)															
11th Highest Volume (MG)															
12th Highest Volume (MG)															
13th Highest Volume (MG)															
Highest Peak Flow (MGD)						0.67		2.08	0.60	0.75	0.31			0.58	0.59
2nd Peak Flow (MGD)						0.52		1.76	0.38					0.30	0.40
3rd Peak Flow (MGD)						0.50		1.06	0.24					0.16	0.32
4th Peak Flow (MGD)						0.39		0.83							0.26
5th Peak Flow (MGD)						0.35		0.49							
6th Peak Flow (MGD)						0.35		0.47							
7th Peak Flow (MGD)															
8th Peak Flow (MGD)															
9th Peak Flow (MGD)															
10th Peak Flow (MGD)															
11th Peak Flow (MGD)															
12th Peak Flow (MGD)															
13th Peak Flow (MGD)															

Category	Blueprint DSRs - Miller Kelton									Blueprint DSRs - Barthman Parsons								
Description	DSR 177 (Miller Kelton)	DSR 181 (Miller Kelton)	DSR 189 (Miller Kelton)	DSR 179 (Miller Kelton)	DSR 188 (Miller Kelton)	DSR 190 (Miller Kelton)	DSR 185 (Miller Kelton)	DSR 199 (Miller Kelton)	DSR 193 (Miller Kelton)	DSR 203 (Barthman)	DSR 201 (Barthman)	DSR 211 (Barthman)	DSR 207 (Barthman)	DSR 208 (Barthman)	DSR 206 (Barthman)	DSR 205 (Barthman)	DSR 210 (Barthman)	DSR 213 (Barthman)
Level of Service	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y
TY total overflow volume (MG)	0.29									0.01	0.16					0.08	0.09	
TY total overflow duration (Hrs)	9.75									1.5	12.25					1	6.5	
TY total number of activations	5									1	5					1	3	
TY highest OF event volume (MG)	0.11									0.01	0.06					0.08	0.04	
TY highest OF event peak flow (MGD)	1.90									0.29	0.66					3.08	0.73	
Highest Volume (MG)	0.11									0.01	0.06					0.08	0.04	
2nd Highest Volume (MG)	0.10										0.05						0.03	
3rd Highest Volume (MG)	0.04										0.02						0.02	
4th Highest Volume (MG)	0.03										0.01							
5th Highest Volume (MG)	0.02										0.01							
6th Highest Volume (MG)																		
7th Highest Volume (MG)																		
8th Highest Volume (MG)																		
9th Highest Volume (MG)																		
10th Highest Volume (MG)																		
11th Highest Volume (MG)																		
12th Highest Volume (MG)																		
13th Highest Volume (MG)																		
Highest Peak Flow (MGD)	1.90									0.29	0.66					3.08	0.73	
2nd Peak Flow (MGD)	1.57										0.45						0.40	
3rd Peak Flow (MGD)	1.50										0.40						0.35	
4th Peak Flow (MGD)	1.02										0.23							
5th Peak Flow (MGD)	0.63										0.23							
6th Peak Flow (MGD)																		
7th Peak Flow (MGD)																		
8th Peak Flow (MGD)																		
9th Peak Flow (MGD)																		
10th Peak Flow (MGD)																		
11th Peak Flow (MGD)																		
12th Peak Flow (MGD)																		
13th Peak Flow (MGD)																		

Category	Blueprint DSRs - Hilltop				Blueprint DSRs - Linden/Northeast Area								Blueprint DSRs - Clintonville														PR DSRs
Description	DSR 250 (Early Ditch)	DSR 254 (Early Ditch)	DSR 252 (Early Ditch)	DSR 256 (Early Ditch)	DSR 314 (NWAC)	DSR 307 (NWAC)	DSR 305 (NWAC)	DSR 306 (NWAC)	DSR 312 (NWAC)	DSR 315 (NWAC)	DSR 339 (NWAC)	DSR 952 (NWAC)	DSR 326 (CVM)	DSR 323 (CVM)	DSR 335 (CVM)	DSR 352 (CVM)	DSR 346 (CVM)	DSR 351 (CVM)	DSR 360 (CVM)	DSR 337 (CVM)	DSR 349 (CVM)	DSR 368 (CVM)	DSR 285 (Walhalla)	DSR 328 (Walhalla)	DSR 898 (Walhalla)	DSR 329 (Walhalla)	DSR 364 (Plum Ridge)
Level of Service	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y
TY total overflow volume (MG)	0.09						0.03						0.62	0.03	0.69	0.05	0.21	0.01	0.01					0.15	0.02	0.03	0.03
TY total overflow duration (Hrs)	2						3.5						19	2	7.25	1.75	5.75	1	0.75					12	1.5	3.5	2.5
TY total number of activations	1						1						7	1	3	1	2	1	1					3	1	2	1
TY highest OF event volume (MG)	0.09						0.03						0.22	0.03	0.46	0.05	0.17	0.01	0.01					0.11	0.02	0.02	0.03
TY highest OF event peak flow (MGD)	1.61						0.30						1.48	0.89	5.16	1.25	2.12	0.54	0.41					1.01	0.59	0.34	0.47
Highest Volume (MG)	0.09						0.03						0.22	0.03	0.46	0.05	0.17	0.01	0.01					0.11	0.02	0.02	0.03
2nd Highest Volume (MG)													0.18		0.19		0.04							0.03		0.01	
3rd Highest Volume (MG)													0.09		0.05									0.01			
4th Highest Volume (MG)													0.06														
5th Highest Volume (MG)													0.04														
6th Highest Volume (MG)													0.02														
7th Highest Volume (MG)													0.02														
8th Highest Volume (MG)																											
9th Highest Volume (MG)																											
10th Highest Volume (MG)																											
11th Highest Volume (MG)																											
12th Highest Volume (MG)																											
13th Highest Volume (MG)																											
Highest Peak Flow (MGD)	1.61						0.30						1.48	0.89	5.16	1.25	2.12	0.54	0.41					1.01	0.59	0.34	0.47
2nd Peak Flow (MGD)													1.38		2.36		0.52							0.52		0.21	
3rd Peak Flow (MGD)													1.31		1.43									0.28			
4th Peak Flow (MGD)													0.82														
5th Peak Flow (MGD)													0.74														
6th Peak Flow (MGD)													0.53														
7th Peak Flow (MGD)													0.32														
8th Peak Flow (MGD)																											
9th Peak Flow (MGD)																											
10th Peak Flow (MGD)																											
11th Peak Flow (MGD)																											
12th Peak Flow (MGD)																											
13th Peak Flow (MGD)																											

Model: IP Models\BAS\SSCM12_RPM_BAS_woACISACTCleanup_woRamping_OptCEPT_TY.inp
Cutoff Values: Volume: 0.01 MG; Peak: 0.1 MGD; Duration: 0.25 hours

FIGURE 5.1.1 » DETAILED SURFACE APPROACH AREAS

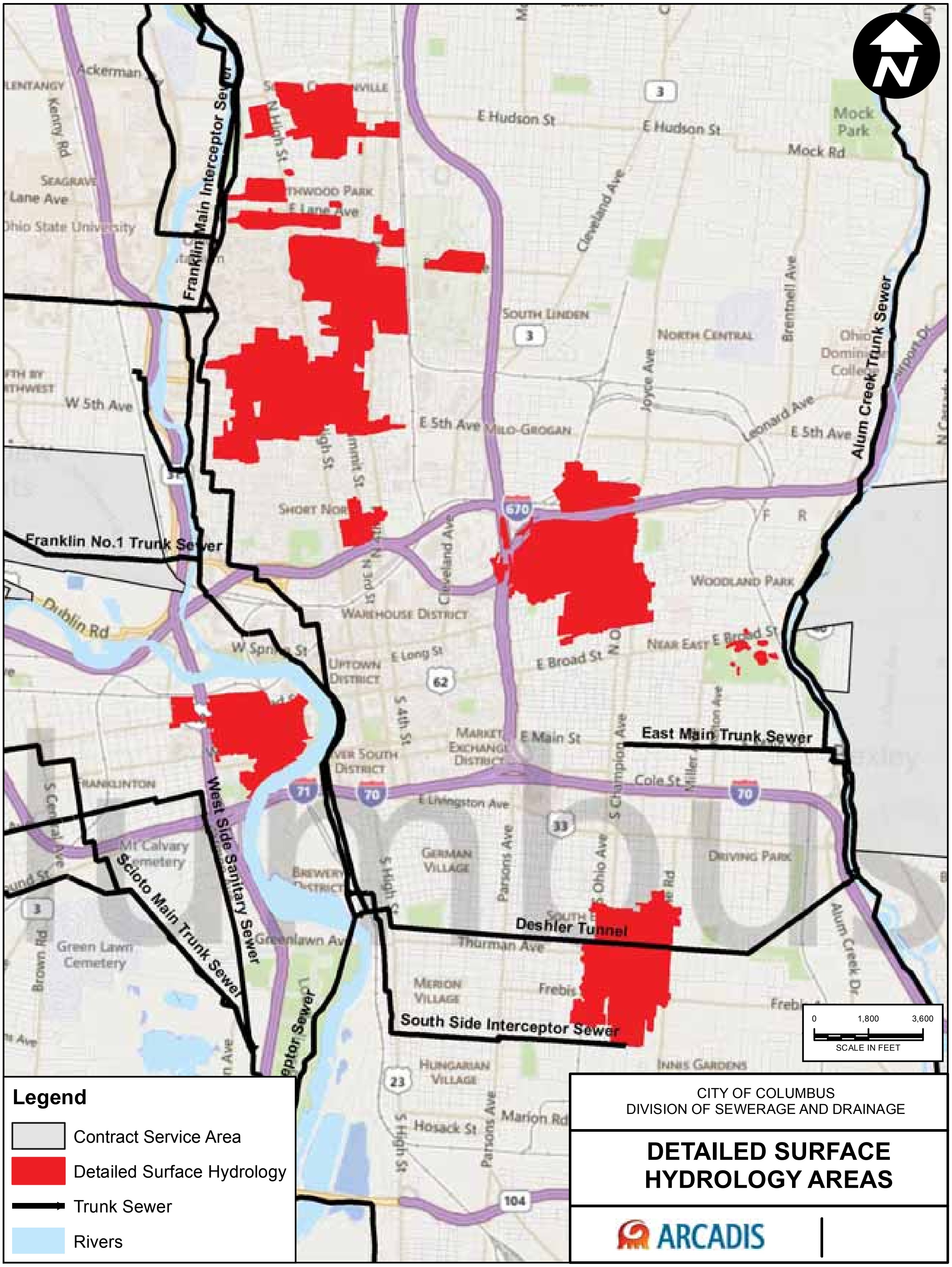


FIGURE 5.1.2 » CALIBRATION FLOW METERS

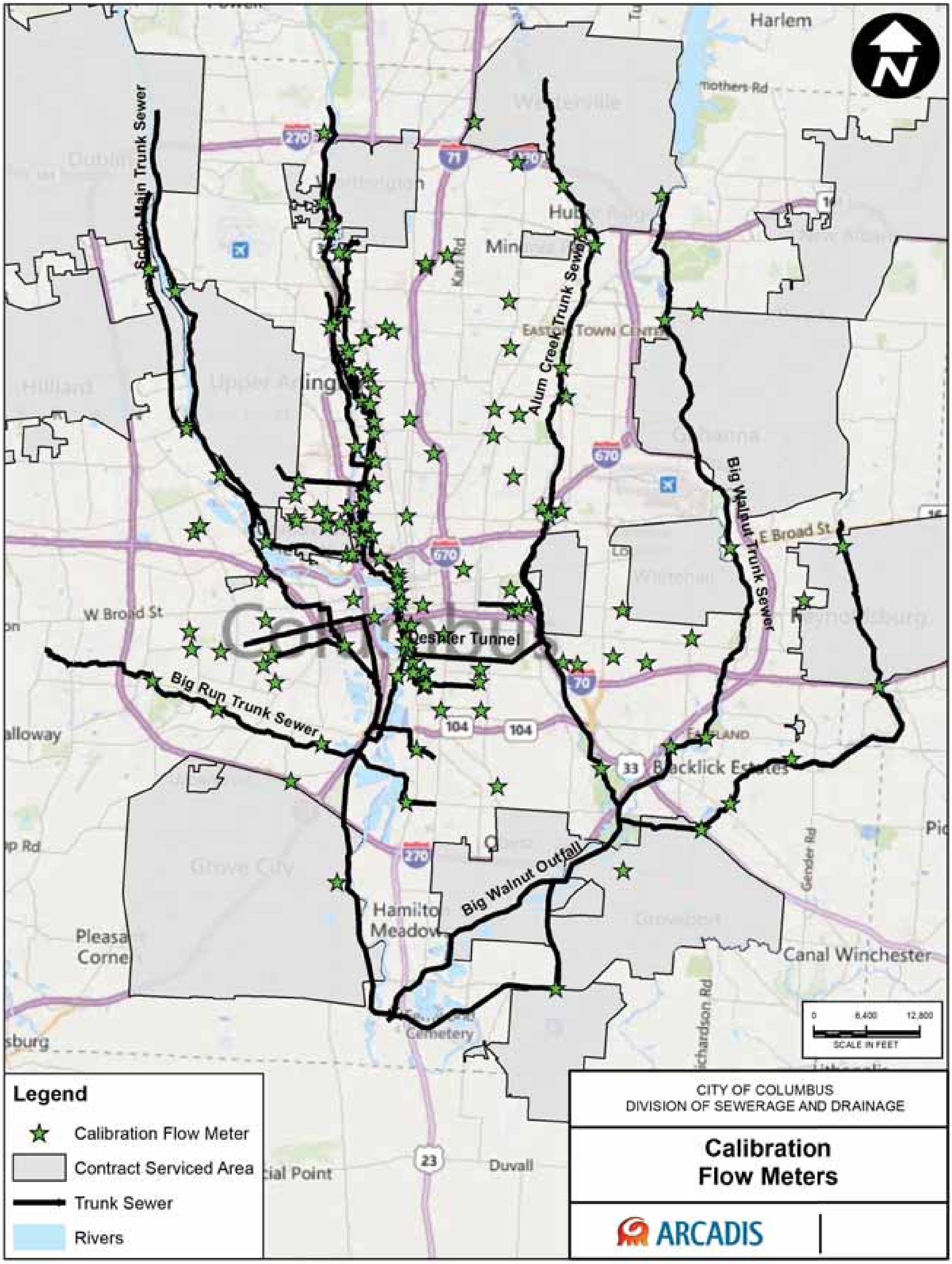


FIGURE 5.2.1 » OSIS AUGMENTATION AND RELIEF SEWER (OARS)

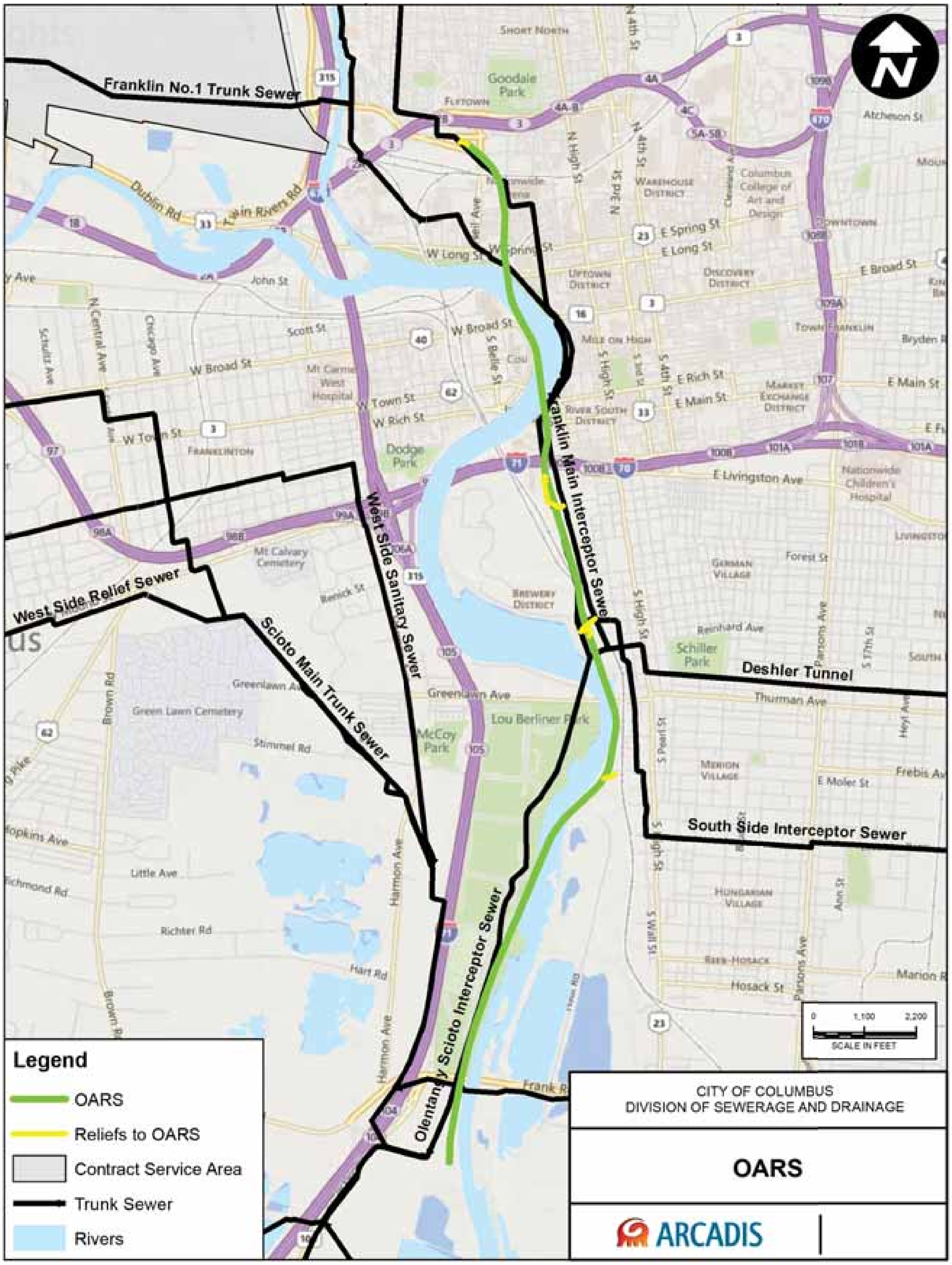


FIGURE 5.2.2 » PHASE 1 LOWER OLENTANGY TUNNEL (LOT1)

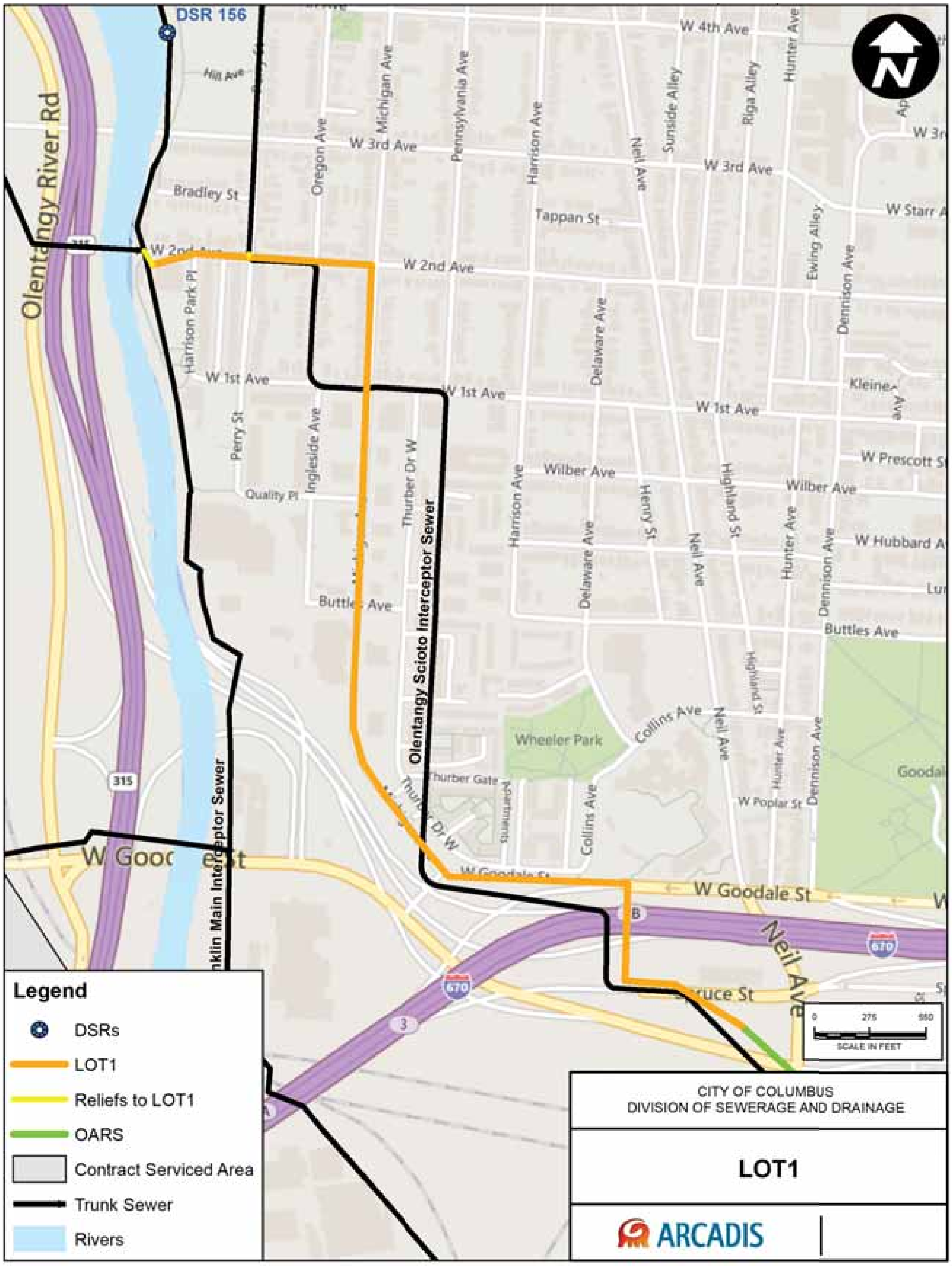


FIGURE 5.2.3 » PROPOSED DODGE PARK INFLOW REDIRECTION AREA

FIGURE 5.2.4 » PROPOSED KERR & RUSSELL INFLOW REDIRECTION AREA

FIGURE 5.2.5 » PROPOSED MARKISON INFLOW REDIRECTION AREA

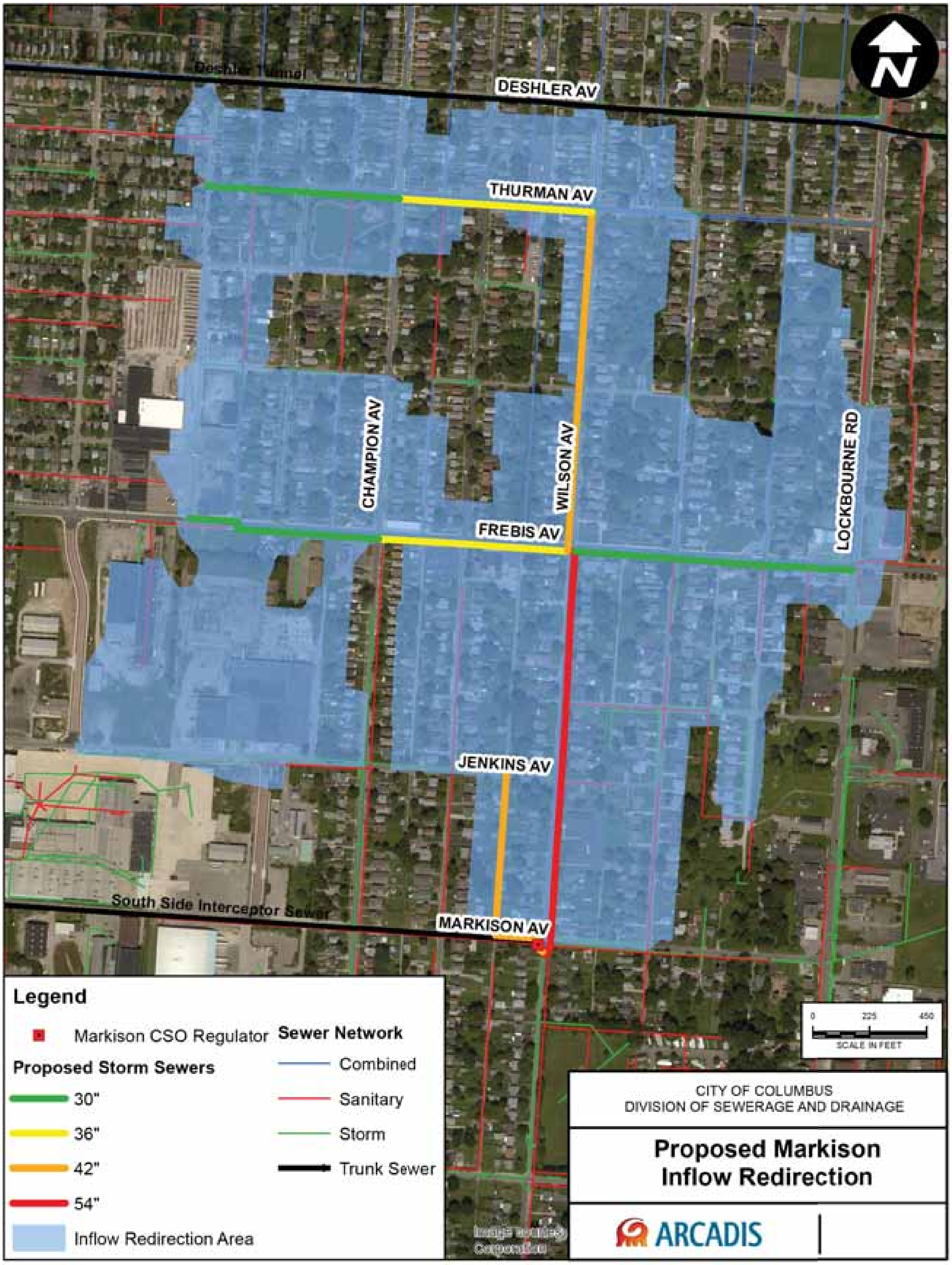


FIGURE 5.2.6 » PROPOSED NOBLE AND FOURTH INFLOW REDIRECTION

FIGURE 5.2.7 » COMPLETED INFLOW REDIRECTION PROJECTS

FIGURE 5.2.8 » LOCATION OF WEIR AT 18TH & LONG STREET

FIGURE 5.2.9 » CLINTONVILLE BASE CONDITIONS AND MODELED WIBs

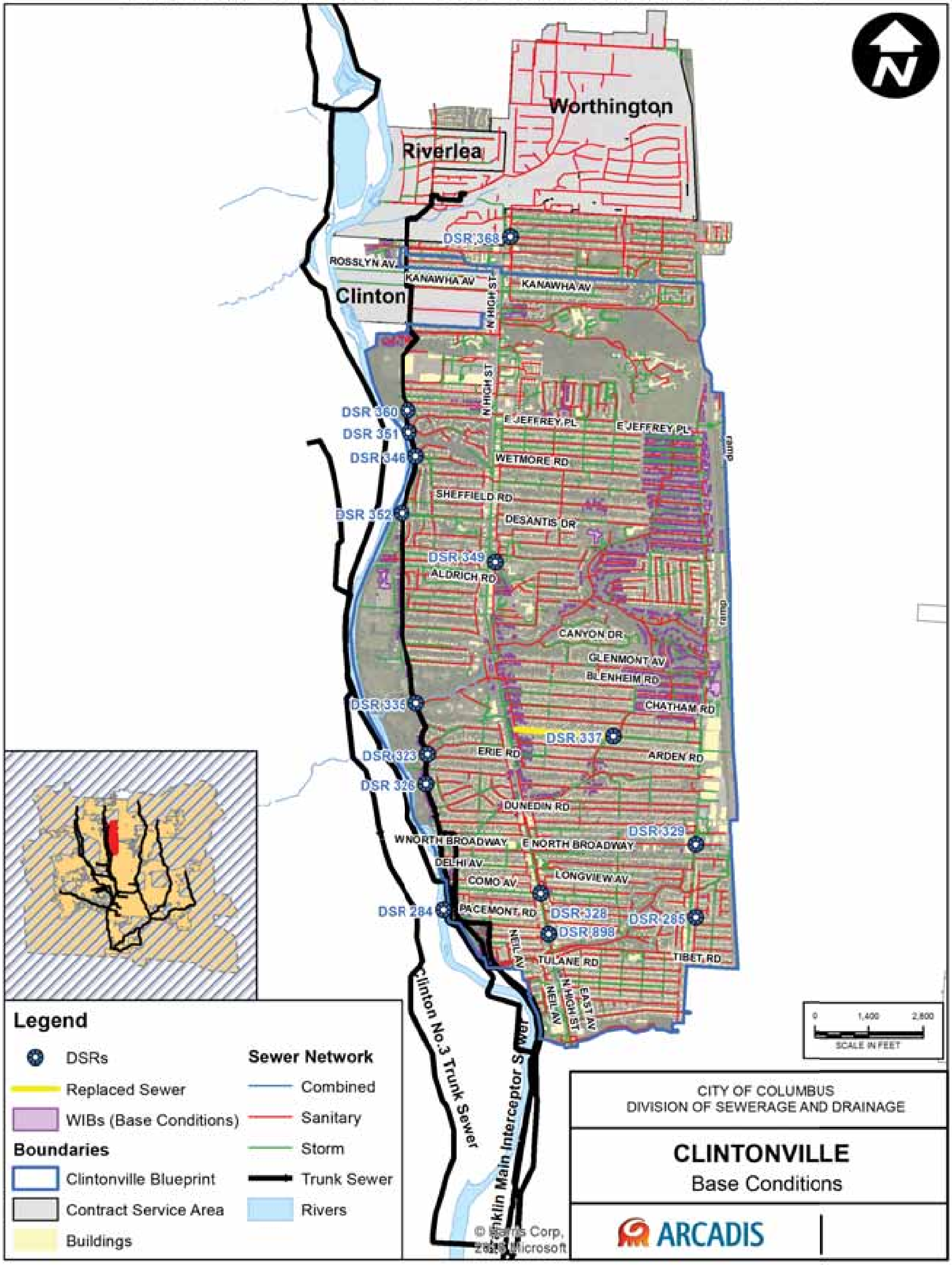


FIGURE 5.2.10 » HILLTOP BASE CONDITIONS AND MODELED WIBs

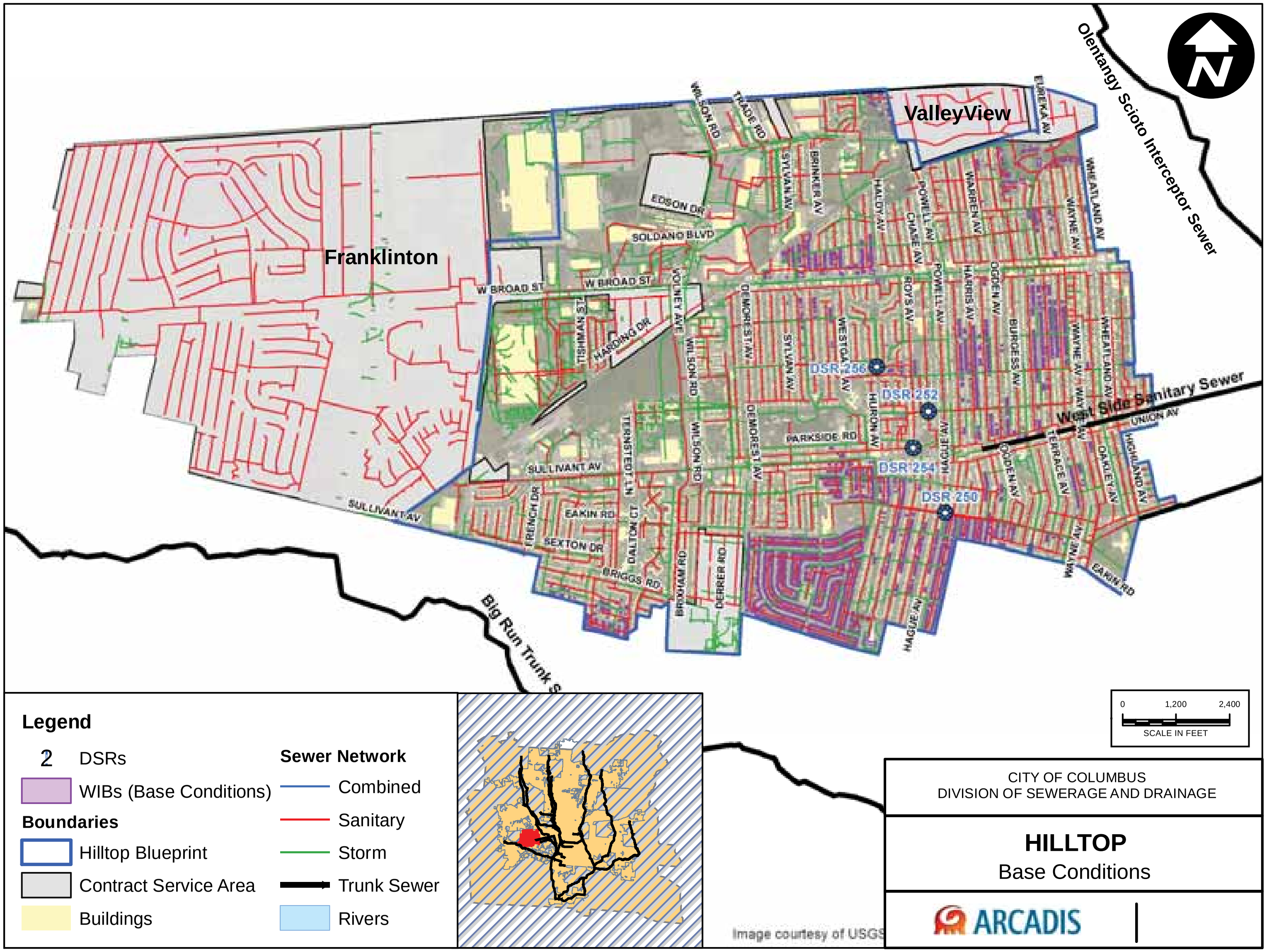


FIGURE 5.2.11 » LINDEN BASE CONDITIONS AND MODELED WIBs

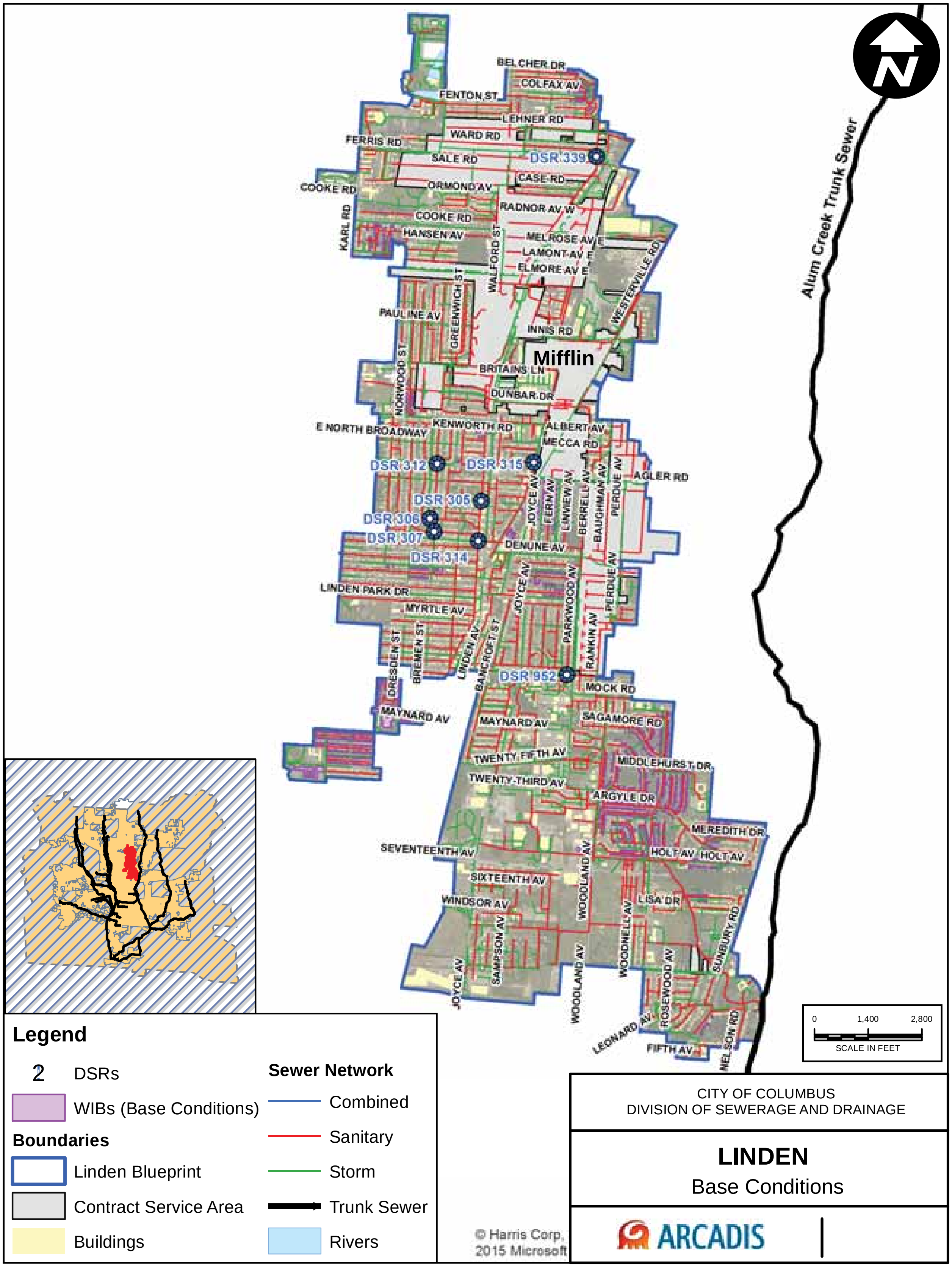


FIGURE 5.2.12 » MILLER KELTON BASE CONDITIONS AND MODELED WIBs

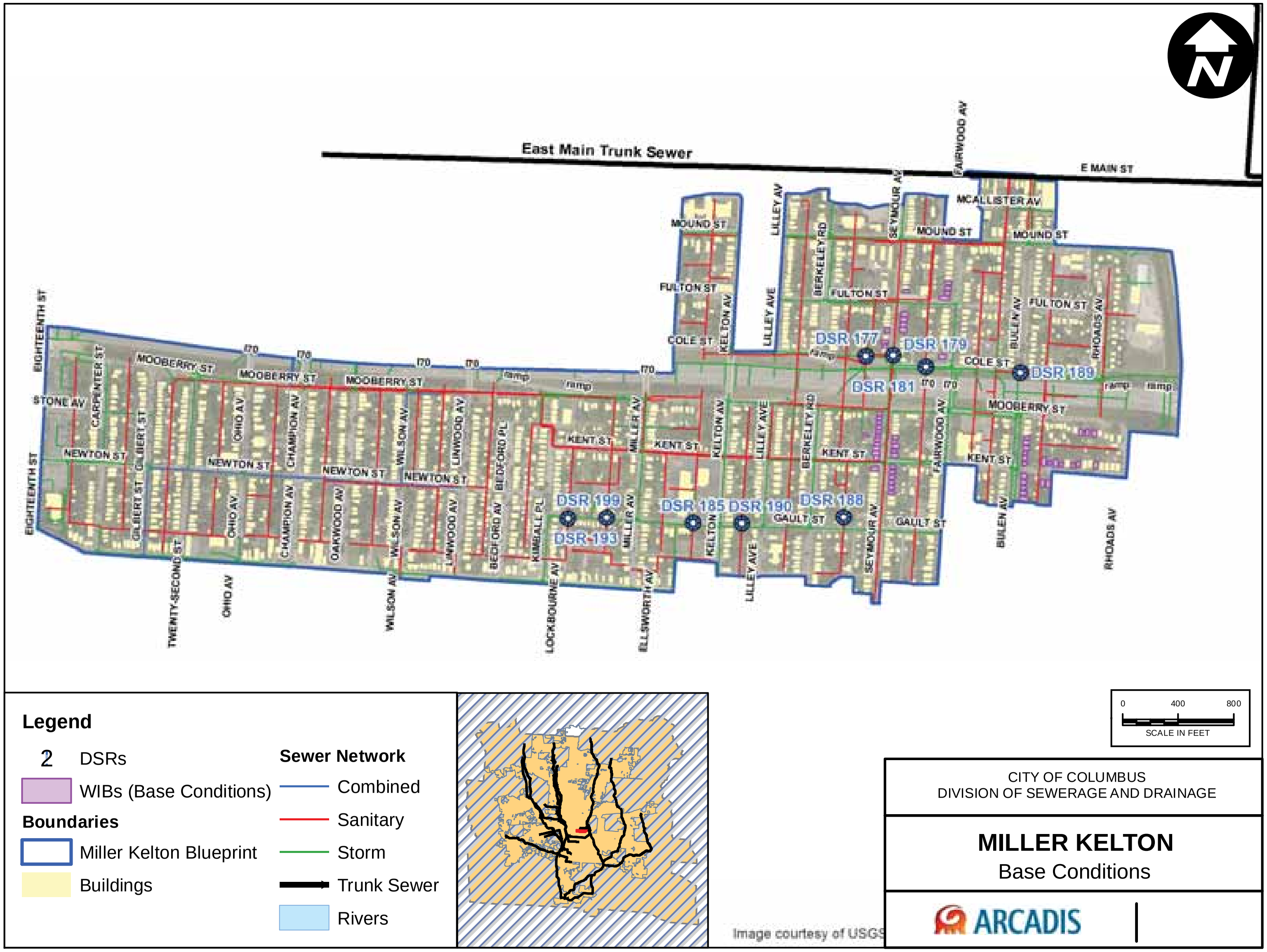


FIGURE 5.2.13 » PLUM RIDGE BASE CONDITIONS AND MODELED WIBs

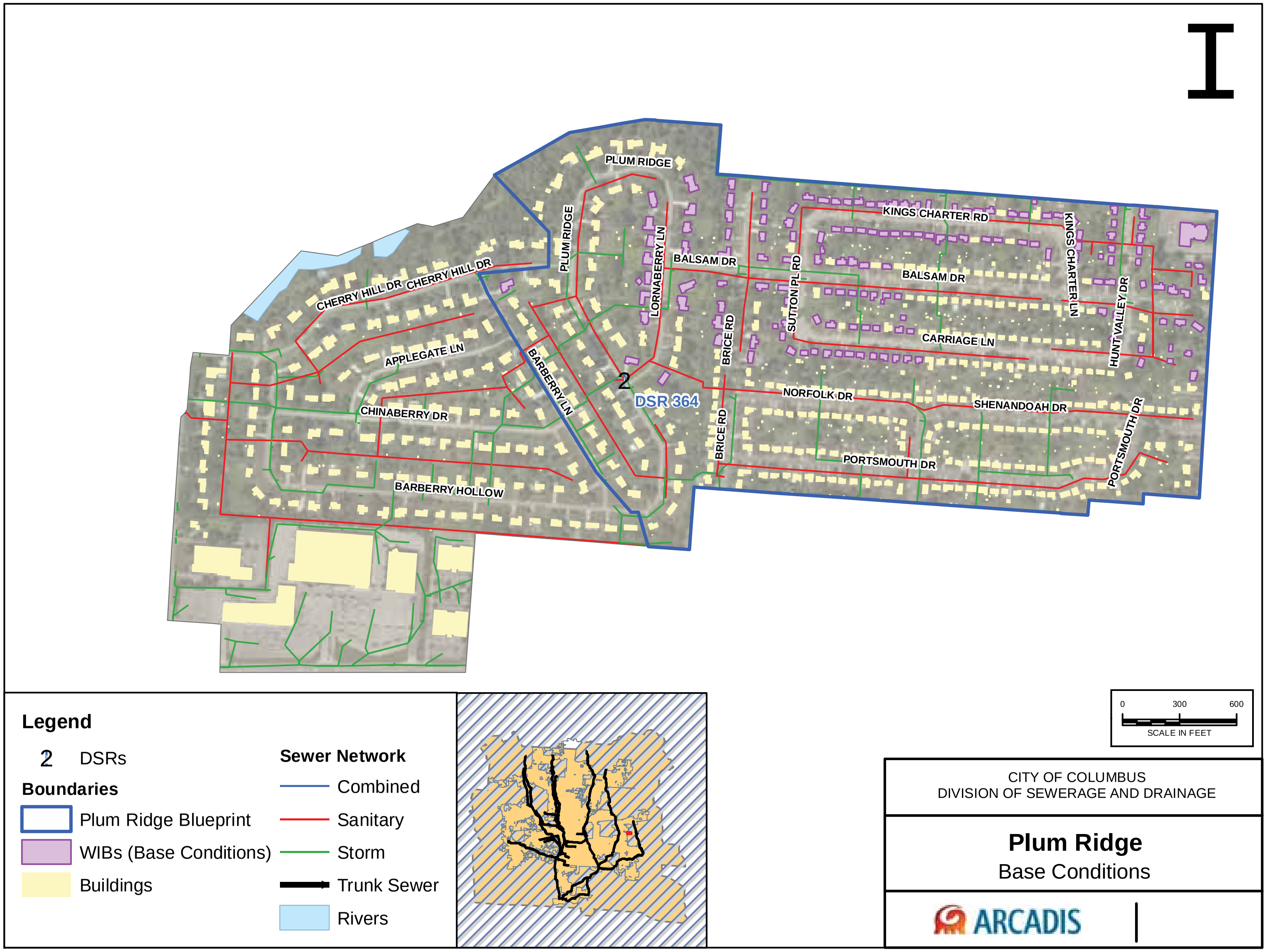


FIGURE 5.2.14 » NEAR SOUTH BASE CONDITIONS AND MODELED WIBs

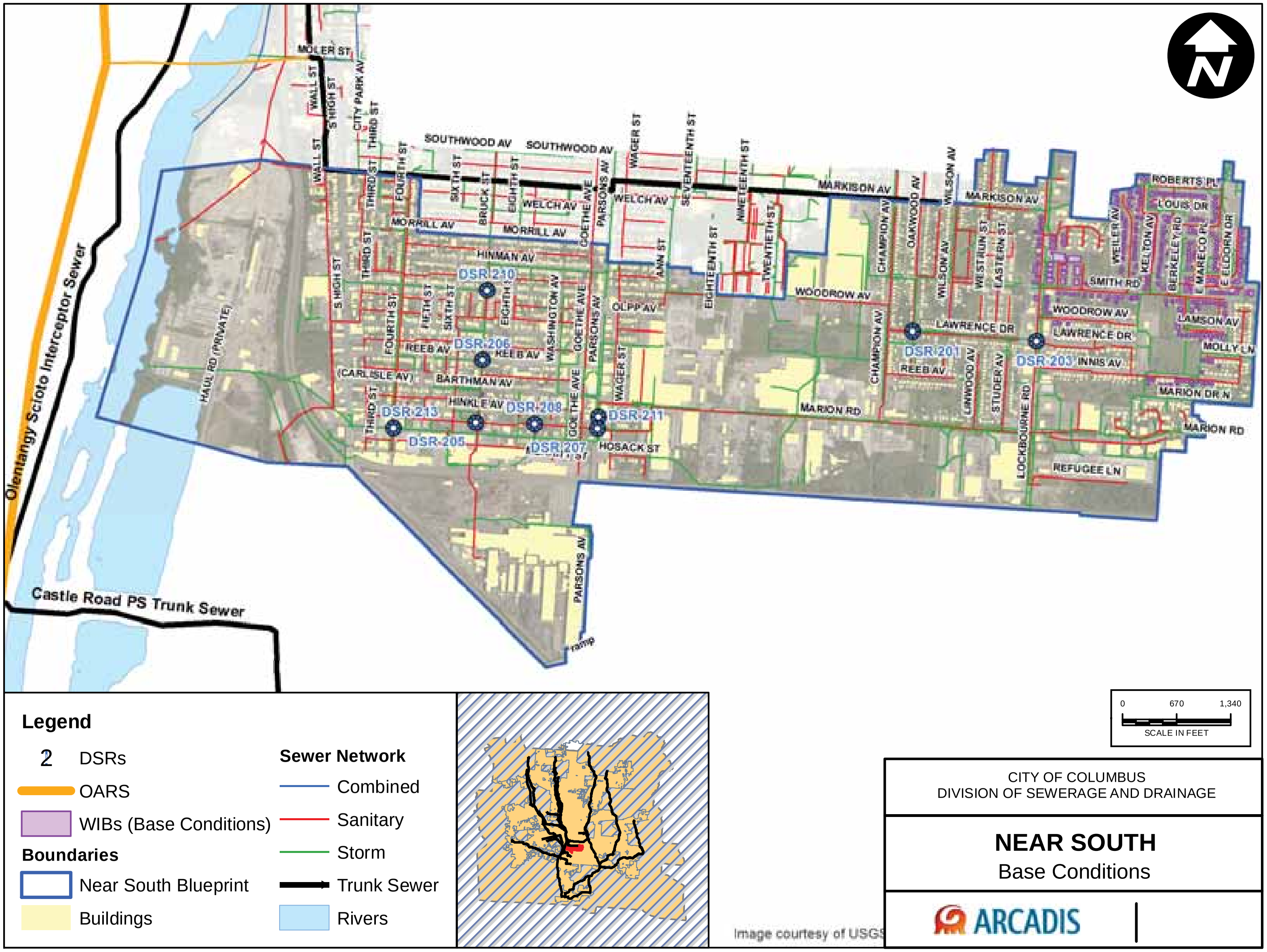


FIGURE 5.2.15 » JAMES LIVINGSTON BASE CONDITIONS AND MODELED WIBs

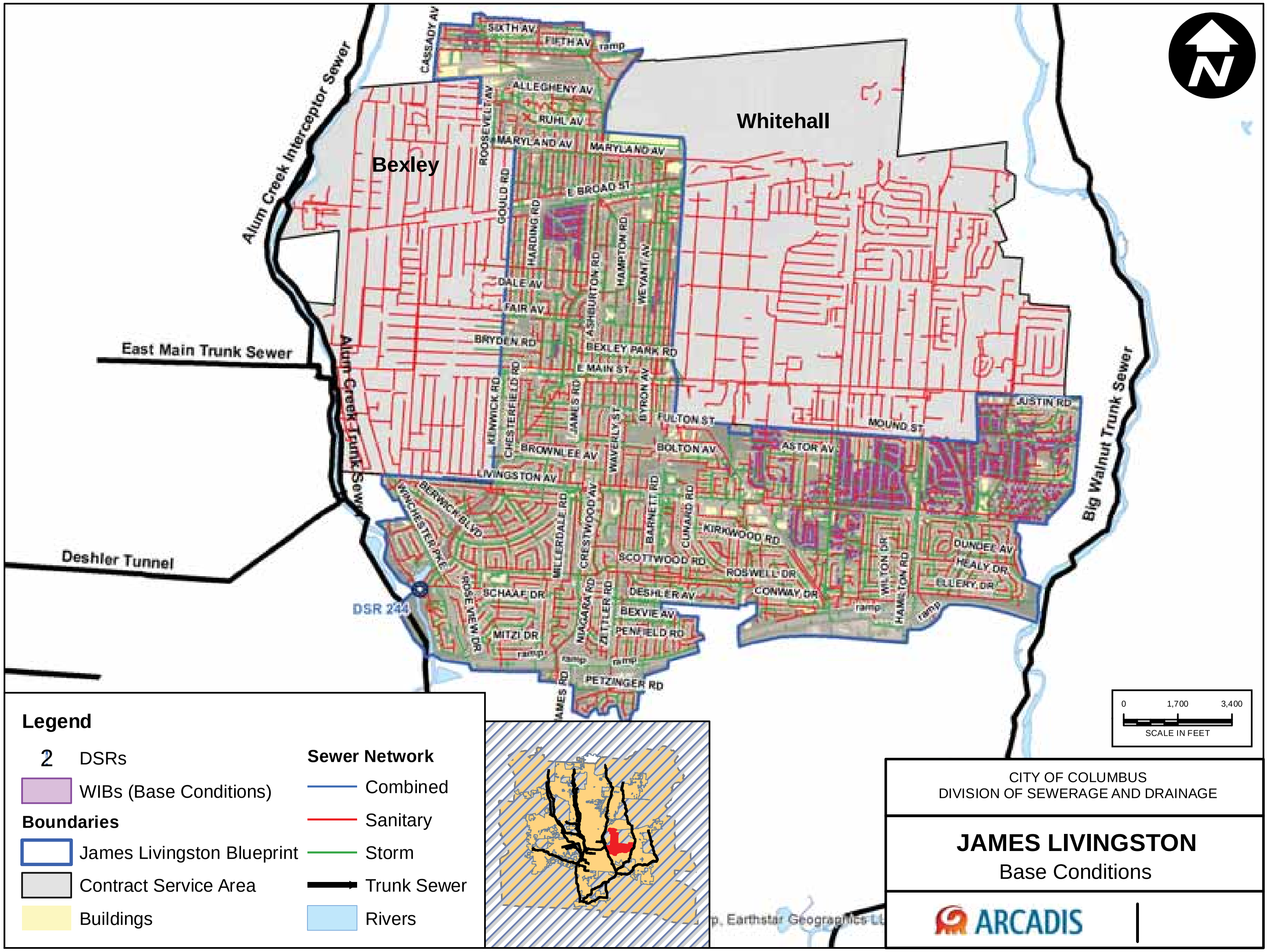


FIGURE 5.2.16 » FIFTH BY NORTHWEST BASE CONDITIONS AND MODELED WIBs

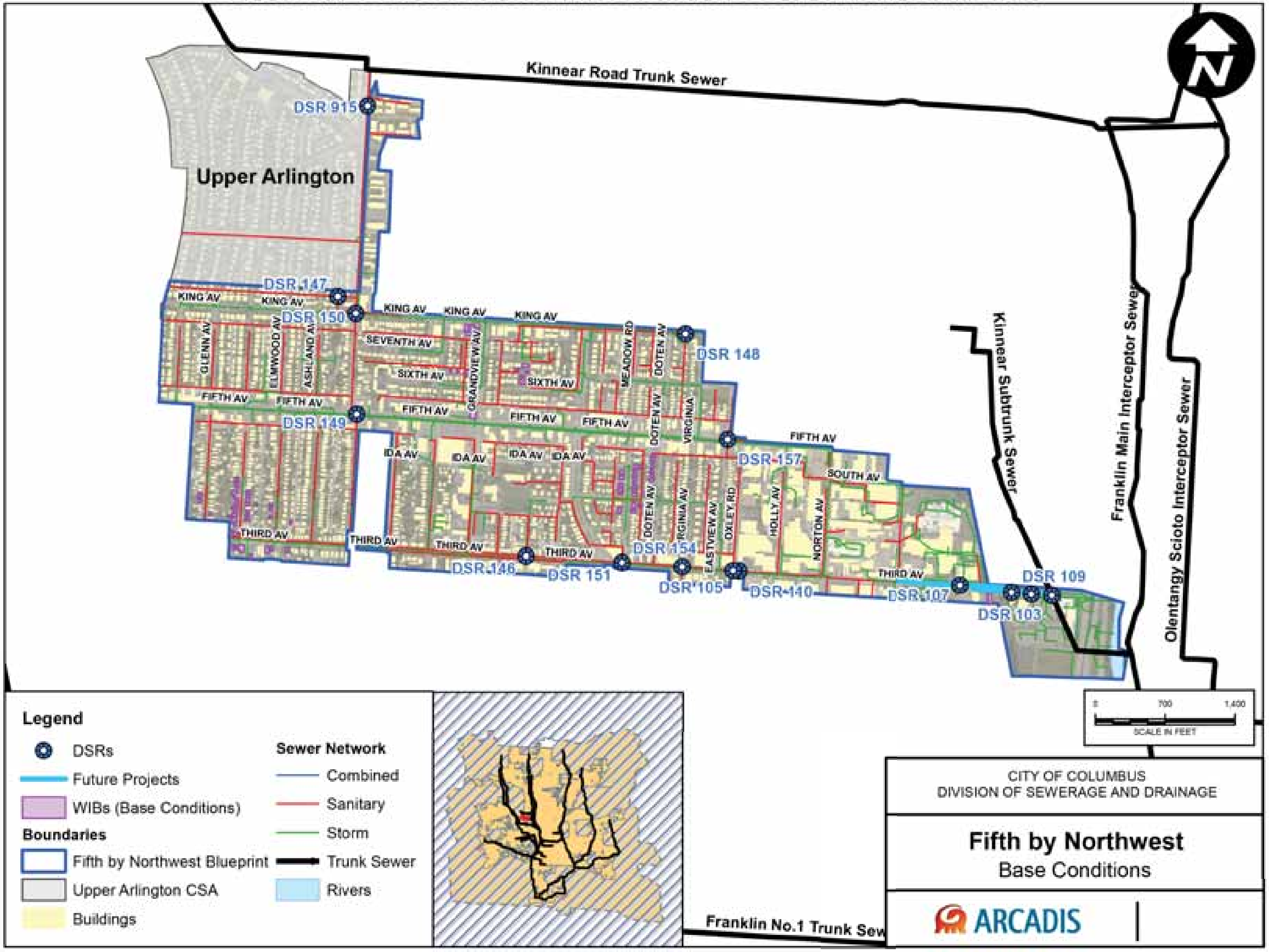


FIGURE 5.2.17 » WEST FRANKLINTON BASE CONDITIONS AND MODELED WIBs

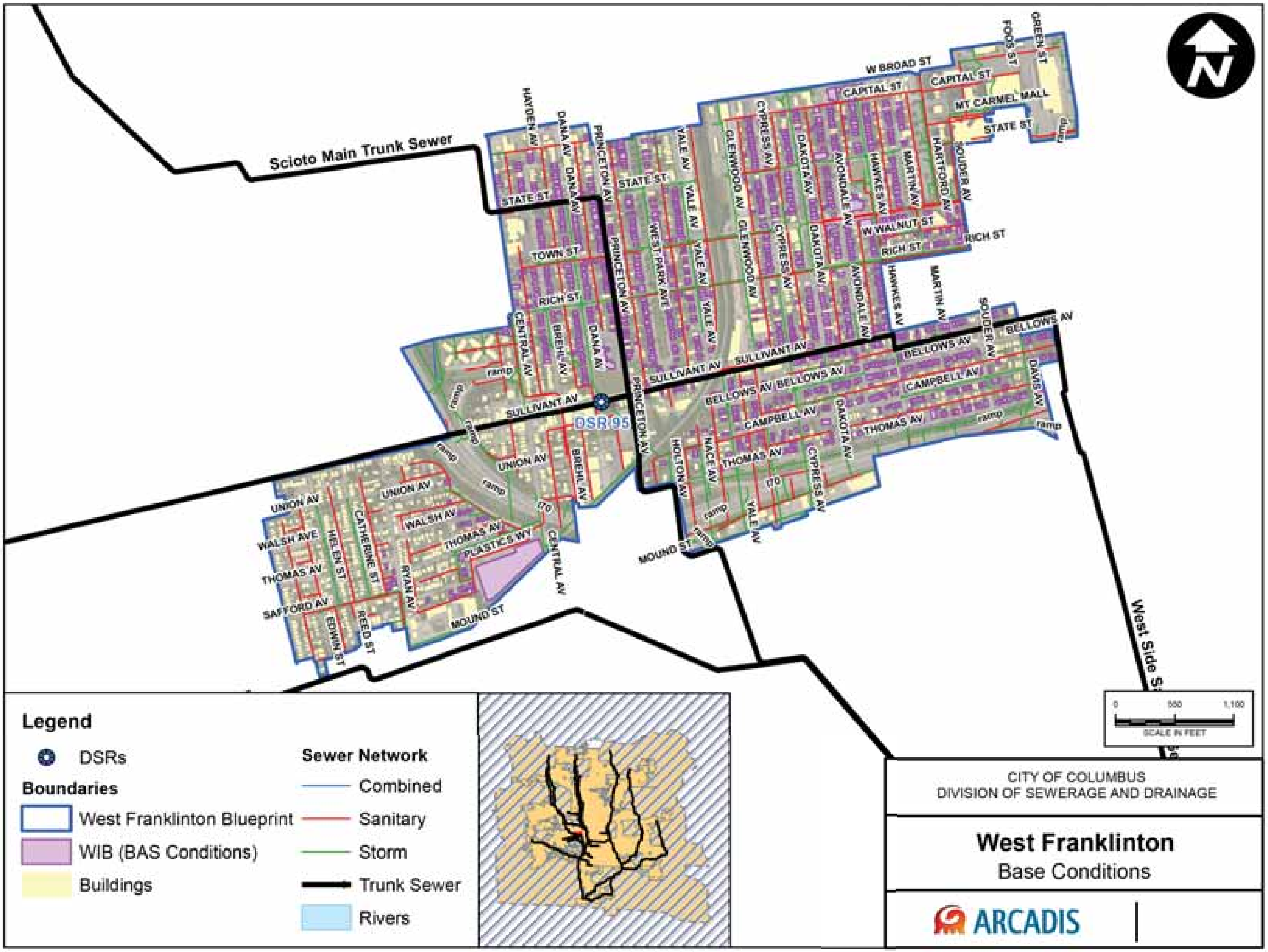


FIGURE 5.2.18 » NEAR EAST BASE CONDITIONS AND MODELED WIBs

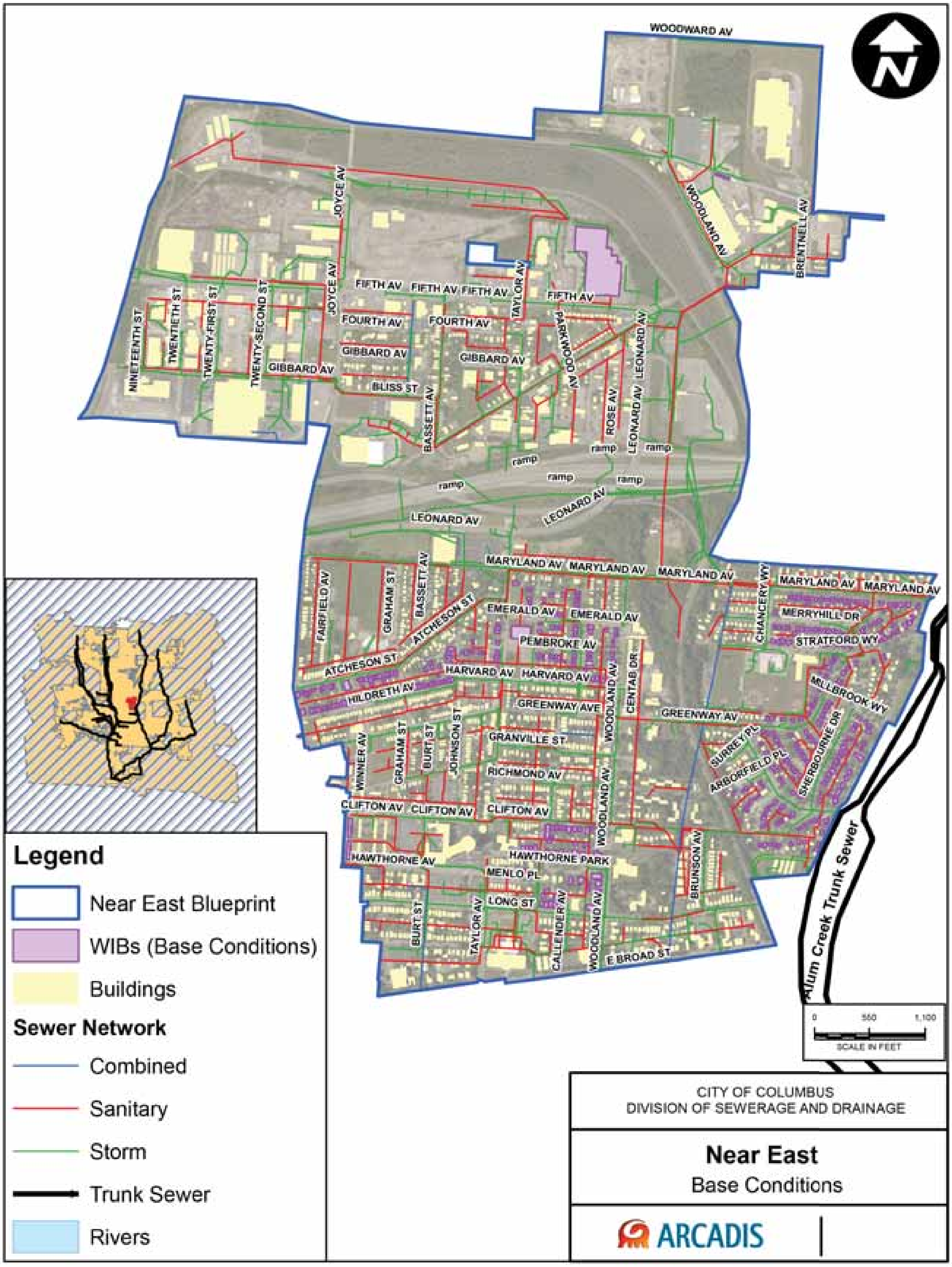


FIGURE 5.3.1 » SYSTEMWIDE WATER IN BASEMENT (WIBs) BASE CONDITIONS

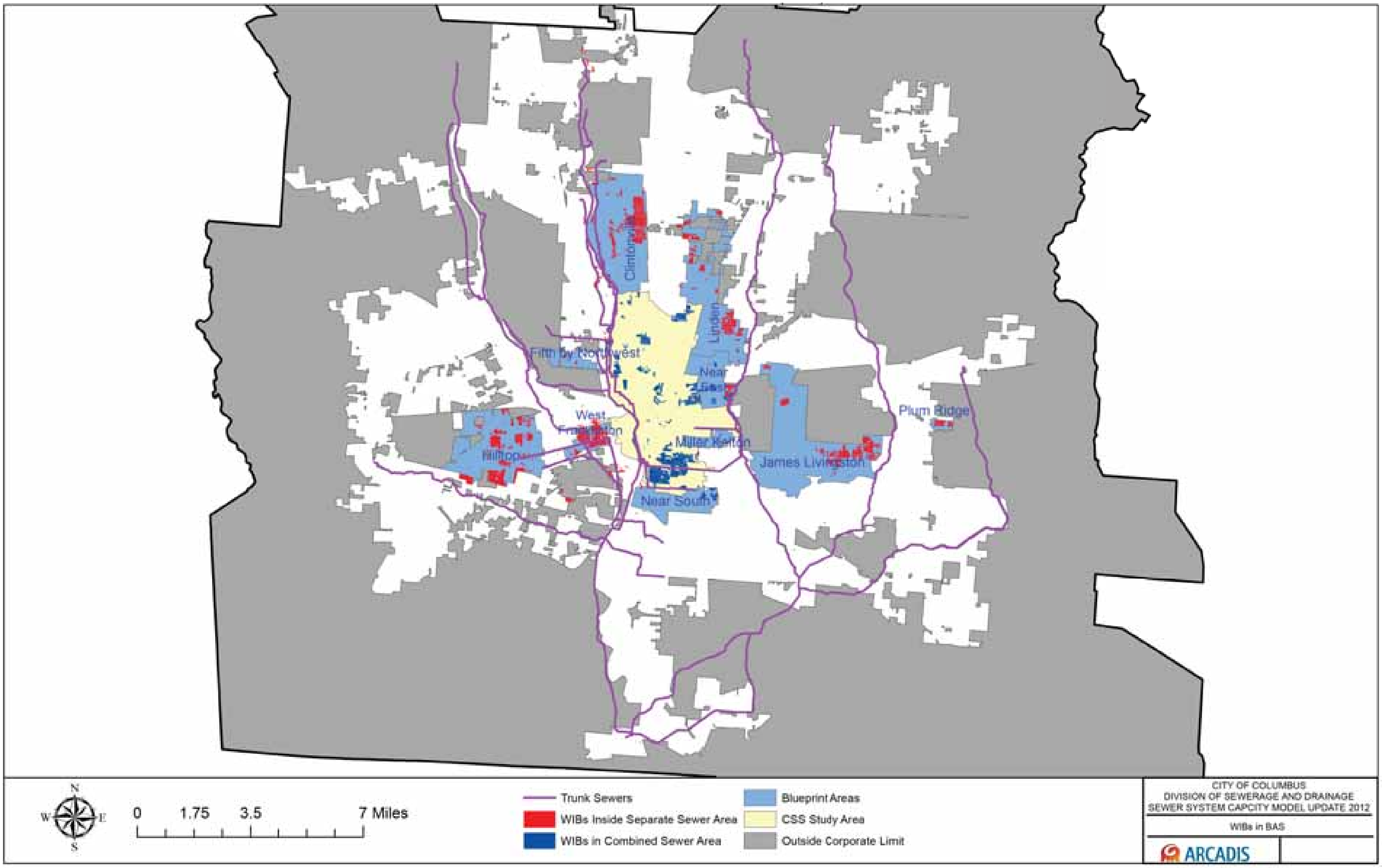
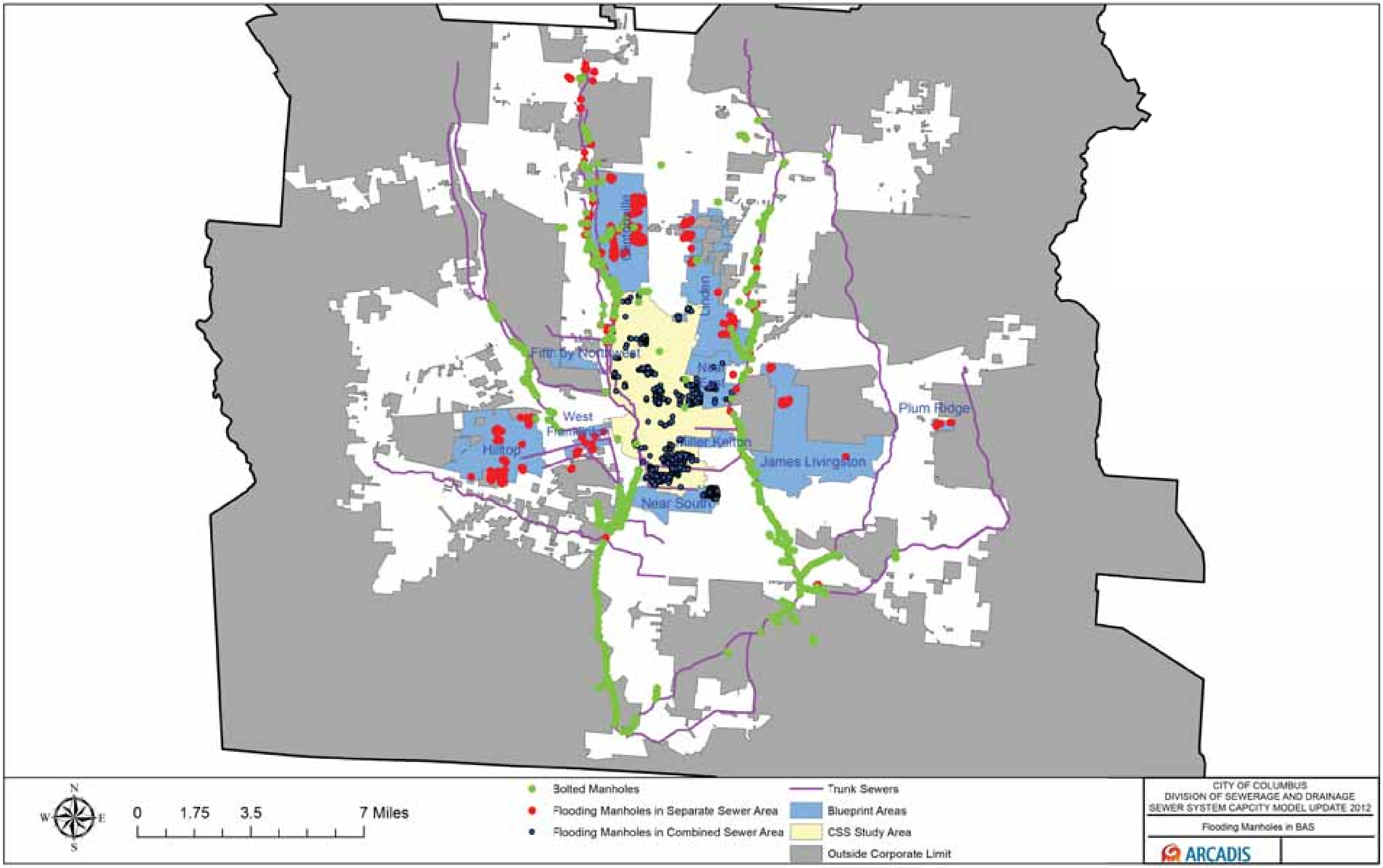


FIGURE 5.3.2 » SYSTEMWIDE FLOODING MANHOLES BASE CONDITIONS



6

BLUEPRINT PLAN

(INTEGRATED PLAN)

THE CITY OF COLUMBUS
MICHAEL B. COLEMAN, MAYOR

DEPARTMENT OF PUBLIC UTILITIES

The Integrated Plan and 2015 WWMP Update Report

BLUEPRINT COLUMBUS

Clean streams.
Strong neighborhoods.

Clean streams. Strong neighborhoods.

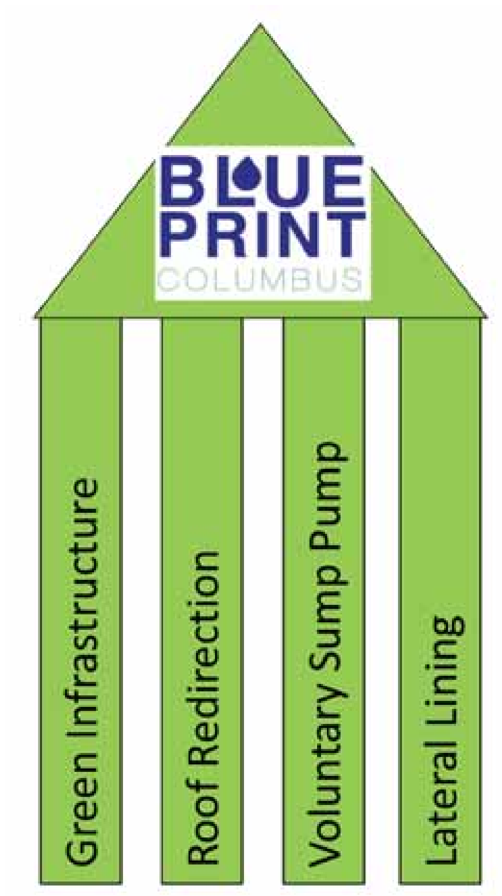
SECTION 6

6 BLUEPRINT PLAN (INTEGRATED PLAN)

6.1 The Four Pillars of Blueprint Columbus

Blueprint Columbus is an integrated plan that addresses sanitary sewer overflows (SSOs), basement back-ups or water in basement events (WIBs) and stormwater quality. The SSOs and WIBs are addressed by removing inflow and infiltration (I/I) from the sanitary sewer system, allowing that system to function properly with no overflows or back-ups. The I/I removal is accomplished by the first three technologies involved in Blueprint: rehabilitating sewer pipes (city owned and private laterals), redirection of roof water away from houses to protect the foundation drain and a voluntary sump pump program. Stormwater quality is addressed by green infrastructure. The city refers to these components as the four pillars. See Exhibit 6.1.1.

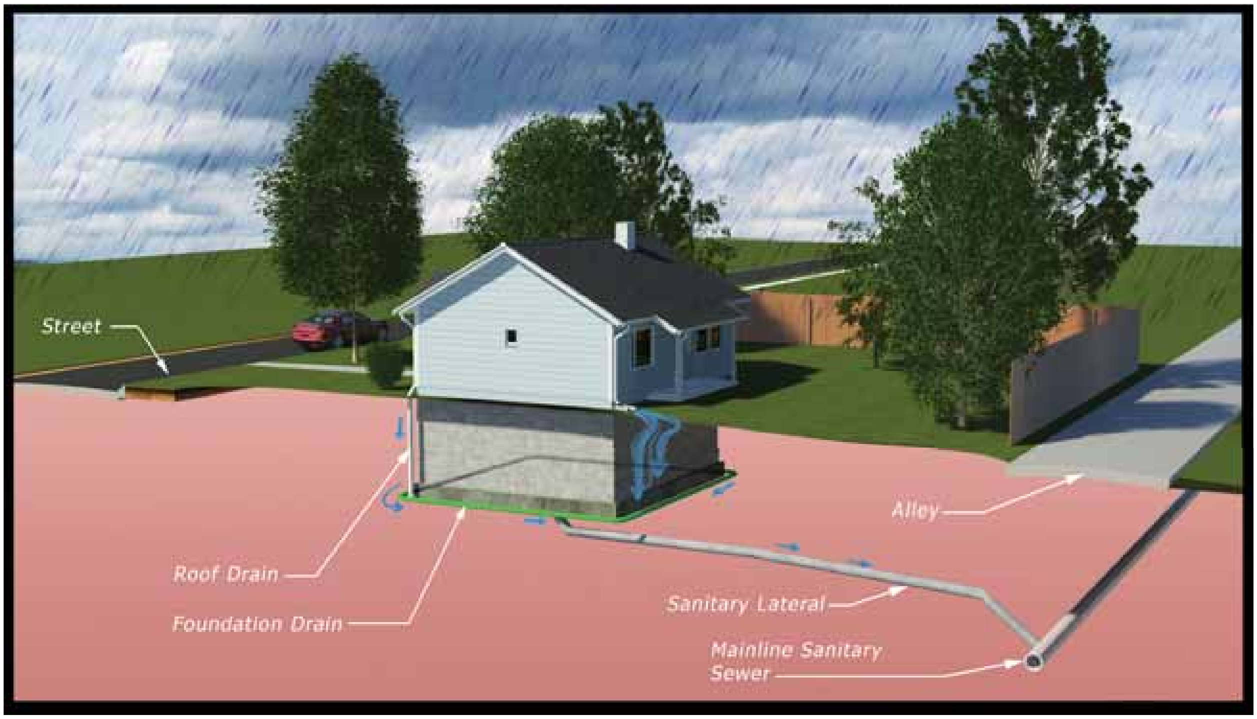
EXHIBIT 6.1.1 » THE FOUR PILLARS OF BLUEPRINT COLUMBUS



6.1.1 The I/I Removal Technologies

The root cause of sewer overflows and WIBs is I/I entering the separate sanitary sewers including private laterals. The city has been studying I/I for years and has determined that the majority of it is entering the system from older residential areas. 6.1.2 shows how these homes are impacting the system.

EXHIBIT 6.1.2 » EXISTING RESIDENTIAL CONDITIONS



The inflow source shown in Exhibit 6.1.2 is a roof drain (downspout) that is directly connected to the foundation drain. This connection rapidly fills the foundation drain with rainwater and enters the private sanitary lateral feeding the sanitary sewer. This connection was made illegal in 1907. The city's I/I studies have found that these connections are relatively rare.

There are two sources of infiltration depicted. First, the lateral itself may allow infiltration through cracks, leaks or non-water tight seals. The joints on older clay lateral pipes are typically not watertight.

Second, the foundation drain can also serve as a source of infiltration. In houses built before the 1960s (when sump pumps became a mandatory part of the plumbing code), foundation drains were typically tied directly into the service lateral through the 4-inch to 6-inch transition. The 4-inch to 6-inch transition connects the house plumbing (four inches in diameter) with the private sanitary lateral (six inches in diameter). This connection is typically not watertight. The city's extensive studies have found that the roof leaders from the house often contribute significant infiltration by allowing the water from the roof to infiltrate along the side of the foundation to the foundation drain, which ultimately leads to the sanitary sewer.

Blueprint proposes to resolve these issues as follows: First, the sanitary lateral and the mainline sanitary sewer will be rehabilitated, dramatically reducing I/I influence on the sewer system. This will mostly be done using a cured in place pipe liner (CIPP), although other technologies (such as pipe-bursting) are possible as well. Previous studies conducted by the city indicate that lining residential laterals can reduce I/I by 30%. In addition, a private storm drainpipe will be installed that will take the rain from the roof and direct it toward green infrastructure in the right of way. Also depicted in Exhibit 6.1.3 is a sump pump. Columbus will offer a voluntary sump pump program to residents within the Blueprint areas. Sump pumps are effective at reducing the amount of water getting to the sanitary lateral because they not only collect rain from roofs (roofs that aren't directed to the street) but they also collect groundwater from rain that fell in the area surrounding the house. The Blueprint alternative has another benefit in that it physically separates the stormwater system from the sewer system for each residential area.

EXHIBIT 6.1.3 » RESIDENTIAL CONDITIONS WITH BLUEPRINT IMPLEMENTATION

6.1.2 The Green Infrastructure Component

The final pillar of Blueprint is green infrastructure. One of the original driving factors for including green infrastructure was to stay ahead of national stormwater regulations. Since that time national stormwater regulations have been postponed indefinitely. However, green infrastructure is needed to offset the additional rainwater reaching the stormwater system when roof redirection and sump pump installation occurs. In addition, green infrastructure provides many other benefits such as water quality improvement, neighborhood improvement, local job creation and increased green space.

The Clintonville Pilot Area Technical Committee (PATC) led the investigation into sizing for the green infrastructure. PATC recognized that the local total maximum daily load (TMDL) for the Olentangy River calls for a reduction in total suspended solids (TSS) of 65%. PATC determined that a 58% reduction of TSS would be more cost effective. The six Clintonville engineering firms then estimated the amount and cost of creating enough green infrastructure to achieve this level of TSS removal in the Clintonville pilot area. The cost was far more than the city could justify, and thus a new level of service (LOS) for sizing the green infrastructure was needed.

In addition, the city determined that it should not make the existing stormwater system worse. A do-no-harm concept was developed, proposing that even though additional stormwater sources would be added to the stormwater system (sump pumps and roof redirections), no additional street flooding would be allowed.

The LOS metrics for the stormwater flow component of green infrastructure are maintaining peak flow rates at the storm sewer outfalls, elevation of street flooding and peak flow rate of surface flow from the project area.

In addition, a water quality benefit was highly desirable and appropriate. The city determined that the water quality LOS would be a 20% reduction in TSS from the area that could be controlled. This level was considered a significant benefit, while also affordable. The controllable area is defined as the area that generates runoff that can reach the surface of a public street. A TSS removal goal of 20% is analogous to the Ohio EPA general construction permit, which requires either a 20% reduction in impervious area or treatment of the 20% of the redeveloped impervious area for new development projects. The water quality treatment requirement for a Blueprint project exceeds the Ohio EPA general construction permit because the controllable area greatly exceeds the total area of disturbance of the project.

Thus, the green infrastructure component will be sized to control stormwater to the levels that existed before Blueprint was applied (do-no-harm) while also achieving a 20% TSS reduction.

6.2 Legal Authority

The city's authority to access private property and line service laterals and/or redirect roof drains in those neighborhoods contributing I/I to its sewer system stems from: (1) its police powers as set forth in Article XVIII, §3 of the Ohio Constitution, including its authority to abate public nuisances; and (2) the city's authority to own and operate a municipal utility under Article XVIII, §4 of the Ohio Constitution, as well as the Ohio Revised Code (RC). That legal authority is summarized in this section. The city has drafted legislation to implement this authority and the Blueprint plan; this legislation will be submitted to City Council upon approval of Blueprint.

6.2.1 City Council has Broad Authority to Declare a Nuisance and Abate It

Ohio courts have long recognized that private property rights are limited by the public welfare, and that private property use may be controlled by municipalities exercising local police powers. "As the constitutional right of the individual to use private property has always been subservient to the public welfare under Section 19, Article I of the Ohio Constitution, such use is subject to the legitimate exercise of local police power pursuant to Sections 3 and 7, Article XVIII of the Ohio Constitution." *Northern Ohio Sign Contractors Ass'n v. City of Lakewood,* 32 Ohio St. 3d 316, 320 (1987) (holding that a city validly exercised its police powers when determining that certain offensive commercial signs were a nuisance). As the court explained in *DeMoise v. Dowell,* 10 Ohio St.3d 92 (1984):

> *Almost every exercise of the police power interferes with the enjoyment of liberty or the acquisition, production or possession of property. Yet the constitutional provisions against the taking of property must give way to the exercise of the police power ... if it bears a real and substantial relation to the public health, safety, morals or general welfare of the public and if it is not unreasonable or arbitrary.*

Id. Declaring and abating a nuisance is a legitimate exercise of a municipality's police power. A municipality's ability to abate nuisances is further supported by the Ohio RC. See RC §715.44 (which explicitly authorizes municipalities to abate and remediate nuisances). Moreover, a municipality may regulate as a nuisance a pre-existing condition that was not formerly regulated.

Under common law, "'public nuisance' includes '(any) unreasonable interference with a right common to the general public.' . . . 'Unreasonable interference' includes those acts that significantly interfere with public health, safety, peace, comfort, or convenience, (or) conduct that is contrary to a statute, ordinance, or regulation . . ." *City of Cincinnati v. Beretta U.S.A. Corp.*, 95 Ohio St. 3d 416, 419 (2002) (citing Restatement of the Law 2d, Torts (1965)) (internal citation omitted). Given this sweeping definition, state courts recognize that, "a city has wide police power in defining and declaring what shall constitute a nuisance." *Ferguson v. City of Columbus*, 128 N.E.2d 198, 204 (2d Dist. 1954).

In this case, Columbus City Council may declare that excessive I/I that causes SSOs and WIBs is a public health nuisance to be abated by the director of public utilities. This is a legitimate use of the city's police powers as it directly relates to preventing the public health threat of human contact with raw sewage. The legislation passes the following two part test: "A municipal ordinance passed under such authority will be valid if it (1) bears a real and substantial relationship to the health, safety, morals or general welfare of the public and (2) if it is not unreasonable or arbitrary. Id. See also *Village of West Jefferson v. Robinson*, 1 Ohio St. 2d 113, 120 (1965) (citing *Ghaster, Inc. v. Preston*, 176 Ohio St. 425 (1964)) ("the legislation may provide that a theretofore lawful activity will thereafter be a nuisance; and such legislation may be valid, if it comes within the police power, i.e., if it has a real and substantial relation to the public safety and general welfare of the public and is neither unreasonable nor arbitrary.")

THE I/I REDUCTION PROGRAM HAS A REAL AND SUBSTANTIAL RELATION TO THE PUBLIC SAFETY AND GENERAL WELFARE

While analyzing this first criterion, courts will not substitute their judgment for that of the local government, presumed to be familiar with local conditions and the needs of the community, unless there has been a clear and palpable abuse of power. *Porter v. Oberlin* (1965), 1 Ohio St.2d 143, 205 N.E.2d 363. As the court explained in Benjamin:

> *Whether an exercise of the police power does bear a real and substantial relation to the public health, safety, morals or general welfare of the public and whether it is unreasonable or arbitrary are questions which are committed in the first instance to the judgment and discretion of the legislative body, and, unless the decisions of such legislative body on those questions appear to be clearly erroneous, the courts will not invalidate them.*

In determining whether an ordinance is reasonable and bears a substantial relationship, courts should weigh the benefits sought by the legislation against the benefits of the alleged nuisance activity. *Id.*

With respect to the first criterion, the city's service lateral lining and roof drain redirection initiatives have "a real and substantial relation to the public safety and general welfare of the public." The city has ample evidence of the following facts:

- Excessive I/I is the cause of SSOs and WIBs;
- Approximately 60% of the I/I in the sanitary sewer system is entering the system from private property, primarily older residential homes;
- The I/I is entering the system from sewer laterals and roof drains that are connected directly or indirectly to the city's sanitary sewers;
- SSOs and WIBs allow human contact with raw sewage, which is a public health threat; and
- Relining laterals and redirecting roof drainage will substantially reduce the I/I and therefore the nuisance.

Moreover, the purpose of the legislation – elimination of raw sewage from waterways and basements – has a strong public benefit that outweighs the minimal intrusion onto private property.

Thus, the city's efforts to maintain its sewer system and thereby protect the public from SSOs "come within" its police powers. See Robinson, 1 Ohio St. 2d at 120; see also *Hutchinson v. City of Lakewood*, 125 Ohio St. 100, 103 (1932) (recognizing that a municipality's construction of sewer systems concerns the "health, safety and welfare of the dwellers in urban centers of population" and thus constitutes a valid exercise of police power).

THE CITY'S LATERAL LINING AND ROOF DRAIN REDIRECTION INITIATIVES ARE NEITHER UNREASONABLE NOR ARBITRARY

The second criterion for determining the lawfulness of a nuisance regulation is whether it is unreasonable or arbitrary. In determining whether a nuisance regulation is reasonable, courts will generally review the legislative history of the nuisance ordinance to ensure that it is based on adequate factual findings. See In re Thornburg, 55 Ohio App. 229, 234 (8th Dist. 1936) ("The legislative body of (a city) cannot, under the guise of the exercise of police power, declare that a nuisance as a matter of law which is not a nuisance as a matter of fact, but may become so by reason of circumstances only."). And when reviewing retroactive nuisance legislation, some Ohio Supreme Court cases have held that the municipality must make a "factual determination that the continued use of the property (in its non-conforming state) immediately and directly imperils the public health, safety or morals." E.g. *Gates Co. v. Housing Appeals Bd.*, 10 Ohio St. 2d 48, 52 (1967).

The city has a strong factual basis for its private I/I removal program. First, the city has been studying I/I issues for over 20 years. These numerous studies have provided the city with a clear understanding of the origin of the excessive I/I and how it impacts its sewers.

In addition, the city's program is supported by a robust and comprehensive computer model. This model allows the city to have a very high degree of confidence that it is choosing the correct areas of the city to target its I/I removal program, and that the program will in fact work to eliminate SSOs and WIBs.

The city's approach to eliminate SSOs is also supported by the United States Environmental Protection Agency (USEPA). For example, the USEPA has recognized the benefit of disconnecting sources of stormwater in order to reduce I/I: "Disconnecting sources of stormwater to sanitary sewer systems should be a high priority for any SSO abatement program." See USEPA, SSOs, green infrastructure permitting and enforcement series, p. 3.

Other municipalities have undertaken I/I abatement steps, including lateral lining and roof redirection. See, e.g., City of McMinnville, Oregon I/I reduction program, available at http://www.ci.mcminnville.or.us/city/departments/wastewater-services-conveyance-system-sewer-lateral-faq/; St. Louis Sewer District Private I/I Reduction Program (Oct. 2012), available at http://www.stlmsd.com/sites/default/files/misc/606662.PDF (a property owner will be notified that a capital project is scheduled in their area that includes the removal of private inflow sources from their property and the work that will be performed at no cost to the homeowner; the homeowner must sign a release or may be subject to sanctions).

6.2.2 The City's Broad Authority to Operate a Municipal Sewer Utility Authorizes Regulation of Private Laterals

Article XVIII, §4 of the Ohio Constitution authorizes a municipality to own and operate a public utility, including a sewerage system. Britt v. Columbus, 38 Ohio St.2d 1 (1974). The Ohio RC also establishes this right, as well as a broad grant of authority with regard to the regulation and control of the systems. RC §729.51 provides the legislative authority of a municipal corporation with specific authority to regulate "house sewers and their connections to the sewerage system":

> *The (city) . . . may make such bylaws and regulations as are necessary for the safe, economical and efficient management and protection of the sewerage system and sewage pumping, treatment and disposal works mentioned in §729.49 of the RC, and for the construction and use of house sewers and their connections to the sewerage system. Such bylaws and regulations shall have the same effect as ordinances when not repugnant thereto, or to the constitution or laws of the state.*

In addition, although roof drains are not specifically mentioned in the statutory text, "(t)he legislative authority of a municipal corporation may provide for the repair or reconstruction of any sewer, ditch, or drain." See RC §729.46. This broad grant of authority provided to the city pursuant to Article XVIII, §4 and the statutes implies the authority to enter private property to line a sewer lateral and/or redirect a roof drain for the purpose of protecting the sewer system.

The Ohio Supreme Court has found that a public entity's duty to regulate a utility in order to protect the public health supports entry onto private property. In *Utility Serv. Partners, Inc. v. Pub. Util. Comm'n of Ohio,* et al., 124 Ohio St.3d 284 (2009), the Supreme Court upheld an order of the Public Utilities Commission of Ohio (PUCO) which made Columbia Gas of Ohio, Inc. (Columbia) responsible for repair or replacement of deteriorating natural gas service lines, notwithstanding private ownership of the lines by Columbia Gas customers. Prior to the order, homeowners were responsible for the repair of these lines. This order was challenged by Utility Service Partners (USP), a provider of gas line service warranties. USP alleged, inter alia, that PUCO lacked statutory authority to issue the order.

The court found that the order fell within PUCO's general supervisory authority over utilities under RC §4905.06, which includes the power to prescribe any rule or order that the commission finds necessary for the protection of public health. The court noted that the commission was given a very broad grant of authority to take action to protect the public health and safety and the order would improve the public health and safety.

The court rejected the argument that the order exceeded the statutory authority because it regulated property that had been previously unregulated. The court found that although the commission had not directly regulated service lines previously (they were the responsibility of the homeowner), it had jurisdiction over them (as a segment of the distribution system) and could change its regulatory approach.

The city's current program is analogous. The city has a broad grant of authority to own, maintain and protect its sewer system. The grant of authority includes the ability to issue regulations for the protection of the system. RC 729.51. Moreover, the lateral lines, like the gas service lines, are a part of the sewer system. See Code 1145.02.086 (the definition of sewer system: "All of the facilities required to transport stormwater, sanitary wastewater or combined wastewater from the source to the publicly owned treatment works (POTW) treatment plant or waters of the state.")

In Utility Service Partners, the Ohio Supreme Court did not rely on any specific statutory authority allowing the commission to order entry, by a private party, onto private property to perform repairs or replacement. Rather, it relied on PUCO's general supervisory authority with respect to utilities. The same argument is applicable to the city's general supervisory authority over its sewer system and its specific authority over service laterals outlined in RC §729.51 and general authority over "any" drains outlined in RC §729.46.

6.3 Suburban Outreach

After receiving approval from the Ohio EPA in the summer of 2012 to pursue an integrated plan approach for the Wet Weather Management Plan (WWMP), the city of Columbus held a meeting with all sewer contract service areas (CSAs). This meeting held in December of 2012, discussed the city's new approach (subsequently named Blueprint Columbus), its major components and the reasons for choosing this approach. Also at the meeting, the city of Columbus offered any assistance such as information sharing or lessons learned in developing our capacity, maintenance, operations and management (CMOM) program to help the suburbs meet their Director's Final Findings and Orders (DFFOs) for addressing SSOs and WIBs.

In 2013, an update to the Blueprint Columbus plan was presented at a central Ohio city engineer's meeting that included all city CSAs.

Throughout 2013, Columbus met individually with almost all CSA communities for our affordability analysis work. At these meetings, we explained the affordability analysis that was required as part of the Ohio EPA's conditional approval of the city's WWMP and requested the information needed from the CSAs to assist in our analysis. All meetings were very positive and information was freely shared.

Information sharing such as flow monitoring, modeling results and mapping information has been shared with various suburban communities over the past few years to assist both Columbus and the CSAs. Columbus has received copies of all available sewer system evaluation studies (SSES) reports from the suburban communities for informational purposes.

In an effort to promote dialogue between the suburban communities and the city of Columbus, the city facilitated two ad hoc sewer operations forums. The first was held in November of 2013 with the topic of sewer inspection technologies and included presentations from various vendors. The second was held in Worthington in April of 2014 with the topic of sewer cleaning combination trucks. The various types of combination trucks made by the different manufacturers and the crews that use them were brought from several of the CSAs; pros and cons of each type/manufacturer were discussed freely among the various crews from the different communities without vendors present to bias the discussion.

The city of Columbus held a meeting of the Sewer Water Advisory Board on August 19, 2015. The meeting covered costs, affordability, the Blueprint plan and the gray plan and benefits of the Blueprint approach. All of the CSA communities were invited to attend.

Finally, regarding outreach to our CSAs, the city of Columbus holds a quarterly suburban meeting where topics or questions from any community can be discussed or presented. These meetings have been held as usual throughout the development of this report.

6.4 Pilot Projects Update

As part of the negotiations with the Ohio EPA to reevaluate the WWMP the city of Columbus and the Ohio EPA agreed to defer several WWMP projects, and instead undertake several new projects that would align with the new plan direction. These new projects were called "quick hit" projects. The quick hit projects include pilot implementation areas and other initiatives that the city believes will assist in optimizing performance of the collection system.

The quick hit projects include the following:

- Blueprint Columbus pilot in Clintonville
- Public Outreach
- Repurpose vacant lots in the Barthman Parsons area
- Third Avenue green infrastructure
- Designed sanitary relief (DSR) 83 weir raise
- Real time control
- Chemically Enhanced Primary Treatment (CEPT) at Southerly Waste Water Treatment Plant (WWTP)

This section provides an update on the quick hit projects.

6.4.1 Blueprint Columbus Pilot in Clintonville

One of the most critical quick hit projects is implementation of Blueprint Columbus in a pilot location, the Clintonville neighborhood. As discussed above, Blueprint Columbus consists of four pillars or technologies that are designed to work together to reduce I/I while improving stormwater with green infrastructure. The Clintonville pilot study area will be the first full scale implementation of Blueprint Columbus if and when the Blueprint approach is approved by the Ohio EPA. This area was selected as the first Blueprint Columbus pilot implementation area by the Ohio EPA due to DSR 335, located in the Park of Roses, a popular resident destination.

The work on this pilot project has been instrumental in developing the Blueprint plan. Working on the pilot has allowed the city to identify and solve numerous practical difficulties with this new approach.

The city approached the pilot by first identifying the sewer shed for DSR 335. The sewer shed turned out to be approximately 1000 acres and included approximately 3000 homes, which is a very large pilot. In order to make the work more manageable and to get more perspectives on the work, the city broke the pilot area into six areas and hired engineering consultants for each area. To date, the city has spent $6.4 million on engineering work for the Clintonville pilot area.

One of the first steps the city took for this pilot was to create the PATC. PATC included the engineering firms from the six Clintonville engineering firms, the Barthman Parsons pilot, the Franklin Soil and Water District, and city staff. One of the first tasks PATC undertook was defining the models that would be used as part of the work. PATC also helped the city determine the appropriate sizing for the green infrastructure by determining the costs of various alternatives. As discussed above, this resulted in the "do no harm" standard plus 20% removal of TSS.

Work that has already been completed on the Clintonville pilot includes survey work including all houses and televising most residential laterals. This survey work will allow the city to move forward with two of the necessary technologies, lateral lining and roof redirection. The city also used its existing annual lining contract to finish lining all public sewers in the pilot area.

In addition to the survey work, the engineering firms have also completed the preliminary design, and have completed 75% of the detailed design plans for the pilot's green infrastructure component. The plans call for building approximately 4.4 acres of green infrastructure. This is divided between porous pavement and bioswales.

In addition to the engineering work, the city has done significant public outreach in the pilot area. The city held three public information sessions to educate residents on the four pillars. The city then held six meetings, one for each area, to focus more specifically on the location of the green infrastructure in each area.

If approval from the Ohio EPA is received in time, the city is prepared to begin construction of the pilot project in 2016. To make sure local flooding issues are not worsened, the city plans to sequence this pilot (and all future areas) to build the green infrastructure first. The final phase of the design, reduction of private source I/I, can only be implemented after construction of the green infrastructure is complete. The private I/I work includes lateral lining, roof redirection and sump pump installation. Design of the private I/I improvements can continue following the completion of the first design phase. It is anticipated that construction of these private I/I reduction components will take 3 years, and will begin following construction of the green infrastructure.

6.4.2 Public Outreach

Public outreach efforts for Blueprint Columbus are described in Section 4.

6.4.3 Repurpose Vacant Lots in Barthman Parsons Area

The Barthman Parsons area in south Columbus has a number of vacant lots. The purpose of this quick hit was to develop a project that would utilize these vacant lots as green stormwater features in order to reduce overflows. The Barthman Parsons area has both combined and separate sewers. The combined sewers are located in the northern end of the neighborhood. The separate sewers are located on the southern end.

BARTHMAN PARSONS COMBINED AREA IMPROVEMENTS

In the combined sewer area, a total of five vacant lots have been identified and acquired, and in the fall of 2015, construction will begin, creating three new stormwater green infrastructure installations. They offer a variety of rain garden plantings, and the five lots will be tracked with flow monitoring devices so that information and observations from these locations can be incorporated into future Blueprint Columbus rain garden installations. The performance of the rain gardens will be documented to examine the reduction in downstream peak flows and overall total volume of flow that contributes to the downstream combined sewer overflows (CSOs). The proposed installations will manage runoff from nine acres, for a total of approximately 3.8 million gallons (MG) of stormwater annually, at a cost of approximately \$0.22/gallon. In the combined sewer area, all of the stormwater diverted will contribute directly to a decrease in combined sewage volume.

BARTHMAN PARSONS SEPARATE AREA IMPROVEMENTS

The separate sewer area of Barthman Parsons will receive a large stormwater park, with playground equipment and a porous pavement basketball court. More than six acres will drain to this park and the stormwater will receive treatment in the park prior to release. In conjunction with the large stormwater park, a neighboring collection of three vacant parcels will be converted to green space and additional stormwater treatment will be incorporated in this space as well. These two stormwater treatment facilities will be monitored for both downstream flow and pollutant reduction. Each gallon of water treated will reduce the pollutant loading that discharges downstream into the Scioto River. Sampling will be conducted to confirm the pollutant reduction and to provide feedback on performance for future installations. The two facilities will manage runoff from 14 acres and are projected to treat approximately 6.7 MG on an annual basis, at a cost of approximately $0.30/gallon. Construction is slated to begin in September 2015.

6.4.4 Third Avenue Green Infrastructure

The Third Avenue area is in the city's combined sewer area, and is home to the Columbus neighborhood of Victorian Village. The original WWMP called for this area to receive 20 acres of inflow redirection (the creation of a new stormwater infrastructure to reduce combined sewer overflows). This project was changed to now include green infrastructure as a substitute for the inflow redirection. This project pilots the implementation of green infrastructure in an urban area and will reduce combined sewer overflows by reducing and retaining stormwater in the area. The Third Avenue green infrastructure construction project will go to bid in 2015.

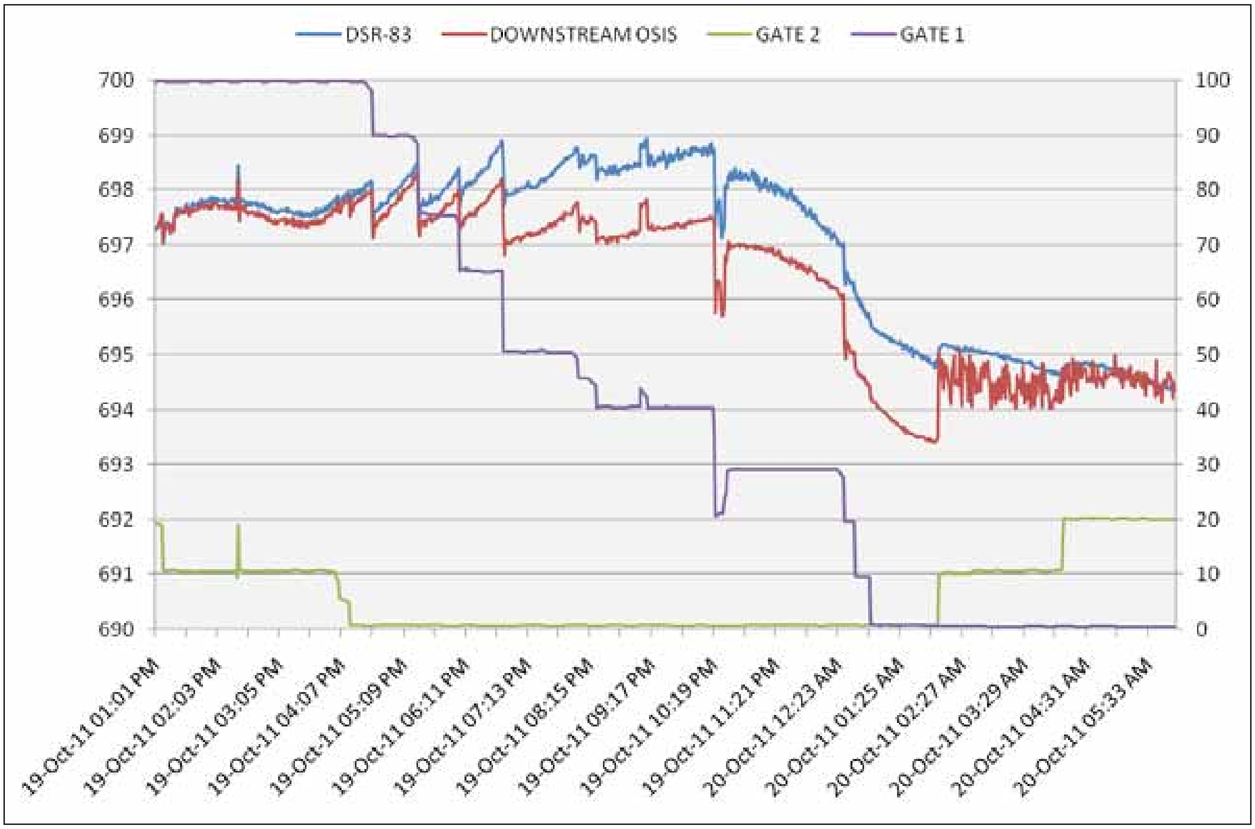
6.4.5 DSR 83 Weir Raise

DSR 83 is the city's largest sanitary sewer overflow location. The level of flow at DSR 83 is regulated by the Whittier Street Storm Tanks (WSSTs), where two regulator gates prevent it from activating. The DSR 83 overflow weir crest was at 699 feet, limiting the amount of flow conveyed to Jackson Pike Wastewater Treatment Plant (JPWWTP). Efforts have been made to test the effectiveness of raising the DSR 83 weir to higher elevations and were supported by the city's model. The modeling included raising DSR 83 weir elevation to 705 feet and operating it at 704 feet using control rules that mimic operation. Field-testing validated the modeled results, which predicted surcharged conditions in the Olentangy Scioto Interceptor Sewer (OSIS) all the way from the JPWWTP upstream to DSR 83 as well as flooding from some manholes along the stretch of sewer. Both efforts led to raising the DSR 83 weir crest from 699 feet to 705 feet, bolting flooded manholes along the OSIS and changes in operations. Currently, DSR 83 is being regulated by the WSSTs' regulator gates at an elevation of 702 feet. The operation will be updated to 704 feet once additional manhole repairs are completed. Because of this improvement, the JPWWTP receives additional volumes of combined sewage resulting in reduced combined and sanitary sewer overflows upstream and increased biological treatment.

6.4.6 Real Time Control

To convey more flow from the city's largest CSO downstream to the treatment plants, careful management of the sewer levels has to be kept. This means there must be careful management of the regulator gates at the WSSTs. Historically, the operation of the regulator gates was done manually by plant staff. Typical manual operations would involve closing the gates to decrease downstream sewer levels in steps. Manual operation would result in over correction, restricting the flow down the sewer unnecessarily. Automatic controls were implemented on the regulator gates to allow for much more frequent control adjustment and to maximize conveyance to treatment. Exhibit 6.4.1 shows historical data from the regulator gates in a manually controlled wet weather event. The operators manually controlled regulator gate 1 to maintain flow below the DSR 83 weir elevation of 699 feet.

EXHIBIT 6.4.1 » REGULATOR GATE MANUAL CONTROL



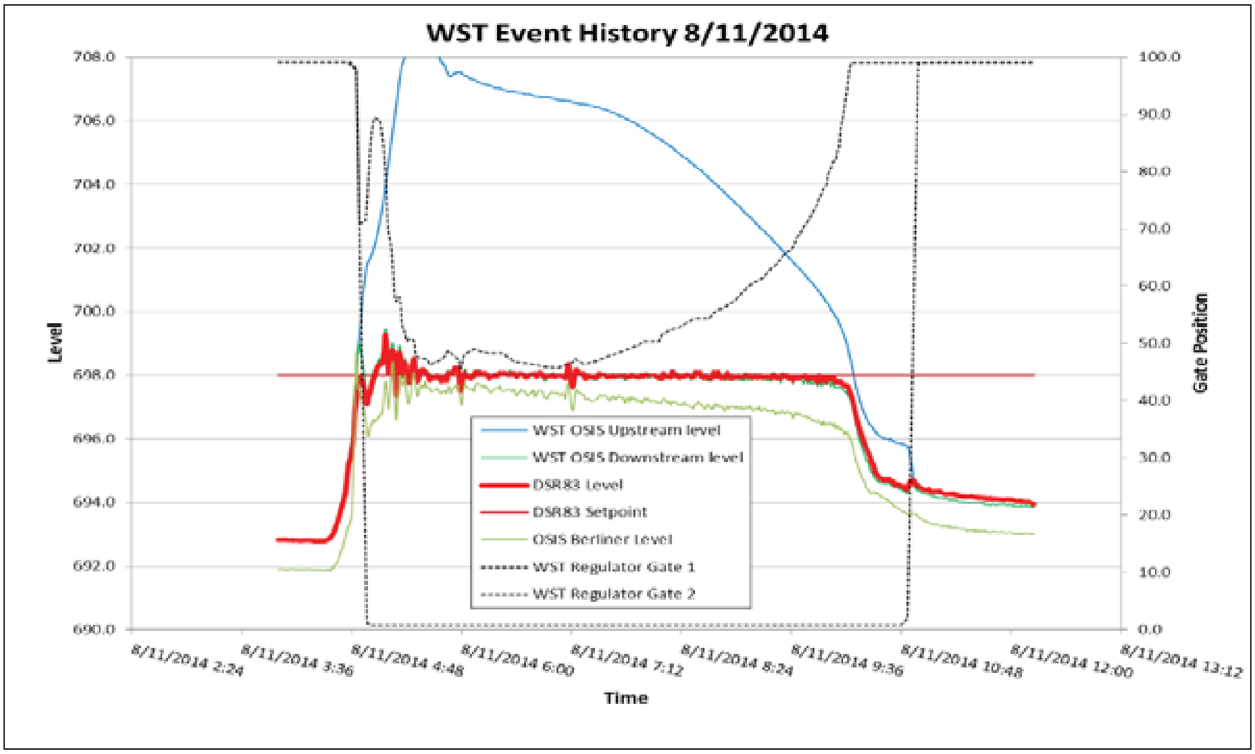
Note the large manual corrections to DSR 83 level through regulator gate movements.

More recently, automatic logic has been implemented at the regulator gates and new actuators have been installed to increase reliability and functionality.

Exhibit 6.4.2 shows a wet weather event in automatic control holding an elevation of 698 feet.

In addition, level monitoring was added to the collection system to aid with understanding the sewer operations downstream of the WSSTs in Berliner Park and in the DSR 83 weir chamber. Even though the WSST control house is close to DSR 83, the sewer level between the control house and DSR 83 has been noted to deviate about 1 foot. Knowing the level right at DSR 83 allows for tighter control of the level against this constraint.

EXHIBIT 6.4.2 » REGULATOR GATE AUTOMATIC CONTROL



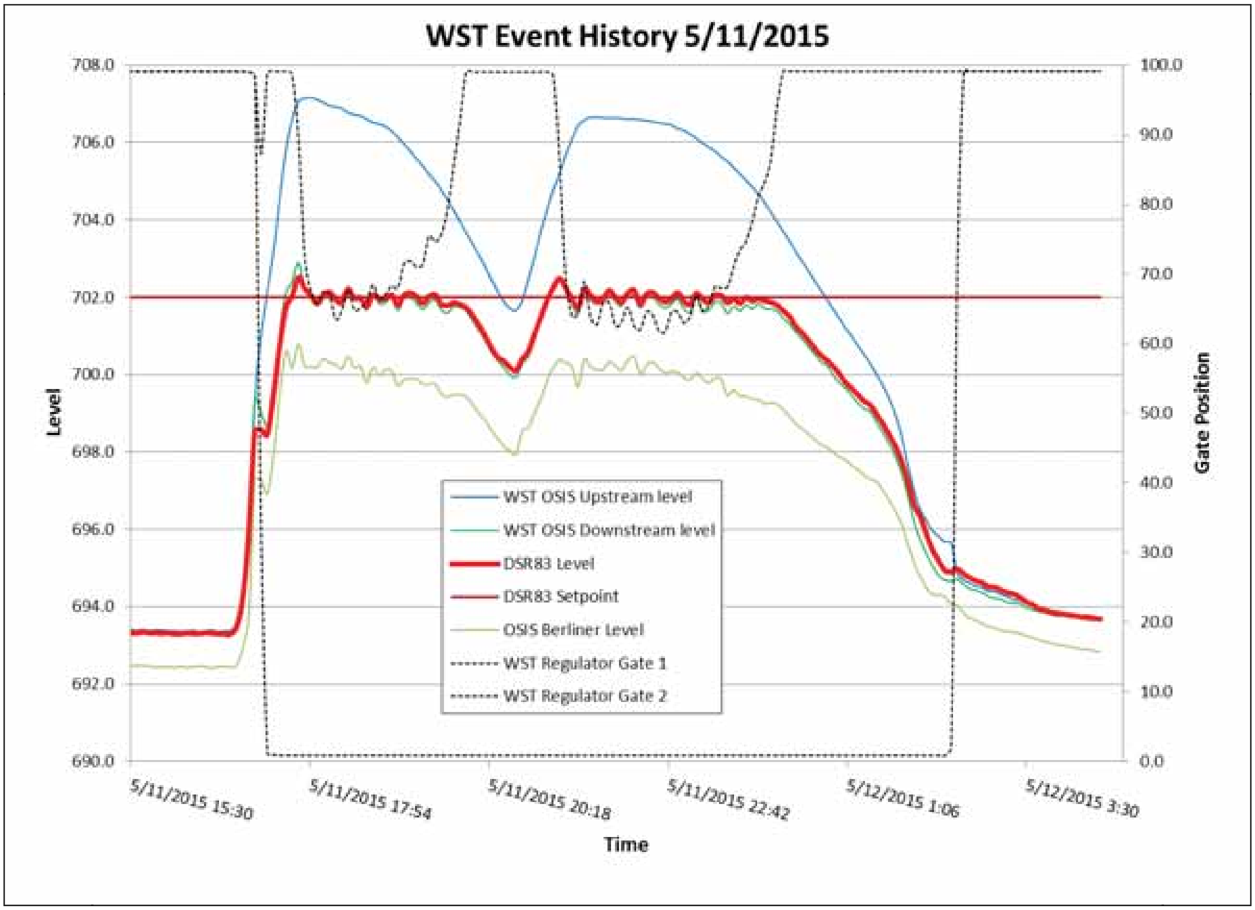
Note the small continual automatic corrections to DSR 83 level through regulator gate movements to maintain the DSR 83 698-foot set point.

Improvements were implemented to increase the conveyance from Whittier Street to Jackson Pike by raising the sewer elevation, or hydraulic grade line (HGL), allowed during wet weather events. Four key elements had to be addressed:

1. Low sewer service connections along Greenlawn Avenue were protected with a new lift station on the Greenlawn Avenue sewer, which is a tributary to the OSIS. The new lift station only pumps during wet weather.
2. DSR 83 weir was raised from 699 feet to 705 feet. WIB analysis was performed on the Franklin Main and Deshler Tunnel, which are serviced by DSR 83 to establish maximum safe weir elevation.
3. OSIS manholes through Berliner Park were structurally improved to handle surcharge conditions. Many manholes are below the 705-foot elevation of DSR 83.
4. The regulator gate actuators were reconfigured to travel the full 6-foot opening.

Exhibit 6.4.3 shows a recent wet weather event with regulator gate automatic controls holding the 702 operating set point target. This event shows how the gates respond to back-to-back storms. Notice how the regulator gate goes full open to maximize flow to the treatment plant in between the rain events.

EXHIBIT 6.4.3 » REGULATOR GATE AUTOMATIC CONTROL IN A RECENT EVENT



Note the DSR 83 target is now 702 resulting in increased OSIS conveyance.

The automatic controls and real time control effort has yielded additional flow at the wastewater treatment plants, and reduced overflows by more fully utilizing the existing capacity present in the sewer system.

6.4.7 Chemically Enhanced Primary Treatment at Southerly Wastewater Treatment Plant

In negotiations with the Ohio EPA, it was agreed that the first phase of the Alum Creek Relief Tunnel (ART) would be deferred while the integrated planning concept was investigated. In place of ART, the city accelerated construction of a high rate treatment technology. The city analyzed the information and elected to construct CEPT technology to treat 110 MGD at the Southerly Wastewater Treatment Plant (SWWTP). These flows would normally be bypassed, however, the CEPT technology will provide preliminary treatment, primary clarification and disinfection before mixing with the final effluent prior to discharge to the Scioto River. The project schedule stipulates initial design in April 2014 and construction start by May of 2017. CEPT will be operational on or before December 16, 2019. The CEPT will reduce TSS to meet 30 mg/L averaged across seven activations.

The city started design of the project on time, and final detailed design memorandums are expected in late summer/early fall of 2015. The CEPT is currently on schedule.

6.5 Blueprint Alternative

Previous I/I studies demonstrated that there are a number of different types of sources contributing to the I/I inflows. The major sources for I/I are direct downspout connections, downspouts discharging to splash blocks, foundation drains, defective house laterals and defective main sewers. The proposed Blueprint alternative is to direct storm runoff away from the potential input points and to line the lateral connections and sewer mains.

Directing the stormwater away from the sanitary sewer system will be achieved by disconnecting the downspouts that are directly connected to the sanitary lateral, redirecting downspouts where roof drainage splashes around houses without sump pumps and installing sump pumps in basements when applicable. In addition, lining laterals and main sewers to mitigate potential defects will be completed. Exhibit 6.5.1 shows the proposed mitigation technologies (Blueprint technology) with respect to dealing with different sources of the I/I and the city's expected, and modeled, effectiveness and participation rates.

EXHIBIT 6.5.1 » BLUEPRINT TECHNOLOGY EFFECTIVENESS AND PARTICIPATION RATES ASSUMPTIONS

I/I Source (initial I/I source)	Mitigation Technology	Technology Effectiveness	Participation
Roof Drainage on the Buffer Area Around the House*	Route roof water to street via 'storm lateral' or at least 7 feet from the house	50%	50%
Lateral Service Connection	Lining lateral pipes from main to 6 x 4	90%	90%
Mainline Sewers under Pervious Surface	Lining mainline sewers and manholes	90%	100%
Co-located Mainline and Storm Pipe Trenches	Lining mainline sanitary sewers and manholes	90%	100%
Buffer Area Around Buildings	Sump pumps	90%	25%

*Downspouts that are directly connected to the sanitary lateral will be disconnected as they are illegal. Instead, they will be connected to the street or splash blocks.

I/I reduction applied only to separate areas within city of Columbus. No I/I reduction assumed in the contract service areas.

6.5.1 System-wide Large Scale Solutions Blueprint Alternative

System-wide deficiencies require large scale solutions. These solutions solve hydraulic deficiencies in the main trunk sewers and provide free outfall for the local areas. The system-wide large scale solutions (LSS) included in the Blueprint alternative are listed in Table 6.5.1 and are described in the following subsections.

6.5.1.1 Lower Olentangy Tunnel Phase 2

As discussed in Section 5, Lower Olentangy Tunnel Phase 1 (LOT1) will be operational by July 1, 2025 and is considered part of the base system. Phase 2 of the Lower Olentangy Tunnel (LOT2) (Figure 6.5.1) for the Blueprint alternative is a 9-foot diameter tunnel that starts at the upstream termination point of LOT1 and ends at Dodridge Street. The Blueprint alternative LOT2 is shorter in length compared to the LOT2 required in the gray alternative. The proposed alignment is along Olentangy River Road with a total length of 14,500 ft. LOT2 provides hydraulic relief to the collection system at three points:

- Franklin Main Interceptor Sewer (FMI) at manhole 0086S0385 (north of Dodridge Street, east of the Olentangy River)
- Olentangy Main Interceptor Sewer (OMI) at manhole 0127S0003 (north of Dodridge Street, west of the Olentangy River)
- OSIS at manhole 0086C0384 (north of Dodridge Street, east of the Olentangy River)

LOT2 provides the following benefits:

- Reduces the peak HGL along the Clinton #3 trunk sewer, FMI and OMI Sewer during large events.
- Assists with the attainment of the 10-year LOS for DSR 284, a mainline DSR on the FMI.
- Assists with the attainment of the 10-year LOS for DSR 898, a Walhalla area DSR.
- Allows for the closure of DSR 328, a Walhalla area DSR.

6.5.1.2 SWWTP Second Interconnector Barrel

The interconnecting trunk sewer interconnector routes flow above the treatment capacity of JPWWTP to SWWTP. The existing INT consists of a 13-foot diameter sewer for most of its length. However, the INT is connected to SWWTP through an 8.5-foot sewer. To alleviate this bottleneck, a parallel 8.5-foot diameter sewer parallel was added, with a total length of 2,175 feet. See Figure 6.5.2. This project is the same in both the Blueprint and gray plans.

The second interconnector barrel provides the following benefits:

- Reduces the peak HGL along the INT and the upstream tributary sewers during large events.
- Assists with the attainment of the 10-year level of service for DSR 95, a mainline DSR on the west side sanitary sewer.

6.5.1.3 DSR 873 Relief

DSR 873 is a mainline DSR located on the Clinton #3 trunk sewer. See Figure 6.5.3. In order to be able to attain the desired 10-year LOS at this DSR, a 70-feet long 2-feet diameter relief pipe was added from manhole 0232S0083 (DSR 873) on the Clinton #3 trunk sewer to manhole 0232S0340 on the OMI Sewer. This project is the same in both the Blueprint and gray plans.

6.5.2 Blueprint Area Solutions

As discussed in Section 5.2.4, the city has identified ten areas that contain DSRs or significant WIBs.These ten areas, referred to as the Blueprint areas, are the main focus of the Blueprint plan. Each area will have the four pillars of Blueprint applied. In addition, if the model indicates that Blueprint alone is insufficient to meet the LOS, gray solutions were added. The details of each area are discussed below.

6.5.2.1 Clintonville Blueprint Alternative

The common denominator for the Blueprint alternative in local areas is the application of mitigation technology to reduce I/I (see Exhibit 6.5.1). Moreover, the System-wide Blueprint alternative includes the construction of a 9-foot diameter tunnel (LOT2) that relieves both the FMI and OSIS in proximity of Dodridge Street. These two main trunks are both recipients of Clintonville sanitary flow.

In the base conditions, 11 out of 14 DSRs would not meet the 10-year LOS in the Clintonville basin. Exhibit 6.5.2 below shows the reduction in model-predicted WIBs in the Clintonville Blueprint area in comparison to the base conditions.

EXHIBIT 6.5.2 » CLINTONVILLE DSRs AND WIBs BASE VERSUS BLUEPRINT

DSR ID >		326	323	335	352	346	351	360	337	349	368	285	328	898	329	WIB
Base Model Simulation	Number of Activations in 20 Years	127	26	75	26	68	16	16	-	7	-	-	59	19	22	1547
	Level of Service (LOS)	0.2	0.8	0.3	0.8	0.3	1.3	1.3	-	3.0	-	-	0.3	1.1	0.9	
Blueprint Alternative Model Simulation	Number of Activations in 20 Years	-	-	-	1	-	-	-	-	-	-	-	1	1		2
	Level of Service (LOS)	-	-	-	-	33.2	-	-	-	-	-	-	33.2	33.2		

The Clintonville Blueprint alternative includes additional projects aimed to address DSRs and WIBs that would not meet the 10-year LOS after applying I/I reduction and after the relief of wet weather flow into LOT2. The insufficient capacity of Clintonville Main Interceptor Sewer (CVM) causes overflows at most of the DSRs in Clintonville basin. To mitigate these DSRs in Blueprint alternative, a new relief pipe is proposed to intercept CVM flow at the DSR 335 location. The flow is redirected along Milton Avenue (north-south) and Brighton Avenue (east-west); then it is relieved into the OSIS.

An additional solution is required for DSR 346 activations to meet the 10-year LOS. Blueprint alternative includes the closure of the 10-inch relief pipe from Worthington at Broad Meadows Boulevard and divert the flow to the OMI sewer. In addition, a higher sump pump participation of 50% for the area upstream of DSR 346 is assumed. The alternative solution to mitigate all DSRs in the Clintonville Blueprint area also includes the closure of DSR 328 at the intersection of North High Street and California Avenue.

Table 6.5.3 reports all the projects for Clintonville Blueprint alternative and their location is shown in Figure 6.5.4. The project IDs link the projects shown in the table to those shown in the figure.

6.5.2.2 Hilltop Blueprint Alternative

Along with I/I reduction, the Hilltop Blueprint alternative includes two additional projects to solve the deficiency in the sanitary system identified during the analysis of the base conditions. In the base conditions three out of four DSRs would not meet the 10-year LOS (Exhibit 6.5.3). As shown in Exhibit 6.5.3, the Blueprint alternative improves the LOS for the DSRs to more than ten years. Exhibit 6.5.4 below shows the reduction in model-predicted WIBs in the Hilltop Blueprint area in comparison to the base conditions.

EXHIBIT 6.5.3 » HILLTOP AREA DSRs BASE VERSUS BLUEPRINT MODEL CONDITIONS

DSR ID >		250	254	252	256
Base Model Simulation	Number of Activations in 20 Years	29	18	1	6
	Level of Service (LOS)	0.7	1.1.	33.2	3.6
Blueprint Alternative Model Simulation	Number of Activations in 20 Years	-	1	-	-
	Level of Service (LOS)	-	33.2	-	-

EXHIBIT 6.5.4 » MODEL PREDICTED WIBs IN HILLTOP BLUEPRINT AREA

	Base Model	Blueprint Alternative
Model Predicted WIBs in a 20-Year Simulation	1819	1

To address DSR 250 activation, a flow reconfiguration is proposed. The flow is intercepted at the intersection between Kingsford Road and Sullivant Avenue and entirely redirected south to the Big Run sanitary trunk rather than to the east. Part of the intercepted flow is the sanitary flow from the Franklin County area on the west side of the basin.

Blueprint solutions for the Hilltop include upsizing of the sanitary sewer from Westwood Drive to the Scioto main trunk sewer to address WIBs for houses located in the northeast corner of the Blueprint basin in proximity of the Valleyview CSA. In this area, some houses within Columbus are actually served by the sanitary system of Valleyview that ultimately relieves the flow into the Hilltop sanitary network.

The projects included in the Hilltop Blueprint alternative are summarized in detail in Table 6.5.4, and Figure 6.5.5 shows their location. The project IDs link the projects shown in the table to those shown in the figure.

6.5.2.3 Linden Blueprint Alternative

The Linden Blueprint alternative includes the application of mitigation technologies to reduce I/I (Exhibit 6.5.1) as the solution for the deficiency in the sanitary system that emerged during the analysis of the base conditions. In the base conditions four out of eight DSRs would not meet the 10-year LOS (Exhibit 6.5.5). As shown in Exhibit 6.5.5, Blueprint alternative improves the LOS for the DSRs to ten years or more. Exhibit 6.5.6 below shows the reduction in model-predicted WIBs in the Linden Blueprint area in comparison to the base conditions.

EXHIBIT 6.5.5 » LINDEN AREA DSRs BASE VERSUS BLUEPRINT MODEL CONDITIONS

	DSR ID >	314	307	305	306	312	315	339	952
Base Model Simulation	Number of Activations in 20 Years	-	-	39	7	-	17	9	-
	Level of Service (LOS)	-	-	0.5	3.0	-	1.2	2.3	-
Blueprint Alternative Model Simulation	Number of Activations in 20 Years	-	-	2	-	-	-	2	-
	Level of Service (LOS)	-	-	12.5	-	-	-	12.5	-

EXHIBIT 6.5.6 » MODEL PREDICTED WIBs IN LINDEN BLUEPRINT AREA

	Base Model	Blueprint Alternative
Model Predicted WIBs in a 20-Year Simulation	1260	2

The reduced I/I contribution is sufficient to mitigate DSRs activations and WIBs within the Linden basin. Moreover, three out of four weirs regulating the flow relieved into the Alum Creek trunk sewer on the east boundary of the basin are removed. For the smaller area on the southwest side of the main basin, upsizing projects are planned along with I/I reduction to address WIBs identified in base conditions. The Linden Blueprint alternative projects are listed in Table 6.5.5 and shown in Figure 6.5.6. The project IDs link the projects shown in the table to those shown in the figure.

6.5.2.4 Miller Kelton Blueprint Alternative

The Miller Kelton Blueprint alternative includes projects along with I/I reduction to mitigate DSRs overflows and WIBs identified during the analysis of the base conditions. In the base conditions five out of nine DSRs would not meet the 10-year LOS (Exhibit 6.5.7). As shown in Exhibit 6.5.7, Blueprint alternative improves the LOS for the DSRs to ten years or more. Exhibit 6.5.8 below shows the reduction in model-predicted WIBs in the Miller Kelton Blueprint area in comparison to the base conditions.

EXHIBIT 6.5.7 » MILLER KELTON AREA DSRs BASE VERSUS BLUEPRINT MODEL CONDITIONS

DSR ID >		181	189	179	188	190	185	199	193
Base Model Simulation	Number of Activations in 20 Years	3	8	5	-	-	6	-	-
	Level of Service (LOS)	7.7	2.6	4.3	-	-	3.6	-	-
Blueprint Alternative Model Simulation	Number of Activations in 20 Years	1	2	-	-	-	-	-	-
	Level of Service (LOS)	33.2	12.5	-	-	-	-	-	-

EXHIBIT 6.5.8 » MODEL PREDICTED WIBs IN MILLER KELTON BLUEPRINT AREA

	Base Model	Blueprint Alternative
Model Predicted WIBs in a 20-Year Simulation	59	0

DSR 177, the first DSR along Cole Street from West to East, is closed and the stormwater contribution derived from three identified areas of public source inflow is redirected to the storm system.

Exhibit 6.5.9 includes a summary of the projects for the Miller Kelton Blueprint alternative and Figure 6.5.7 shows their location. The project IDs link the projects shown in the table to those shown in the figure.

EXHIBIT 6.5.9 » MILLER KELTON BLUEPRINT ALTERNATIVE PROJECTS

DSR/WIBs	Project ID	Type	Description	New Diameter [ft]	Length [ft]
DSRs 177, 181, 189, 179, 185	N/A	I/I Reduction	Application of mitigation technology to reduce I/I Inflows	N/A	N/A
DSR 177	2	Bulkhead	Closed DSR 177 at 0034T0265	N/A	N/A
WIBs	N/A	I/I Reduction	Application of mitigation technology to reduce I/I Inflows	N/A	N/A
AdditioN/Al Improvements	1	Flow Redirection	Redirect stormwater from four identified areas of public source inflow	N/A	N/A

6.5.2.5 Plum Ridge Blueprint Alternative

The Plum Ridge Blueprint alternative includes the Blueprint technology shown in Exhibit 6.5.10, as well as a list of projects applied to the Plum Ridge Blueprint area. In the base conditions DSR 364 would not meet the 10-year LOS in the Plum Ridge basin (Exhibit 6.5.10). As shown in Exhibit 6.5.10, the Blueprint alternative improves the LOS for the DSRs to more than ten years with no activations over 20 years. Exhibit 6.5.11 below shows the reduction in model-predicted WIBs in the Plum Ridge Blueprint area in comparison to the base conditions.

EXHIBIT 6.5.10 » PLUM RIDGE AREA DSRs BASE VERSUS BLUEPRINT MODEL CONDITIONS

DSR ID >		364
Base Model Simulation	Number of Activations in 20 Years	49
	Level of Service (LOS)	0.4
Blueprint Alternative Model Simulation	Number of Activations in 20 Years	-
	Level of Service (LOS)	-

EXHIBIT 6.5.11 » MODEL PREDICTED WIBs IN PLUM RIDGE BLUEPRINT AREA

	Base Model	Blueprint Alternative
Model Predicted WIBs in a 20-Year Simulation	152	0

Exhibit 6.5.12 shows all the projects associated with the Blueprint alternative solutions for the Plum Ridge Blueprint area including pipe cleaning to reduce the roughness of the pipes and removing the known driveway drain stormwater inflow. The location of each project is shown in Figure 6.5.8 with the corresponding project IDs indicated in Exhibit 6.5.12.

EXHIBIT 6.5.12 » PLUM RIDGE BLUEPRINT ALTERNATIVE PROJECTS

DSR/ WIBs	Project ID	Type	Description	New Diameter [ft]	Length [ft]
DSR/WIBs	N/A	I/I Reduction	Application of mitigation technology to reduce I/I Inflows	N/A	N/A
DSR 364 WIBs	1	Line/Clean	Lined additioN/Al pipes from 0391S0137 to 0391S0195 (Roughness reduced from 0.022 to 0.017)	N/A	1,223
	2	Flow Redirection	Remove known driveway drain stormwater inflow	N/A	N/A
	3	N/A	Address hydraulic issues associated with 90 degree bends between 0391S0137 and 0391S0195 as needed	N/A	2,415

6.5.2.6 Near South Blueprint Alternative

The Near South Blueprint alternative consists of I/I reduction applied in the Blueprint area along with few additional projects. The alternative aims to reduce activations of DSRs and occurrences of WIBs to meet the 10-year LOS. In the base conditions six out of nine DSRs would not meet the 10-year LOS (Exhibit 6.5.13). As shown in Exhibit 6.5.13, the Blueprint alternative improves the LOS for the DSRs to more than ten years with no activations over 20 years. Exhibit 6.5.14 below shows the reduction in model-predicted WIBs in the Near South Blueprint area in comparison to the base conditions.

EXHIBIT 6.5.13 » NEAR SOUTH AREA DSRs BASE VERSUS BLUEPRINT MODEL CONDITIONS

DSR ID		201	203	205	206	207	208	210	211	213
Base Model Simulation	Number of Activations in 20 Years	92	17	17	10	-	-	43	17	-
	Level of Service (LOS)	0.22	1.20	1.20	2.08	-	-	0.47	1.20	-
Blueprint Alternative Model Simulation	Number of Activations in 20 Years	-	-	-	-	-	-	-	-	-
	Level of Service (LOS)	-	-	-	-	-	-	-	-	-

EXHIBIT 6.5.14 » MODEL PREDICTED WIBs IN NEAR SOUTH BLUEPRINT AREA

	Base Model	Blueprint Alternative
Model Predicted WIBs in a 20-Year Simulation	392	0

A relief into the OARS tunnel is planned along the South Side Interceptor Sewer in proximity of the intersection of Moler and Front Streets. The wet weather flow is relieved into the existing relief sewer that conveys the flow from the Moler regulator into the tunnel.

Upsizing the sewer along Champion Avenue addresses DSRs 201 and 203 overflows and upsizing along Innis Avenue mitigates DSR 210. Remaining WIBs in the northeast side of the basin are solved by upsizing the sewer along Smith Road.

Blueprint projects for the Near South basin are listed in Table 6.5.6 and their location is shown in Figure 6.5.9. The project IDs link the projects shown in the table to those shown in the figure.

6.5.2.7 James Livingston Blueprint Alternative

In the James Livingston Blueprint Alternative the application of I/I reduction techniques across the basin mitigates the WIBs identified in base conditions. Exhibit 6.5.15 below shows the reduction in model-predicted WIBs in the James Livingston Blueprint area in comparison to the base conditions. Exhibit 6.5.16 indicates that after Blueprint is implemented in the area no additional projects are planned for the basin. There are no DSRs in the James Livingston Blueprint area.

EXHIBIT 6.5.15 » MODEL PREDICTED WIBs IN JAMES LIVINGSTON BLUEPRINT AREA

	Base Model	Blueprint Alternative
Model Predicted WIBs in a 20-Year Simulation	1849	0

EXHIBIT 6.5.16 » JAMES LIVINGSTON BLUEPRINT ALTERNATIVE PROJECTS

DSR/ WIBs	Project ID	Type	Description	New Diameter [ft]	Length [ft]
WIBs	NA	I/I Reduction	Application of mitigation technology to reduce I/I Inflows	N/A	N/A

6.5.2.8 Fifth by Northwest Blueprint Alternative

The Fifth by Northwest Blueprint alternative solutions include the Blueprint technology shown in Exhibit 6.5.1, as well as a list of projects that was applied to the Fifth by Northwest Blueprint area. In the base conditions ten out of fifteen DSRs would not meet the 10-year LOS (Table 6.5.7). As shown in Table 6.5.7, Blueprint alternative improves the LOS for the DSRs to ten years or more. Exhibit 6.5.17 below shows the reduction in model-predicted WIBs in the Fifth by Northwest Blueprint area in comparison to the base conditions.

EXHIBIT 6.5.17 » MODEL PREDICTED WIBs IN FIFTH BY NORTHWEST BLUEPRINT AREA

	Base Model	Blueprint Alternative
Model Predicted WIBs in a 20-Year Simulation	103	1

Table 6.5.8 shows all the projects associated with the Blueprint alternative solutions for the Fifth by Northwest Blueprint area with detailed information associated with the project type, description, length, the original pipe size (for upsized pipes) and the new proposed pipe size. The Blueprint Alternative solutions for Fifth by Northwest primarily include raising weirs, closing DSRs, reconfiguring flow splits, upsizing existing sewer pipes and adding new relief sewers at a few different locations. The location of each project is shown in Figure 6.5.10 with the corresponding project ID indicated in Table 6.5.8.

6.5.2.9 West Franklinton Blueprint Alternative

The West Franklinton Blueprint alternative solutions include the Blueprint technology shown in Exhibit 6.5.1, as well as upsizing four pipes within the West Franklinton Blueprint area. There are no local DSRs in the West Franklinton Blueprint area. Exhibit 6.5.18 below shows the reduction in model-predicted WIBs in the West Franklinton Blueprint area in comparison to the base conditions.

EXHIBIT 6.5.18 » MODEL PREDICTED WIBs IN WEST FRANKLINTON BLUEPRINT AREA

	Base Model	Blueprint Alternative
Model Predicted WIBs in a 20-Year Simulation	1292	15

Exhibit 6.5.19 shows all the projects associated with the Blueprint alternative solutions for the West Franklinton Blueprint area with detailed information associated with the project type, description, length, the original pipe size (for upsized pipes) and the new proposed pipe size. The location of each project is shown in Figure 6.5.11 with the corresponding project ID indicated in Exhibit 6.5.19.

EXHIBIT 6.5.19 » WEST FRANKLINTON BLUEPRINT ALTERNATIVE PROJECTS

DSR/ WIBs	Project ID	Type	Description	New Diameter [ft]	Length [ft]
WIBs	1	Upsize Existing Pipes	Upsized pipes from 0022S0393 to 0007S0197	1	750

6.5.2.10 Near East Blueprint Alternative

There are no DSRs located in the Near East Blueprint area. Exhibit 6.5.20 below shows the reduction in model-predicted WIBs in the Near East Blueprint area in comparison to the base conditions after Blueprint is installed as indicated in Exhibit 6.5.1. Exhibit 6.5.21 below shows the required project for the Near East Blueprint area. The Blueprint Alternative solutions utilized for the Near East are only the Blueprint technology.

EXHIBIT 6.5.20 » MODEL PREDICTED WIBs IN NEAR EAST BLUEPRINT AREA

	Base Model	Blueprint Alternative
Model Predicted WIBs in a 20-Year Simulation	473	3

EXHIBIT 6.5.21 » NEAR EAST BLUEPRINT ALTERNATIVE PROJECTS

DSR/ WIBs	Project ID	Type	Description	New Diameter [ft]	Length [ft]
WIBs	NA	I/I Reduction	Application of mitigation technology to reduce I/I Inflows	N/A	N/A

6.5.3 Alternative System-wide Model Summary

The overflow statistics for 20-Year (1995–2014) and typical year from the system-wide model for Blueprint Alternatives are shown in Table 6.5.9 and Table 6.5.10 respectively. As discussed in Section 5, the base model CSO LOS is achieved for all CSOs in 2025, which is the required compliance date provided in the CSO consent order. The LOS is also achieved in the 20-Year results for all SSOs and bypasses.

The system-wide Blueprint alternative WIBs are shown in Figure 6.5.12 and the system-wide flooding manholes are shown in Figure 6.5.13. The model indicates that most of the city's WIBs are meeting a 10-year level of service. However, there are isolated WIBs across the city, and those WIBs will be addressed through Project Dry Basement or with local pump stations. There are also numerous potential WIBs indicated in the combined sewer area. The collection system model is undergoing additional refinement in the combined sewer area to determine if these WIBs are real or a model inaccuracy. In order to address these potential WIBs in the CSO area, $13,000 per acre has been budgeted and included in the affordability analysis, but not included in the Blueprint alternative cost.

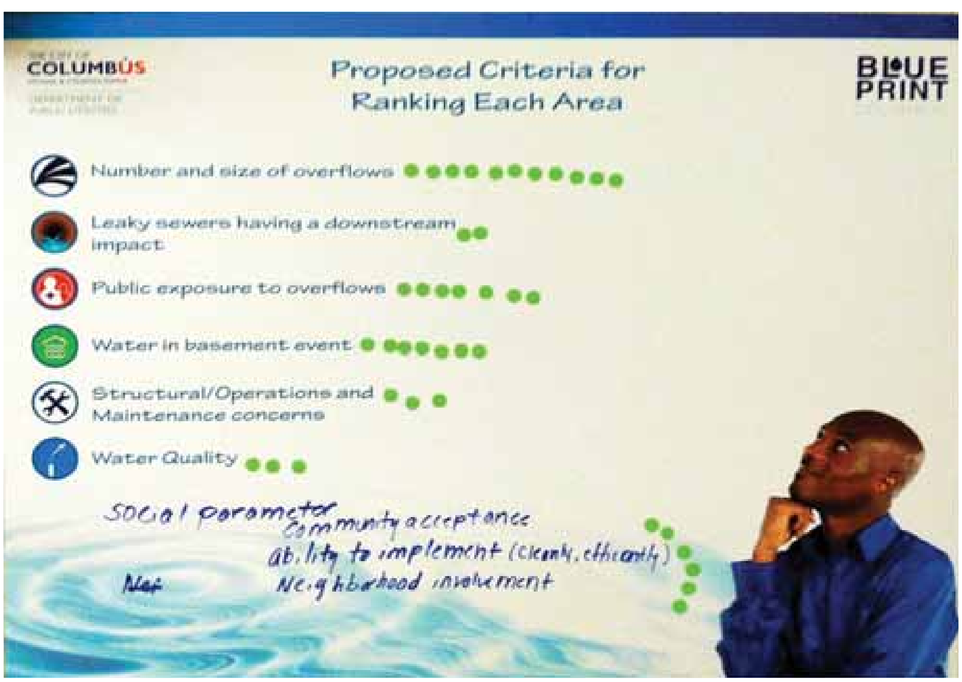
The Blueprint alternative requires a number of manholes to be bolted down. The cost to bolt down these manholes is included in the Blueprint alternative cost and is included in the affordability analysis.

6.6 Prioritization

6.6.1 Introduction

Once the projects required to meet the desired LOS were identified with the collection system model, the order of implementation of the projects was considered. In October 2013 the Community Advisory Panel (CAP) voted on a list of criteria that could be used for ranking areas. The results of the voting are shown in Exhibit 6.6.1.

EXHIBIT 6.6.1 » COMMUNITY ADVISORY PANEL CRITERIA RANKING



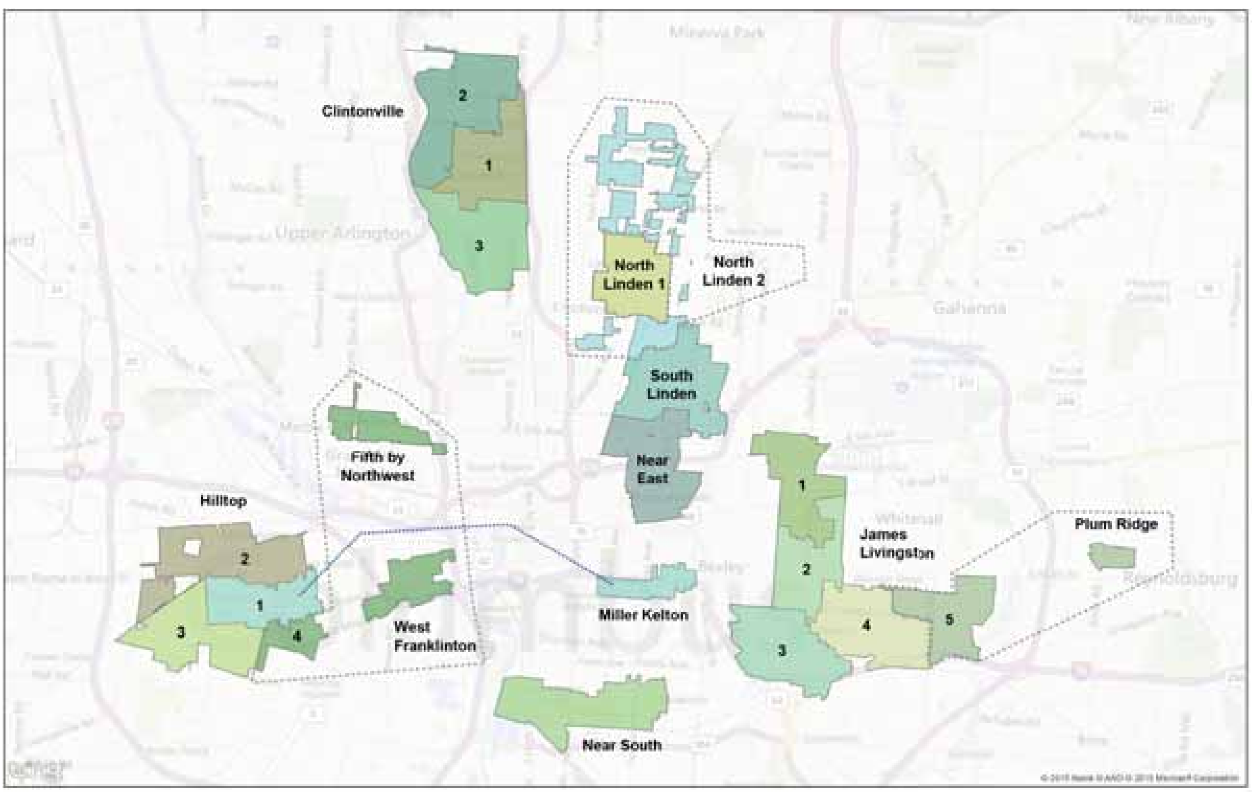
The criteria were then translated into quantifiable metrics. After considerable deliberation, the city decided to eliminate two criteria: “Leaky Sewers Having a Downstream Impact” and “Water Quality.” The “Leaky Sewers Having a Downstream Impact" criterion would require complex analysis. Since it had the smallest amount of weight assigned to it, ignoring it would have a minimal impact on the final results. It would require significant investment for very little return. The “Water Quality” criterion also received few votes, and would be difficult to objectively score due to its similarity throughout the project areas. Additionally, upon investigation there were no significant differences in water quality impacts from the various project areas, so it was determined not to be a useful ranking parameter.

The city reviewed the weights assigned by CAP and determined they were in agreement with their preferences. Table 6.6.1 at the end shows the final scoring criteria.

The criteria are color-coded on a green-to-red scale, with green assigned to low scores and red assigned to high scores. That is, the higher the score, the worse the area’s condition. Each category is explained in detail in the following sections.

The scoring criteria described in Table 6.6.1 were applied to the Blueprint areas, broken into 1,000-acre project areas shown in Exhibit 6.6.2. Project areas were defined based on sewer shed boundaries and previously identified project areas (e.g. North Linden 1). Where possible, areas that were geographically close and with similar scores were combined to create a single 1,000-acre Blueprint project area.

EXHIBIT 6.6.2 » 1000-ACRE BLUEPRINT PROJECT AREAS



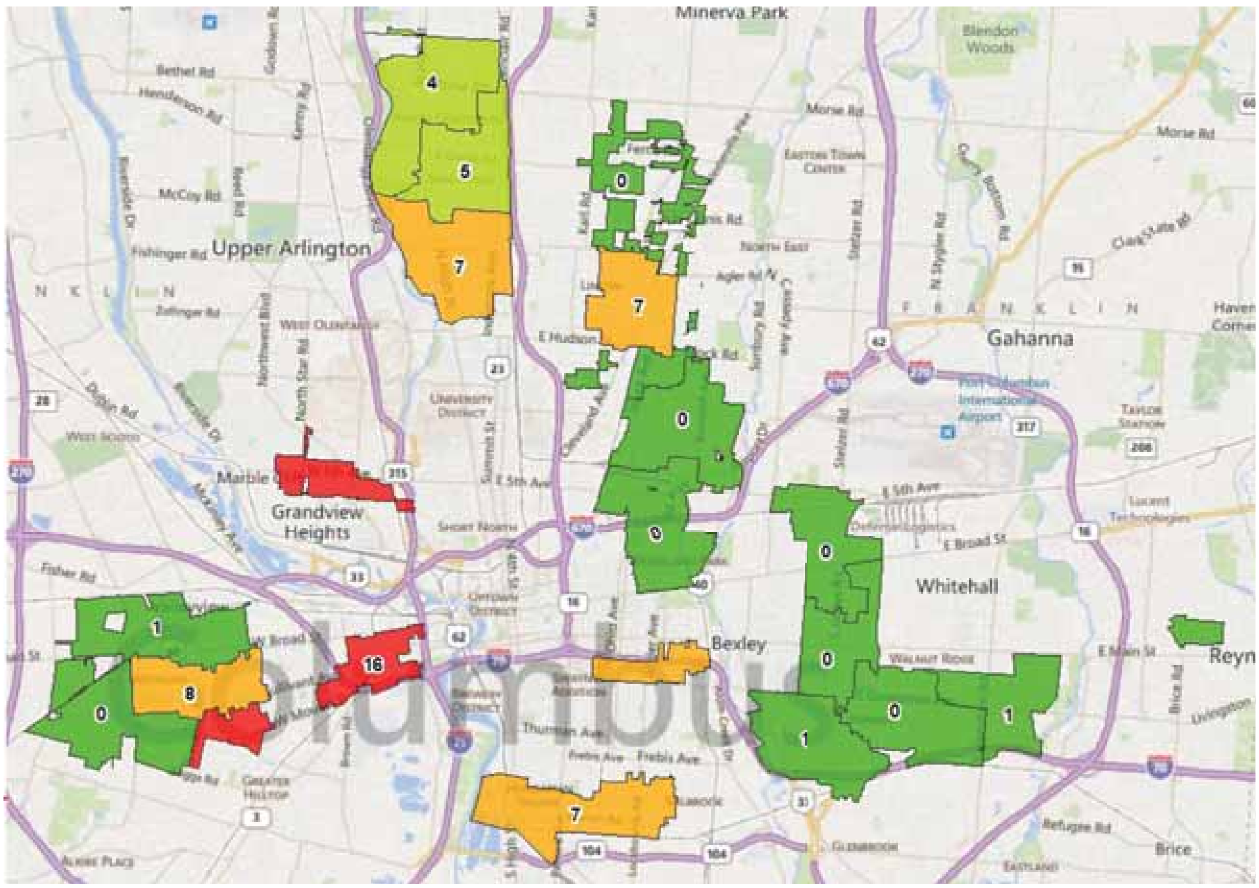
6.6.2 Prioritization Scoring

6.6.2.1 Sanitary Sewer Overflows Category

The SSOs category corresponds to the "Number and Size of Overflows" item from CAP voting. It includes two subcategories: number of SSO locations and number of SSO activations. This category gets weighted 40%, based on CAP voting.

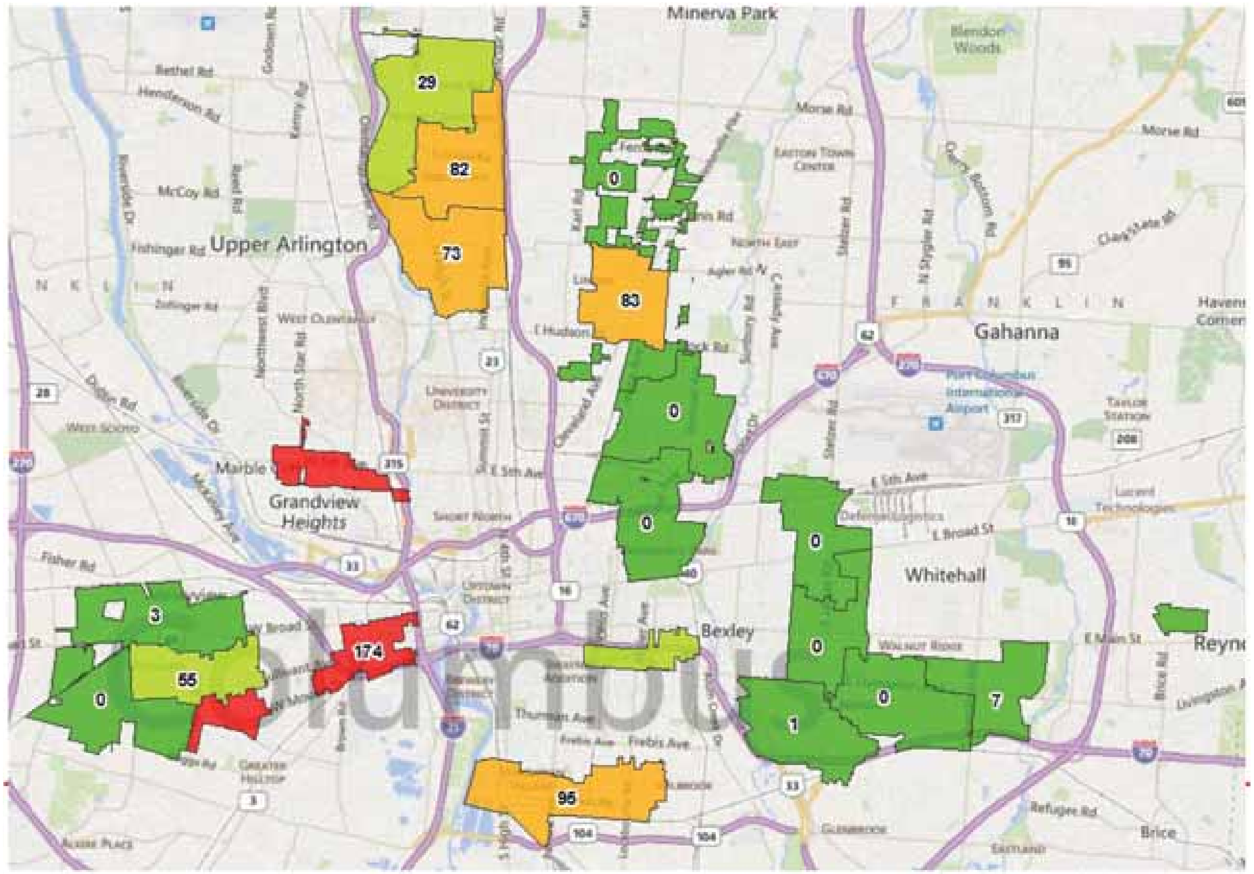
The number of SSO locations scoring is based on the number of DSR locations and manhole locations where wet-weather-induced overflows occurred from January 1, 2010 through July 31, 2013. Values in the Blueprint project areas ranged from 0 to 16. See Exhibit 6.6.3 below.

EXHIBIT 6.6.3 » NUMBER OF SSO LOCATIONS SCORING FOR BLUEPRINT PROJECT AREAS



The number of SSO activations scoring is based on the total number of activations that occurred at each DSR and flooded manhole from January 1, 2010 through July 31, 2013. For this criterion, the location, not the final outlet point, of each DSR was considered. Values in the Blueprint project areas ranged from 0 – 174. See Exhibit 6.6.4 below.

EXHIBIT 6.6.4 » NUMBER OF SSO ACTIVATIONS SCORING FOR BLUEPRINT PROJECT AREAS

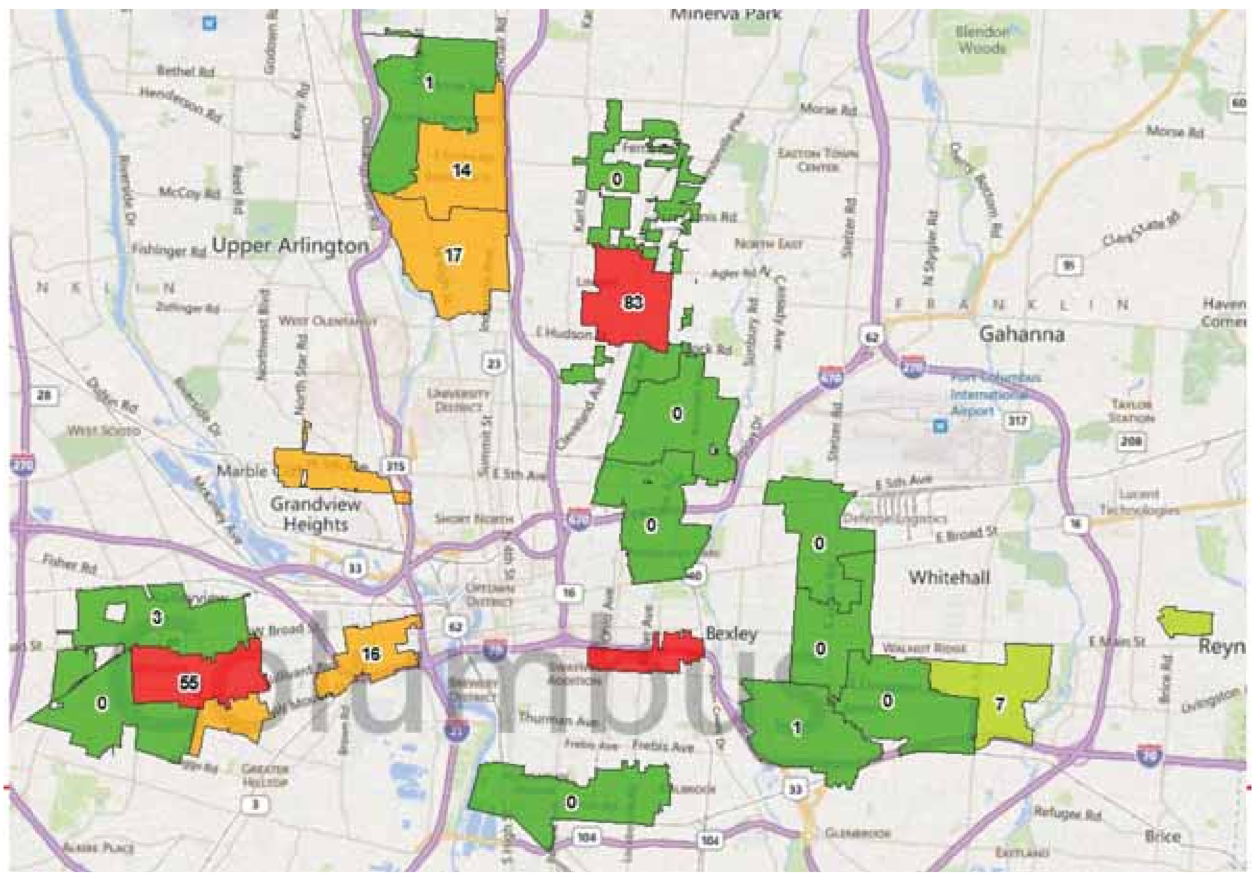


6.6.2.2 Exposure Risk Category

The Exposure Risk Category corresponds to the "Public Exposure to Overflows" item from the CAP voting. It includes three subcategories: SSO activations to tributaries, SSO activations near parks and SSO activations near schools. CAP weighted this category at 25%.

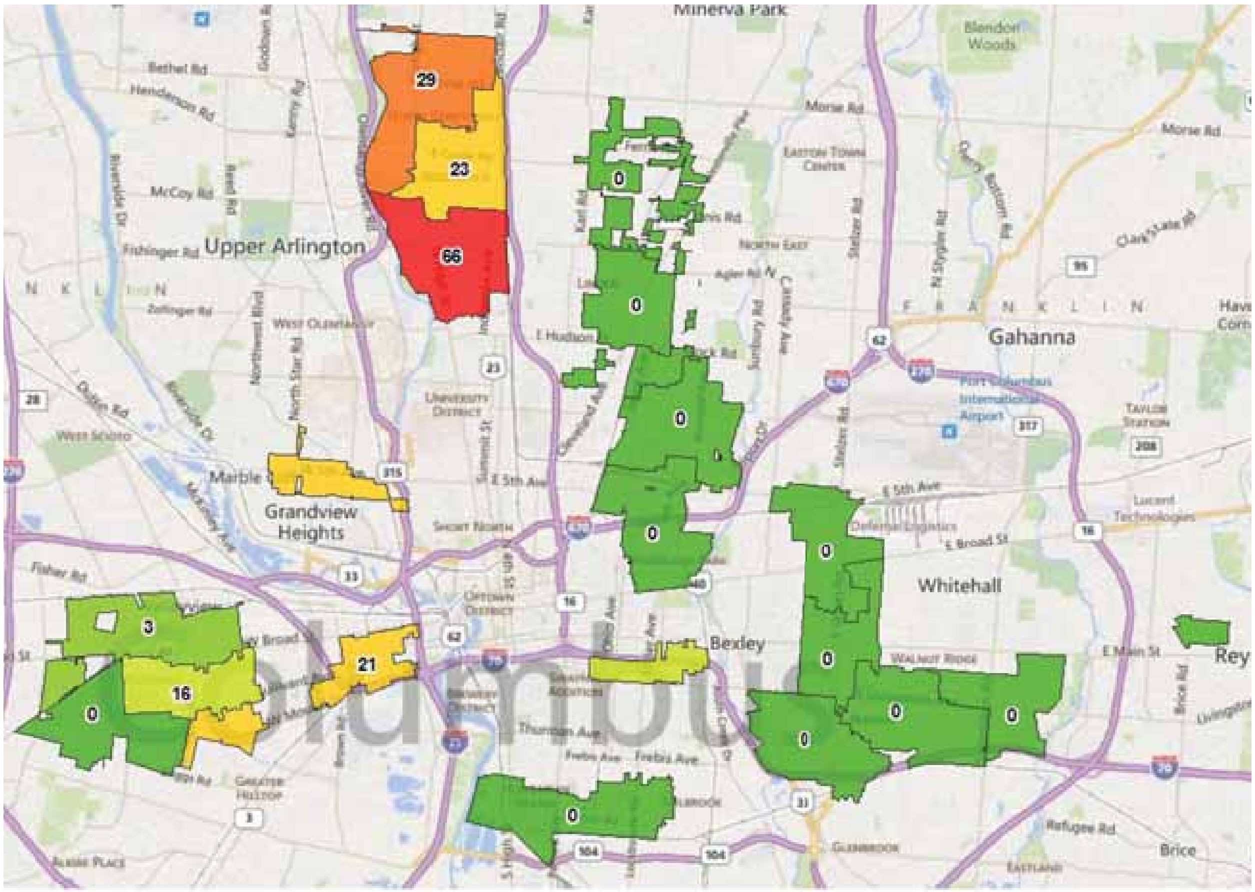
The SSO activations to tributaries category scoring is based on the total number of activations that day-lighted to a tributary stream from January 1, 2010 through July 31, 2013. For this criterion, the location of each DSR's final outlet point was considered, not the location of each DSR. A tributary was considered to be any outlet point not directly on the Scioto or Olentangy Rivers. Values in the Blueprint project areas ranged from 0 – 83. See Exhibit 6.6.5 below.

EXHIBIT 6.6.5 » SSO ACTIVATIONS TO TRIBUTARIES SCORING FOR BLUEPRINT PROJECT AREAS



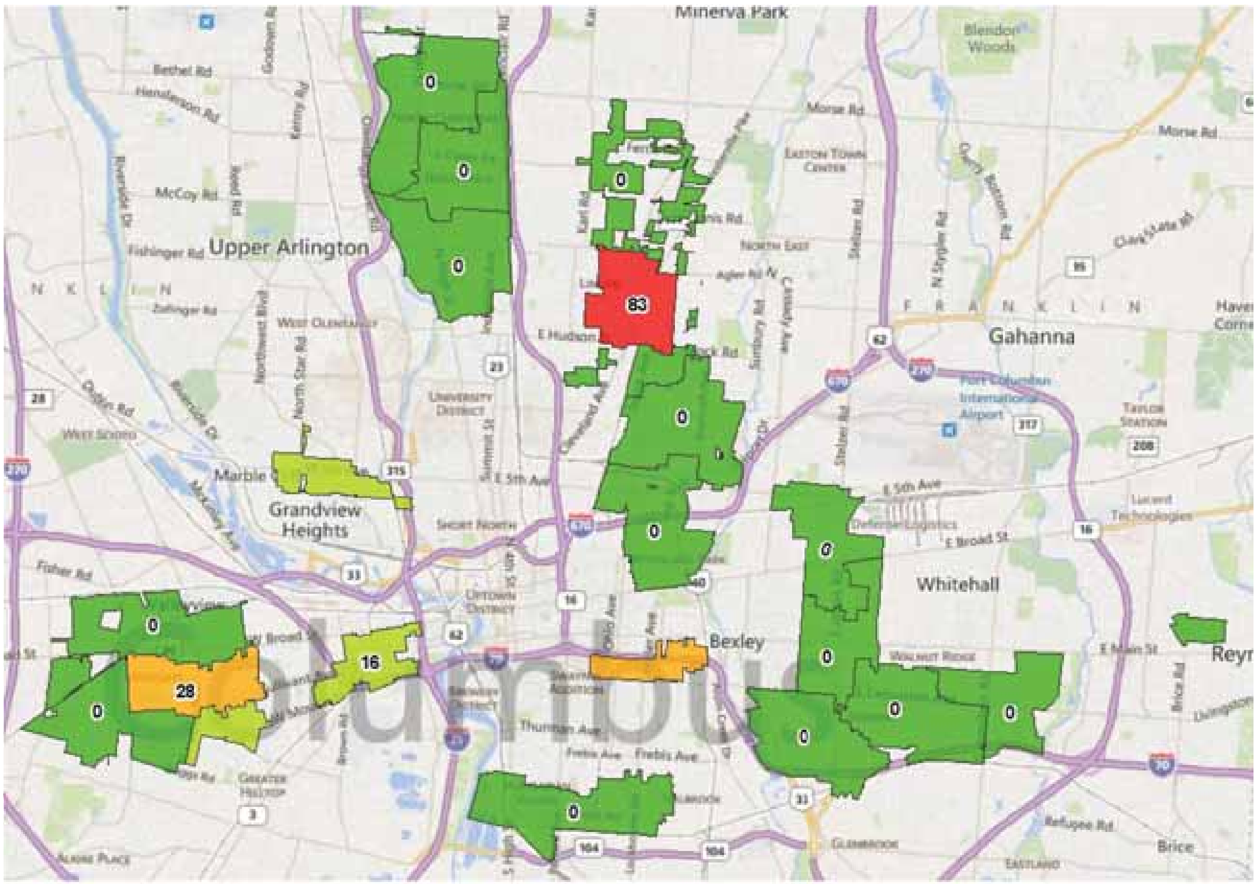
The SSO activations near parks scoring is based on the total number of activations that day-lighted within 500 feet of a park from January 1, 2010 through July 31, 2013. For this criterion, the location of each DSR's final outlet point was considered, not the location of each DSR. Park locations were identified using Bing Maps© and Google Maps©. Values in the Blueprint project areas ranged from 0 – 66. Because parks are especially sensitive areas, any activations near parks are given at least 2 points, and the 1-point category is not used. See Exhibit 6.6.6 below.

EXHIBIT 6.6.6 » SSO ACTIVATIONS NEAR PARKS SCORING FOR BLUEPRINT PROJECT AREAS



The SSO activations near schools scoring is based on the total number of activations that daylighted within 500 feet of a school from January 1, 2010 through July 31, 2013. For this criterion, the location of each DSR's final outlet point was considered, not the location of each DSR. School locations were identified using a 2008 shapefile from the Ohio Department of Education's (ODE's) website containing all ODE facilities, including schools, preschools, child nutrition centers, childcare, after-school programs and the like. Care was taken to only consider locations near DSRs if they were schools or childcare-related as opposed to administrative buildings. Values in the Blueprint project areas ranged from 0 – 83. See Exhibit 6.6.7 below.

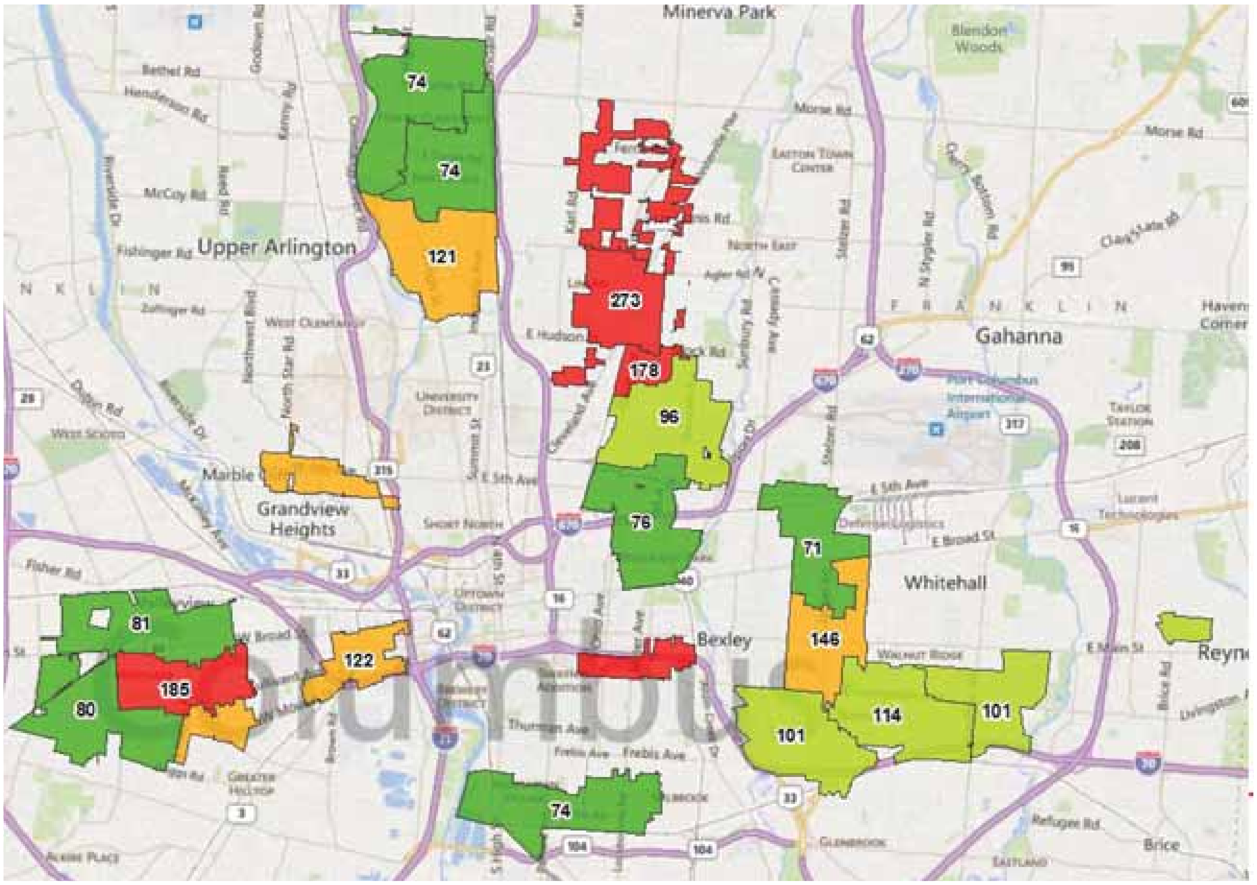
EXHIBIT 6.6.7 » SSO ACTIVATIONS NEAR SCHOOLS SCORING FOR BLUEPRINT PROJECT AREAS



6.6.2.3 Water in Basements Category

The WIBs category corresponds to the "water in basement event" item from the CAP voting. It has a weight of 25%. Scoring is based on the total number of wet-weather-induced WIB events from January 1, 2010 through July 31, 2013. WIBs caused by sewer blockages or by construction are not included. Values in the Blueprint project areas ranged from 71 – 273. See Exhibit 6.6.8 below.

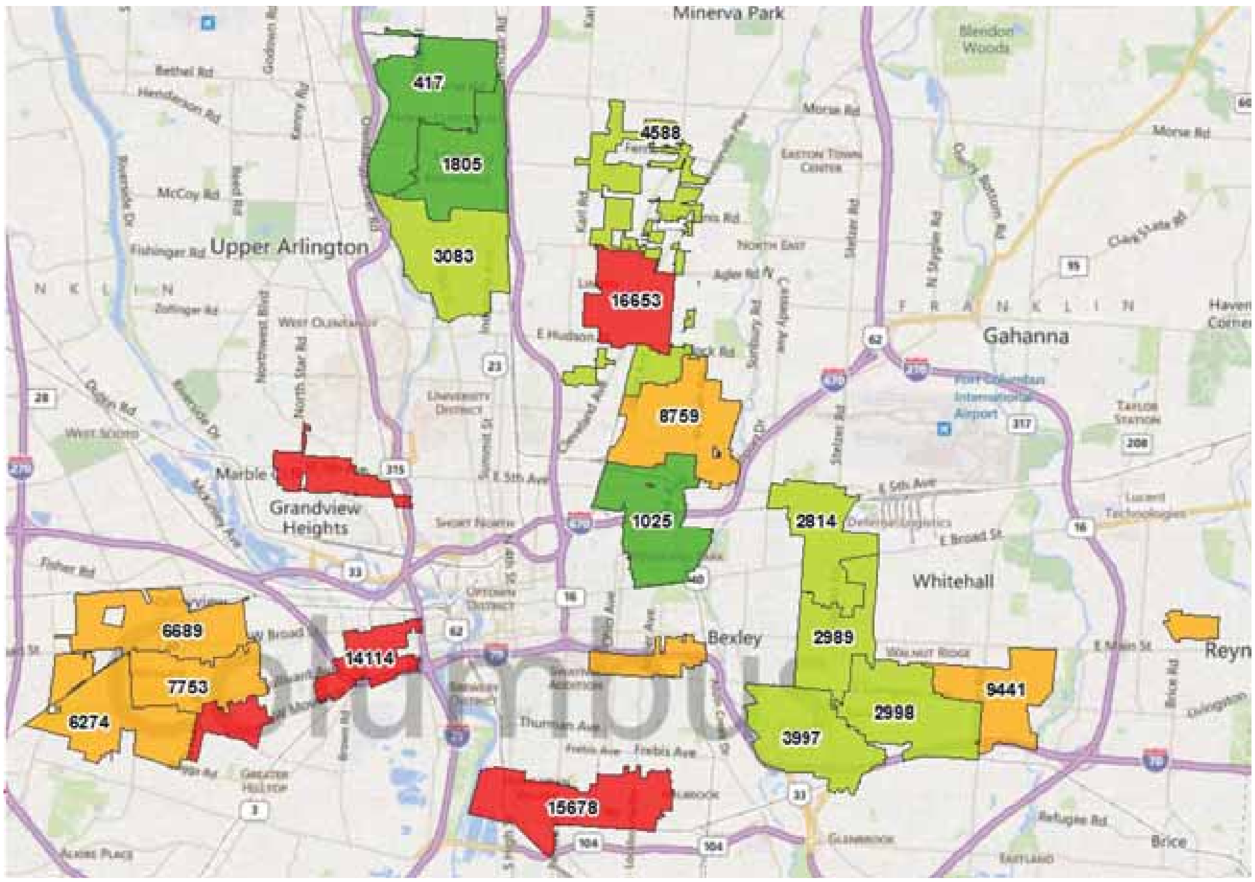
EXHIBIT 6.6.8 » WATER IN BASEMENTS SCORING FOR BLUEPRINT PROJECT AREAS



6.6.2.4 Structural and Operations & Maintenance Category

The structural and operations & maintenance category corresponds to the "structural/ operations and maintenance concerns" item from the CAP voting. Scoring is based on SCREAM data provided by the city. SCREAM data combines sewer structural and maintenance concerns into an overall total score for sanitary, storm and combined sewers. SCREAM scores vary between 0 and 100, with 0 meaning a very good condition and 100 being a sewer in need of repair. For scoring purposes, the length of sanitary and combined sewers with a total SCREAM score of 90-100 was considered. Values in the Blueprint project areas ranged from 417 – 16,653 feet of pipe. See Exhibit 6.6.9 below.

EXHIBIT 6.6.9 » STRUCTURAL AND OPERATIONS & MAINTENANCE SCORING FOR BLUEPRINT PROJECT AREAS



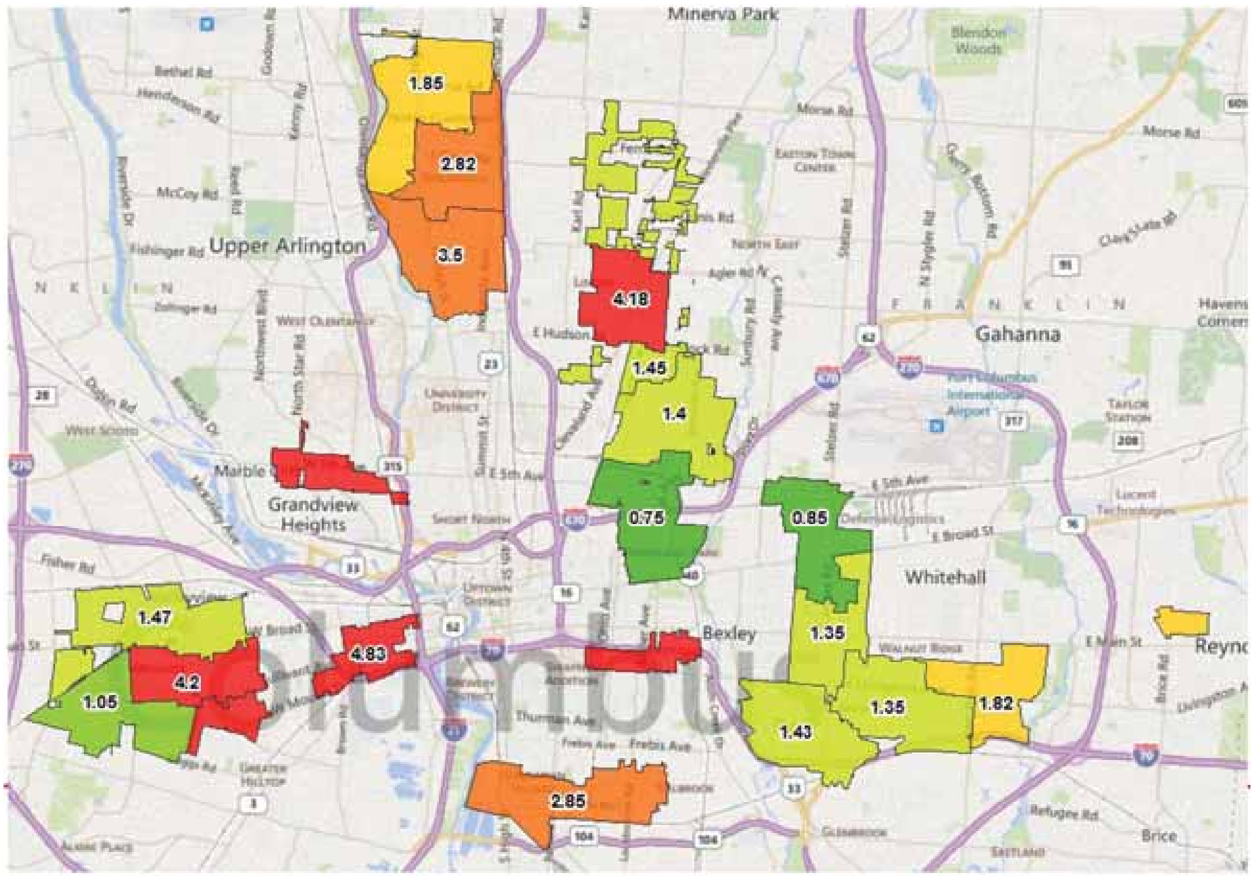
6.6.2.5 Social Implementation Feasibility

The social implementation feasibility category corresponds to "social parameter", a write-in item from the CAP voting. There is no numerical scoring for this category. However, comments from communities will be taken into account when an area is being considered for the program.

6.6.3 Final Prioritization

Combining the scoring and incorporating the weights assigned by the CAP and taking into account the initial Blueprint implementation area (Clintonville 1) and the first and second pilot areas (North Linden 1 and Hilltop 1 + Miller Kelton), Table 6.6.2 presents the prioritized Blueprint project area schedule with the ranking re-ordered based on projects that have already been initiated. Exhibit 6.6.10 below shows each of the Blueprint project areas and their final prioritization scores.

EXHIBIT 6.6.10 » BLUEPRINT PROJECT AREAS FINAL PRIORITIZATION SCORE



6.7 Blueprint Plan Costs

This section of the report summarizes the costs for the Blueprint plan. For a detailed discussion on the unit costs used for this analysis, please see Appendix E. Exhibit 6.7.1 shows the capital costs for the Blueprint plan.

The estimated capital cost for the Blueprint plan is $1.74 billon. There are two main components to the capital cost: conventional infrastructure like what is contained in the gray plan and additional projects summarized as Blueprint infrastructure.

The conventional infrastructure component of the plan costs around $400 million. Approximately half of this cost is for phase 1 and 2 of the LOT. It is also key to note that the cost of the LOT tunnel was estimated as a 10-foot diameter tunnel. The collection system modeling indicates that a 9-to-10-foot diameter pipe will provide the required relief. About ¼ of the cost is for the CEPT facility at SWWTP. The rest of the money covers various collection system improvements throughout the Blueprint areas.

The Blueprint infrastructure covers a series of non-traditional projects designed to remove I/I from entering the collection system. It includes above ground water quality green infrastructure projects, like rain gardens and permeable pavement, designed to infiltrate rainwater into the ground. Underground projects like sewer lining and lateral lining are designed to keep ground water out of the system.

The total for these projects is approximately $1.33 billion. Lateral lining is the largest component costing approximately $450 million. Green infrastructure is the next largest component costing approximately $370 million. Exhibit 6.7.1 outlines the costs for the Blueprint plan.

EXHIBIT 6.7.1 » BLUEPRINT ESTIMATED COSTS

CONVENTIONAL INFRASTRUCTURE	
System-wide tunnels	$185,000,000
System-wide conveyance improvements	$8,000,000
Priority areas, conveyance improvements	$42,000,000
Chemically Enhanced Primary Treatment	$99,000,000
Bolt down manhole cost	$29,000,000
Consent order projects from capital plan	$41,000,000
Subtotal	$434,000,000
BLUEPRINT INFRASTRUCTURE	
Green infrastructure	$373,000,000
Sewer lining	$215,000,000
Manhole rehabilitation	$41,000,000
Private lateral lining	$453,000,000
Roof disconnection & redirection	$152,000,000
Sump pumps	$100,000,000
Subtotal	$1,334,000,000
Consent Order Total	$1,738,000,000

TABLE 6.5.1 » SYSTEMWIDE BLUEPRINT ALTERNATIVE PROJECTS

DSR/ WIBs	Project ID	Type	Description	New Diameter [ft]	Length [ft]
DSR 284, DSR 328, DSR 898 and WIBs	1	Tunnel	LOT2 Tunnel from near Dodridge Street to LOT1 (near 2nd Avenue)	9	14,530
	2	New Relief Weir*	Relief of FMN at 0086S0385 Inlet offset = 1.35 ft, Length = 5 ft	N/A	N/A
	3	New Relief Weir	Relief of OSIS at 0086C0384 Inlet offset = 2 ft, Length = 8 ft	N/A	N/A
	4	New Relief Pipe*	Relief of FMN at 0086S0385 and OSIS at 0086C0384 to LOT2 (conveyence pipe to LOT2 shared by reliefs from both FMN and OSIS)	5	940
	5	New Relief Weir	Relief of OMI at 0127S0003 Inlet offset = 4.5 ft, Length = 17 ft	N/A	N/A
	6	New Relief Pipe	Relief of OMI at 0127S0003 to LOT2	5	800
DSR 873	7	New Relief Pipe	Relief pipe for DSR 873 to OMI from 0232S0083 to 0232S0340	2	70
DSR 95 and WIBs	8	New Relief Pipe	2nd Interconnector Barrel parallel to the existing 8.5' Interconnector Barrel from 0589S0035 to 0589S9982	8.5	2,175

* This project is also listed in the table of Clintonville projects.

Note: Table 6.5.2 was renamed "Exhibit 6.5.2" and can be found on page 135.

TABLE 6.5.3 » CLINTONVILLE BLUEPRINT ALTERNATIVE PROJECTS

DSR/WIBs	Project ID	Type	Description	New Diameter [ft]	Length [ft]
CVM Trunk DSRs (326, 323, 335, 352, 346, 351 and 360)	N/A	I/I Reduction	Application of mitigation technology to reduce I/I Inflows	N/A	N/A
	1	New Relief Pipe	Relief of CVM at 0232S0156 to OSIS at a new manhole between 0175C0176 and 0175C0175 (on Brighton Rd.)	3.5	6,183
DSR 346 (Additional Projects)	3	Bulkhead	Bulkhead 10" pipe at 0451S0086 that relieves flow from Worthington to CVM main trunk	N/A	N/A
	N/A	Increase Sump Pump Participation	Sump pump participation increased from 25% to 50% for area upstream of DSR 346	N/A	N/A
DSR 349	N/A	I/I Reduction	Application of mitigation technology to reduce I/I Inflows	N/A	N/A
DSR 328 and DSR 898	N/A	I/I Reduction	Application of mitigation technology to reduce I/I Inflows	N/A	N/A
	2	Bulkhead	Closed DSR 328 at 0176S0025	N/A	N/A
	4	New Relief Weir*	Relief of FMN at 0086S0385 Inlet offset = 1.35 ft, Length = 5 ft	N/A	N/A
	5	New Relief Pipe*	Relief of FMN at 0086S0385 to LOT2 (conveyance pipe to LOT2 shared by reliefs from both FMN and OSIS)	5	940
DSR 329	N/A	I/I Reduction	Application of mitigation technology to reduce I/I Inflows	N/A	N/A
WIBs	N/A	I/I Reduction	Application of mitigation technology to reduce I/I Inflows	N/A	N/A

TABLE 6.5.4 » HILLTOP BLUEPRINT ALTERNATIVE PROJECTS

DSR/ WIBs	Project ID	Type	Description	New Diameter [ft]	Length [ft]
DSR 250	1	Flow Redirection	Flow redirected South rather than East at 0115S0240A; Removed weir 0115S0240A:0115S0240; Inlet offset to South = 0 ft; Bulkhead pipe to East at 0115S0240A	2.25	50
DSR 254	N/A	I/I Reduction	Application of mitigation technology to reduce I/I Inflows	N/A	N/A
DSR 252	N/A	I/I Reduction	Application of mitigation technology to reduce I/I Inflows	N/A	N/A
DSR 256	N/A	I/I Reduction	Application of mitigation technology to reduce I/I Inflows	N/A	N/A
WIBs	N/A	I/I Reduction	Application of mitigation technology to reduce I/I Inflows	N/A	N/A
	2	Upsize Existing Pipes	Upsized pipes from 0046S0334 to 0046S0358	1.25	616
	3	Upsize Existing Pipes	Upsized pipes from 0046S0358 to 0046S0427	1.5	3,738

TABLE 6.5.5 » LINDEN BLUEPRINT ALTERNATIVE PROJECTS

DSR/ WIBs	Project ID	Type	Description	New Diameter [ft]	Length [ft]
DSR 305	N/A	I/I Reduction	Application of mitigation technology to reduce I/I Inflows	N/A	N/A
DSR 306	N/A	I/I Reduction	Application of mitigation technology to reduce I/I Inflows	N/A	N/A
DSR 315	N/A	I/I Reduction	Application of mitigation technology to reduce I/I Inflows	N/A	N/A
DSR 339	N/A	I/I Reduction	Application of mitigation technology to reduce I/I Inflows	N/A	N/A
WIBs (Main Basin)	N/A	I/I Reduction	Application of mitigation technology to reduce I/I Inflows	N/A	N/A
Additional Improvements	1	Remove Weir	Removed weir at 0089S0262	N/A	N/A
	2	Remove Weir	Removed weir at 0130S0272	N/A	N/A
	3	Remove Weir	Removed weir at 0179S0075	N/A	N/A
WIBs (South West Smaller Basin)	N/A	I/I Reduction	Application of mitigation technology to reduce I/I Inflows	N/A	N/A
	4	Upsize Existing Pipes	Upsized pipes from 0088S0427 to 0088S0287	1	1,089
	5a	Upsize Existing Pipes	Upsized pipes from 0088S0006 to 0088S0010	0.83	634
	5b	Upsize Existing Pipes	Upsized pipes from 0088S0010 to 0055S0408	1	605
	5c	Upsize Existing Pipes	Upsized pipes from 0055S0408 to 0055S0375	1.25	451

TABLE 6.5.6 » NEAR SOUTH BLUEPRINT ALTERNATIVE PROJECTS

DSR/ WIBs	Project ID	Type	Description	New Diameter [ft]	Length [ft]
DSR 203	N/A	I/I Reduction	Application of mitigation technology to reduce I/I Inflows	N/A	N/A
DSR 201	2	Upsize Existing Pipes	Upsized pipes from 0038S0209 to 0038S0186	1.25	1,324
DSR 211	N/A	I/I Reduction	Application of mitigation technology to reduce I/I Inflows	N/A	N/A
DSR 206	N/A	I/I Reduction	Application of mitigation technology to reduce I/I Inflows	N/A	N/A
DSR 205	4a	New Relief Pipe	Relief of SSI at 0018C0213 to OARS	4	75
	4b	New Relief Weir	Relief of SSI at 0018C0213 to OARS	N/A	N/A
			Inlet offset = 5.25 ft, Length = 8 ft		
DSR 210	3	Upsize Existing Pipes	Upsized pipes from 0039S0251 to 0039S0253	1.25	470
WIBs	N/A	I/I Reduction	Application of mitigation technology to reduce I/I Inflows	N/A	N/A
	1	Upsize Existing Pipes	Upsized pipes from 0037S0171 to 0038S0300	1	1,221

TABLE 6.5.7 » FIFTH BY NORTHWEST AREA DSRs BASE VERSUS BLUEPRINT MODEL CONDITIONS

DSR ID >		103	109	111	107	110	105	154	151	146	149	150	147	915	148	157
Base Model Simulation	Number of Activations in 20 Years	-	7	-	-	479	364	-	76	20	27	17	10	-	25	70
	Level of Service (LOS)	-	3.02	-	-	0.04	0.05	-	0.26	1.02	0.75	1.2	2.08	-	0.81	0.29
Blueprint Alternative Model Simulation	Number of Activations in 20 Years	-	-	-	-	-	-	-	-	-	1	1	1	-	1	2
	Level of Service (LOS)	-	-	-	-	-	-	-	-	-	33.2	33.2	33.2	-	33.2	12.5

TABLE 6.5.8 » FIFTH BY NORTHWEST BLUEPRINT ALTERNATIVE PROJECTS

DSR/ WIBs	Project ID	Type	Description	New Diameter [ft]	Length [ft]
DSR 103	2a	Bulkhead	Closed DSR 103 at 0010S1394a	N/A	N/A
DSR 109	2b	Bulkhead	Closed DSR 109 at 0010S1395	3	1,448
DSR 111	2C	Bulkhead	Closed DSR 111 at 0010S1396	N/A	N/A
DSR 107	N/A	N/A	N/A	N/A	N/A
DSR 110, 105, 154 and 151 WIBs	4	Upsize Existing Pipes	Upsized pipes from 0026S0418 to 0010S0364	3	3,061
DSR 146	2d	Bulkhead	Closed DSR 146 at 0026S0358	1.5	611
DSR 149	1d	Raise Weir Elevation	Raised weir elevation at 0026S0156 from 1.65 ft to 5 ft	N/A	N/A
DSR 150	1b	Raise Weir Elevation	Raised weir elevation at 0026S0164 from 0.9 ft to 3.15 ft	N/A	N/A
DSR 147	1a	Raise Weir Elevation	Raised weir elevation at 0026C0040 from 0.69 ft to 2.17 ft	N/A	N/A
DSR 915	N/A	N/A	N/A	N/A	N/A
DSR 148	1c	Raise Weir Elevation	Raised weir elevation at 0026S0287 from 0.86 ft to 3 ft	N/A	N/A
DSR 157	3	Flow Split Reconfigured	Reconfigured flow split at 0027S0012, so that dominant flow path is to the east instead of to the south	N/A	N/A
WIBs	5a	New Relief Weir	Relief KST at 0010S1394 Inlet Offset = 2 ft, Weir Length = 10 ft	N/A	N/A
	5b	New Relief Pipe	Relief KST at 0010S1394 to LOT 1	3	1,448
	6	Bulkhead	Bulkhead Oxley Road relief pipe at 0027S0028	N/A	N/A

Category	Overall Summary				OARS/WWTP/ACST							
Description	Total SSO (MG)	Total CSO (MG)	Total Bypasses (MG)	Total System Overflow (MG)	OARS OF	WSST Weir OF	WSST Emergency Gates	ACST	JPWWTP Mech Bypass	JPWWTP Gravity Bypass	SWWTP Gravity Bypass	CEPT
Level of Service	N/A	N/A	N/A	N/A	4/TY	TY	TY	TY	10Y	10Y	1.4Y	N/A
20Y Total Overflow Volume (MG)					3909	8.80	4.90	46.7			507	3085
20Y Total Overflow Duration (Hrs)					441	126	81	34			121	714
20Y Total Number of Activations	3	4052	507	4561	37	5	3	16			9	50
20Y LOS(in years)					N/A	N/A	N/A	N/A			2.3	N/A
10yr LOS Target Volume (MG)					N/A	N/A	N/A	N/A	Met	Met	N/A	N/A
10yr LOS Target Peak Flow (MGD)					N/A	N/A	N/A	N/A	Met	Met	N/A	N/A
Highest Volume (MG)					524.3	4.57	2.49	8.50			194.1	343.4
2nd Highest Volume (MG)					467.0	2.37	1.90	5.57			180.9	279.3
3rd Highest Volume (MG)					376.5	0.95	0.50	5.09			97.9	250.4
4th Highest Volume (MG)					227.9	0.65		4.93			15.7	145.9
5th Highest Volume (MG)					199.1	0.26		4.67			7.52	143.7
6th Highest Volume (MG)					194.7			4.10			3.87	133.0
7th Highest Volume (MG)					192.3			3.18			3.52	130.8
8th Highest Volume (MG)					150.2			2.81			2.07	120.7
9th Highest Volume (MG)					125.1			2.31			1.44	117.3
10th Highest Volume (MG)					117.7			1.30				106.1
11th Highest Volume (MG)					114.6			1.21				105.6
12th Highest Volume (MG)					102.6			0.74				95.1
13th Highest Volume (MG)					99.8			0.74				93.8
14th Highest Volume (MG)					97.5			0.67				88.0
15th Highest Volume (MG)					91.3			0.52				85.0
16th Highest Volume (MG)					91.0			0.41				72.9
17th Highest Volume (MG)					84.3							70.3
18th Highest Volume (MG)					67.6							65.0
19th Highest Volume (MG)					59.9							56.1
20th Highest Volume (MG)					54.9							53.9
Highest Peak Flow (MGD)					2359	54.2	30.1	121.2			266.2	110
2nd Peak Flow (MGD)					891.6	46.6	24.5	110.6			225.5	110
3rd Peak Flow (MGD)					819.3	37.4	2.28	104.1			204.9	110
4th Peak Flow (MGD)					809.9	21.4		88.4			69.6	110
5th Peak Flow (MGD)					739.0	12.9		79.1			41.3	110
6th Peak Flow (MGD)					567.1			70.0			29.8	110
7th Peak Flow (MGD)					559.4			56.4			29.7	110
8th Peak Flow (MGD)					538.1			49.0			14.3	110
9th Peak Flow (MGD)					513.5			45.0			10.7	110
10th Peak Flow (MGD)					447.3			44.9				110
11th Peak Flow (MGD)					434.6			44.0				110
12th Peak Flow (MGD)					381.8			34.4				110
13th Peak Flow (MGD)					362.0			30.0				110
14th Peak Flow (MGD)					356.2			23.0				110
15th Peak Flow (MGD)					346.4			18.0				110
16th Peak Flow (MGD)					320.9			15.3				110
17th Peak Flow (MGD)					304.9							110
18th Peak Flow (MGD)					303.5							110
19th Peak Flow (MGD)					284.2							110
20th Peak Flow (MGD)					273.6							110

Category	Mainline DSRs									CSO Regulator	
Description	DSR 083 Deschler	DSR 095 West Side Sanitary	DSR 399 McKinley	DSR 873 Francisco Teteridge	DSR 284 FMN Pacemont Dr	DSR 156 FMN North of Hill Ave	DSR 244 Livingston James	DSR 246 Castle Rd PS	DSR 322 Williams Rd PS	Markison	Dodge Park
Level of Service	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	TY	TY
20Y Total Overflow Volume (MG)		1.36					0.93			9.47	2.85
20Y Total Overflow Duration (Hrs)		6.75					6.25			8.5	6.75
20Y Total Number of Activations		2					2			9	7
20Y LOS(in years)		12.5					12.5			N/A	N/A
10yr LOS Target Volume (MG)	Met	Met	Met	Met	Met	Met	Met	Met	Met	N/A	N/A
10yr LOS Target Peak Flow (MGD)	Met	Met	Met	Met	Met	Met	Met	Met	Met	N/A	N/A
Highest Volume (MG)		1.33					0.80			2.52	1.41
2nd Highest Volume (MG)		0.02					0.14			2.20	0.53
3rd Highest Volume (MG)										1.04	0.28
4th Highest Volume (MG)										0.97	0.20
5th Highest Volume (MG)										0.92	0.18
6th Highest Volume (MG)										0.84	0.17
7th Highest Volume (MG)										0.45	0.07
8th Highest Volume (MG)										0.41	
9th Highest Volume (MG)										0.14	
10th Highest Volume (MG)											
11th Highest Volume (MG)											
12th Highest Volume (MG)											
13th Highest Volume (MG)											
14th Highest Volume (MG)											
15th Highest Volume (MG)											
16th Highest Volume (MG)											
17th Highest Volume (MG)											
18th Highest Volume (MG)											
19th Highest Volume (MG)											
20th Highest Volume (MG)											
Highest Peak Flow (MGD)		18.8					7.43			100.2	42.1
2nd Peak Flow (MGD)		0.55					2.45			63.6	13.1
3rd Peak Flow (MGD)										58.8	12.2
4th Peak Flow (MGD)										46.8	11.2
5th Peak Flow (MGD)										39.5	9.94
6th Peak Flow (MGD)										33.3	8.37
7th Peak Flow (MGD)										32.6	3.28
8th Peak Flow (MGD)										20.2	
9th Peak Flow (MGD)										8.98	
10th Peak Flow (MGD)											
11th Peak Flow (MGD)											
12th Peak Flow (MGD)											
13th Peak Flow (MGD)											
14th Peak Flow (MGD)											
15th Peak Flow (MGD)											
16th Peak Flow (MGD)											
17th Peak Flow (MGD)											
18th Peak Flow (MGD)											
19th Peak Flow (MGD)											
20th Peak Flow (MGD)											

Category	Downtown CSO								Olentangy CSO Regulators						
Description	Town	State	Capital	Broad	Long	Spring	Chestnut	Henry	First	Third	King	Indianola	Frambes	Doe Alley	Hudson
Level of Service	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	TY	TY	TY	TY	TY	TY	TY
20Y Total Overflow Volume (MG)					0.40	0.82				1.96	0.18	45.4	0.44	0.69	2.29
20Y Total Overflow Duration (Hrs)					0.5	0.5				1.5	1	15.3	1.25	2.25	3.25
20Y Total Number of Activations					1	1				2	1	14	2	3	5
20Y LOS(in years)					33.2	33.2				N/A	N/A	N/A	N/A	N/A	N/A
10yr LOS Target Volume (MG)	Met	Met	Met	Met	Met	Met	Met	Met	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10yr LOS Target Peak Flow (MGD)	Met	Met	Met	Met	Met	Met	Met	Met	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Highest Volume (MG)					0.40	0.82				1.18	0.18	8.22	0.34	0.31	0.75
2nd Highest Volume (MG)										0.78		6.83	0.10	0.22	0.62
3rd Highest Volume (MG)												6.15		0.16	0.50
4th Highest Volume (MG)												4.85			0.27
5th Highest Volume (MG)												3.46			0.15
6th Highest Volume (MG)												3.01			
7th Highest Volume (MG)												2.46			
8th Highest Volume (MG)												2.30			
9th Highest Volume (MG)												1.82			
10th Highest Volume (MG)												1.76			
11th Highest Volume (MG)												1.52			
12th Highest Volume (MG)												1.48			
13th Highest Volume (MG)												1.30			
14th Highest Volume (MG)												0.19			
15th Highest Volume (MG)															
16th Highest Volume (MG)															
17th Highest Volume (MG)															
18th Highest Volume (MG)															
19th Highest Volume (MG)															
20th Highest Volume (MG)															
Highest Peak Flow (MGD)					32.1	49.6				85.0	5.52	212.9	25.9	25.8	65.5
2nd Peak Flow (MGD)										30.8		210.4	8.87	12.0	28.1
3rd Peak Flow (MGD)												202.5		9.18	26.0
4th Peak Flow (MGD)												184.0			19.4
5th Peak Flow (MGD)												178.7			8.12
6th Peak Flow (MGD)												178.6			
7th Peak Flow (MGD)												124.9			
8th Peak Flow (MGD)												109.4			
9th Peak Flow (MGD)												93.2			
10th Peak Flow (MGD)												84.1			
11th Peak Flow (MGD)												66.5			
12th Peak Flow (MGD)												63.2			
13th Peak Flow (MGD)												62.6			
14th Peak Flow (MGD)												15.1			
15th Peak Flow (MGD)															
16th Peak Flow (MGD)															
17th Peak Flow (MGD)															
18th Peak Flow (MGD)															
19th Peak Flow (MGD)															
20th Peak Flow (MGD)															

Category	CSO Manholes							
Description	Mound/Grant	Noble/Grant	Town/Fourth	Rich/Fifth	Cherry/Fourth	Noble/Fourth	Mound e/71	Kerr/Russel
Level of Service	TY	TY	TY	TY	TY	TY	TY	TY
20Y Total Overflow Volume (MG)			9.05	0.41	8.31	0.11		0.20
20Y Total Overflow Duration (Hrs)			10.5	0.5	5.25	1		0.5
20Y Total Number of Activations			18	1	8	2		1
20Y LOS(in years)			N/A	N/A	N/A	N/A		N/A
10yr LOS Target Volume (MG)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10yr LOS Target Peak Flow (MGD)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Highest Volume (MG)			3.53	0.41	2.94	0.08		0.20
2nd Highest Volume (MG)			0.92		1.69	0.03		
3rd Highest Volume (MG)			0.58		0.94			
4th Highest Volume (MG)			0.53		0.83			
5th Highest Volume (MG)			0.52		0.75			
6th Highest Volume (MG)			0.46		0.63			
7th Highest Volume (MG)			0.42		0.49			
8th Highest Volume (MG)			0.38		0.03			
9th Highest Volume (MG)			0.38					
10th Highest Volume (MG)			0.33					
11th Highest Volume (MG)			0.27					
12th Highest Volume (MG)			0.19					
13th Highest Volume (MG)			0.13					
14th Highest Volume (MG)			0.12					
15th Highest Volume (MG)			0.12					
16th Highest Volume (MG)			0.07					
17th Highest Volume (MG)			0.06					
18th Highest Volume (MG)			0.04					
19th Highest Volume (MG)								
20th Highest Volume (MG)								
Highest Peak Flow (MGD)			157	19.8	146.2	5.97		18.4
2nd Peak Flow (MGD)			54.7		88.4	1.57		
3rd Peak Flow (MGD)			54.5		85.4			
4th Peak Flow (MGD)			50.2		39.2			
5th Peak Flow (MGD)			38.9		38.0			
6th Peak Flow (MGD)			32.9		34.9			
7th Peak Flow (MGD)			29.0		34.4			
8th Peak Flow (MGD)			25.6		1.79			
9th Peak Flow (MGD)			25.5					
10th Peak Flow (MGD)			20.1					
11th Peak Flow (MGD)			15.4					
12th Peak Flow (MGD)			13.5					
13th Peak Flow (MGD)			7.82					
14th Peak Flow (MGD)			7.49					
15th Peak Flow (MGD)			6.25					
16th Peak Flow (MGD)			5.80					
17th Peak Flow (MGD)			3.91					
18th Peak Flow (MGD)			3.82					
19th Peak Flow (MGD)								
20th Peak Flow (MGD)								

Models: IP Models\BLU\SSCM12_RPM_BLU+_wACISACTCleanup_woRamping_OPTCEPT_1995-2014.inp
Cutoff Values: Volume: 0.01 MG; Peak: 0.1 MGD; Duration: 0.25 hours

TABLE 6.5.9 » BLUEPRINT ALTERNATIVE 20-YEAR MODEL RUN SUMMARY OF RESULTS, 2050 CONDITIONS

Category	Blueprint DSRs - Fifth by Northwest														
Description	DSR 103 (West Fifth)	DSR 109 (West Fifth)	DSR 111 (West Fifth)	DSR 107 (West Fifth)	DSR 110 (West Fifth)	DSR 105 (West Fifth)	DSR 154 (West Fifth)	DSR 151 (West Fifth)	DSR 146 (West Fifth)	DSR 149 (West Fifth)	DSR 150 (West Fifth)	DSR 147 (West Fifth)	DSR 915 (West Fifth)	DSR 148 (West Fifth)	DSR 157 (West Fifth)
Level of Service	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y
20Y Total Overflow Volume (MG)				0.04						0.01	0.01	0.03		0.02	0.02
20Y Total Overflow Duration (Hrs)				1.75						1.25	1.5	2		2	2.25
20Y Total Number of Activations				2						1	1	1		1	1
20Y LOS(in years)				12.5						33.2	33.2	33.2		33.2	33.2
10yr LOS Target Volume (MG)	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met
10yr LOS Target Peak Flow (MGD)	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met
Highest Volume (MG)				0.03						0.01	0.01	0.03		0.02	0.02
2nd Highest Volume (MG)				0.02											
3rd Highest Volume (MG)															
4th Highest Volume (MG)															
5th Highest Volume (MG)															
6th Highest Volume (MG)															
7th Highest Volume (MG)															
8th Highest Volume (MG)															
9th Highest Volume (MG)															
10th Highest Volume (MG)															
11th Highest Volume (MG)															
12th Highest Volume (MG)															
13th Highest Volume (MG)															
14th Highest Volume (MG)															
15th Highest Volume (MG)															
16th Highest Volume (MG)															
17th Highest Volume (MG)															
18th Highest Volume (MG)															
19th Highest Volume (MG)															
20th Highest Volume (MG)															
Highest Peak Flow (MGD)				1.18						0.36	0.31	0.52		0.32	0.22
2nd Peak Flow (MGD)				0.87											
3rd Peak Flow (MGD)															
4th Peak Flow (MGD)															
5th Peak Flow (MGD)															
6th Peak Flow (MGD)															
7th Peak Flow (MGD)															
8th Peak Flow (MGD)															
9th Peak Flow (MGD)															
10th Peak Flow (MGD)															
11th Peak Flow (MGD)															
12th Peak Flow (MGD)															
13th Peak Flow (MGD)															
14th Peak Flow (MGD)															
15th Peak Flow (MGD)															
16th Peak Flow (MGD)															
17th Peak Flow (MGD)															
18th Peak Flow (MGD)															
19th Peak Flow (MGD)															
20th Peak Flow (MGD)															

Category	Blueprint DSRs - Miller Kelton									Blueprint DSRs - Barthman Parsons								
Description	DSR 177 (Miller Kelton)	DSR 181 (Miller Kelton)	DSR 189 (Miller Kelton)	DSR 179 (Miller Kelton)	DSR 188 (Miller Kelton)	DSR 190 (Miller Kelton)	DSR 185 (Miller Kelton)	DSR 199 (Miller Kelton)	DSR 193 (Miller Kelton)	DSR 203 (Barthman)	DSR 201 (Barthman)	DSR 211 (Barthman)	DSR 207 (Barthman)	DSR 208 (Barthman)	DSR 206 (Barthman)	DSR 205 (Barthman)	DSR 210 (Barthman)	DSR 213 (Barthman)
Level of Service	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y
20Y Total Overflow Volume (MG)																		
20Y Total Overflow Duration (Hrs)																		
20Y Total Number of Activations																		
20Y LOS(in years)																		
10yr LOS Target Volume (MG)	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met
10yr LOS Target Peak Flow (MGD)	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met
Highest Volume (MG)																		
2nd Highest Volume (MG)																		
3rd Highest Volume (MG)																		
4th Highest Volume (MG)																		
5th Highest Volume (MG)																		
6th Highest Volume (MG)																		
7th Highest Volume (MG)																		
8th Highest Volume (MG)																		
9th Highest Volume (MG)																		
10th Highest Volume (MG)																		
11th Highest Volume (MG)																		
12th Highest Volume (MG)																		
13th Highest Volume (MG)																		
14th Highest Volume (MG)																		
15th Highest Volume (MG)																		
16th Highest Volume (MG)																		
17th Highest Volume (MG)																		
18th Highest Volume (MG)																		
19th Highest Volume (MG)																		
20th Highest Volume (MG)																		
Highest Peak Flow (MGD)																		
2nd Peak Flow (MGD)																		
3rd Peak Flow (MGD)																		
4th Peak Flow (MGD)																		
5th Peak Flow (MGD)																		
6th Peak Flow (MGD)																		
7th Peak Flow (MGD)																		
8th Peak Flow (MGD)																		
9th Peak Flow (MGD)																		
10th Peak Flow (MGD)																		
11th Peak Flow (MGD)																		
12th Peak Flow (MGD)																		
13th Peak Flow (MGD)																		
14th Peak Flow (MGD)																		
15th Peak Flow (MGD)																		
16th Peak Flow (MGD)																		
17th Peak Flow (MGD)																		
18th Peak Flow (MGD)																		
19th Peak Flow (MGD)																		
20th Peak Flow (MGD)																		

Category	Blueprint DSRs - Hilltop				Blueprint DSRs - Linden/Northeast Area							
Description	DSR 250 (Early Ditch)	DSR 254 (Early Ditch)	DSR 252 (Early Ditch)	DSR 256 (Early Ditch)	DSR 314 (NWAC)	DSR 307 (NWAC)	DSR 305 (NWAC)	DSR 306 (NWAC)	DSR 312 (NWAC)	DSR 315 (NWAC)	DSR 339 (NWAC)	DSR 952 (NWAC)
Level of Service	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y
20Y Total Overflow Volume (MG)							0.05				0.14	
20Y Total Overflow Duration (Hrs)							7				6.25	
20Y Total Number of Activations							2				2	
20Y LOS(in years)							12.5				12.5	
10yr LOS Target Volume (MG)	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met
10yr LOS Target Peak Flow (MGD)	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met
Highest Volume (MG)							0.02				0.08	
2nd Highest Volume (MG)							0.02				0.07	
3rd Highest Volume (MG)												
4th Highest Volume (MG)												
5th Highest Volume (MG)												
6th Highest Volume (MG)												
7th Highest Volume (MG)												
8th Highest Volume (MG)												
9th Highest Volume (MG)												
10th Highest Volume (MG)												
11th Highest Volume (MG)												
12th Highest Volume (MG)												
13th Highest Volume (MG)												
14th Highest Volume (MG)												
15th Highest Volume (MG)												
16th Highest Volume (MG)												
17th Highest Volume (MG)												
18th Highest Volume (MG)												
19th Highest Volume (MG)												
20th Highest Volume (MG)												
Highest Peak Flow (MGD)							0.24				1.19	
2nd Peak Flow (MGD)							0.21				0.75	
3rd Peak Flow (MGD)												
4th Peak Flow (MGD)												
5th Peak Flow (MGD)												
6th Peak Flow (MGD)												
7th Peak Flow (MGD)												
8th Peak Flow (MGD)												
9th Peak Flow (MGD)												
10th Peak Flow (MGD)												
11th Peak Flow (MGD)												
12th Peak Flow (MGD)												
13th Peak Flow (MGD)												
14th Peak Flow (MGD)												
15th Peak Flow (MGD)												
16th Peak Flow (MGD)												
17th Peak Flow (MGD)												
18th Peak Flow (MGD)												
19th Peak Flow (MGD)												
20th Peak Flow (MGD)												

Category	Blueprint DSRs - Clintonville														PR DSRs
Description	DSR 326 (CVM)	DSR 323 (CVM)	DSR 335 (CVM)	DSR 352 (CVM)	DSR 346 (CVM)	DSR 351 (CVM)	DSR 360 (CVM)	DSR 337 (CVM)	DSR 349 (CVM)	DSR 368 (CVM)	DSR 285 (Walhalla)	DSR 328 (Walhalla)	DSR 898 (Walhalla)	DSR 329 (Walhalla)	DSR 364 (Plum Ridge)
Level of Service	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y
20Y Total Overflow Volume (MG)					0.01								0.07	0.01	0.02
20Y Total Overflow Duration (Hrs)					0.75								3.25	1.75	1.75
20Y Total Number of Activations					1								1	1	1
20Y LOS(in years)					33.2								33.2	33.2	33.2
10yr LOS Target Volume (MG)	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met
10yr LOS Target Peak Flow (MGD)	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met
Highest Volume (MG)					0.01								0.07	0.01	0.02
2nd Highest Volume (MG)															
3rd Highest Volume (MG)															
4th Highest Volume (MG)															
5th Highest Volume (MG)															
6th Highest Volume (MG)															
7th Highest Volume (MG)															
8th Highest Volume (MG)															
9th Highest Volume (MG)															
10th Highest Volume (MG)															
11th Highest Volume (MG)															
12th Highest Volume (MG)															
13th Highest Volume (MG)															
14th Highest Volume (MG)															
15th Highest Volume (MG)															
16th Highest Volume (MG)															
17th Highest Volume (MG)															
18th Highest Volume (MG)															
19th Highest Volume (MG)															
20th Highest Volume (MG)															
Highest Peak Flow (MGD)					0.41								0.85	0.21	0.29
2nd Peak Flow (MGD)															
3rd Peak Flow (MGD)															
4th Peak Flow (MGD)															
5th Peak Flow (MGD)															
6th Peak Flow (MGD)															
7th Peak Flow (MGD)															
8th Peak Flow (MGD)															
9th Peak Flow (MGD)															
10th Peak Flow (MGD)															
11th Peak Flow (MGD)															
12th Peak Flow (MGD)															
13th Peak Flow (MGD)															
14th Peak Flow (MGD)															
15th Peak Flow (MGD)															
16th Peak Flow (MGD)															
17th Peak Flow (MGD)															
18th Peak Flow (MGD)															
19th Peak Flow (MGD)															
20th Peak Flow (MGD)															

Models: IP Models\BLU\SSCM12_RPM_BLU+_wACISACTCleanup_woRamping_OPTCEPT_1995-2014.inp
Cutoff Values: Volume: 0.01 MG; Peak: 0.1 MGD; Duration: 0.25 hours

TABLE 6.5.10 » BLUEPRINT ALTERNATIVE TYPICAL YEAR MODEL RUN SUMMARY OF RESULTS, 2050 CONDITIONS

Category	Overall Summary				OARS/WWTP/ACST								Mainline DSRs								
Description	Total SSO (MG)	Total CSO (MG)	Total Bypasses (MG)	Total System Overflow (MG)	OARS OF	WSST Weir OF	WSST Emergency Gates	ACST	JPWWTP Mech Bypass	JPWWTP Gravity Bypass	SWWTP Gravity Bypass	CEPT	DSR 083 Deschler	DSR 095 West Side Sanitary	DSR 399 McKinley	DSR 873 Francisco Teteridge	DSR 284 FMN Pacemont Dr	DSR 156 FMN North of Hill Ave	DSR 244 Livingston James	DSR 246 Castle Rd PS	DSR 322 Williams Rd PS
Level of Service	N/A	N/A	N/A	N/A	4/TY	TY	TY	TY	1.4Y	1.4Y	1.4Y	N/A	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y
TY total overflow volume (MG)					0.59							18.7									
TY total overflow duration (Hrs)					1.5							4.8									
TY total number of activations		0.59		0.59	1							1									
TY highest OF event volume (MG)					0.6							18.7									
TY highest OF event peak flow (MGD)					29.7							110									
Highest Volume (MG)					0.6							18.7									
2nd Highest Volume (MG)																					
3rd Highest Volume (MG)																					
4th Highest Volume (MG)																					
5th Highest Volume (MG)																					
6th Highest Volume (MG)																					
7th Highest Volume (MG)																					
8th Highest Volume (MG)																					
9th Highest Volume (MG)																					
10th Highest Volume (MG)																					
11th Highest Volume (MG)																					
12th Highest Volume (MG)																					
13th Highest Volume (MG)																					
Highest Peak Flow (MGD)					29.7							110									
2nd Peak Flow (MGD)																					
3rd Peak Flow (MGD)																					
4th Peak Flow (MGD)																					
5th Peak Flow (MGD)																					
6th Peak Flow (MGD)																					
7th Peak Flow (MGD)																					
8th Peak Flow (MGD)																					
9th Peak Flow (MGD)																					
10th Peak Flow (MGD)																					
11th Peak Flow (MGD)																					
12th Peak Flow (MGD)																					
13th Peak Flow (MGD)																					

Category	CSO Regulator		Downtown CSO								Olentangy CSO Regulators							CSO Manholes							
Description	Markison	Dodge Park	Town	State	Capital	Broad	Long	Spring	Chestnut	Henry	First	Third	King	Indianola	Frambes	Doe Alley	Hudson	Mound/Grant	Noble/Grant	Town/Fourth	Rich/Fifth	Cherry/Fourth	Noble/Fourth	Mound e/71	Kerr/Russel
Level of Service	TY	TY	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	TY	TY	TY	TY	TY	TY	TY	TY	TY	TY	TY	TY	TY	TY	TY
TY total overflow volume (MG)																									
TY total overflow duration (Hrs)																									
TY total number of activations																									
TY highest OF event volume (MG)																									
TY highest OF event peak flow (MGD)																									
Highest Volume (MG)																									
2nd Highest Volume (MG)																									
3rd Highest Volume (MG)																									
4th Highest Volume (MG)																									
5th Highest Volume (MG)																									
6th Highest Volume (MG)																									
7th Highest Volume (MG)																									
8th Highest Volume (MG)																									
9th Highest Volume (MG)																									
10th Highest Volume (MG)																									
11th Highest Volume (MG)																									
12th Highest Volume (MG)																									
13th Highest Volume (MG)																									
Highest Peak Flow (MGD)																									
2nd Peak Flow (MGD)																									
3rd Peak Flow (MGD)																									
4th Peak Flow (MGD)																									
5th Peak Flow (MGD)																									
6th Peak Flow (MGD)																									
7th Peak Flow (MGD)																									
8th Peak Flow (MGD)																									
9th Peak Flow (MGD)																									
10th Peak Flow (MGD)																									
11th Peak Flow (MGD)																									
12th Peak Flow (MGD)																									
13th Peak Flow (MGD)																									

Models: IP Models\BLU\SSCM12_RPM_BLU+_wACISACTCleanup_woRamping_OptCEPT_TY.inp
Cutoff Values: Volume: 0.01 MG; Peak: 0.1 MGD; Duration: 0.25 hours

Category	Blueprint DSRs - Fifth by Northwest														
Description	DSR 103 (West Fifth)	DSR 109 (West Fifth)	DSR 111 (West Fifth)	DSR 107 (West Fifth)	DSR 110 (West Fifth)	DSR 105 (West Fifth)	DSR 154 (West Fifth)	DSR 151 (West Fifth)	DSR 146 (West Fifth)	DSR 149 (West Fifth)	DSR 150 (West Fifth)	DSR 147 (West Fifth)	DSR 915 (West Fifth)	DSR 148 (West Fifth)	DSR 157 (West Fifth)
Level of Service	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y
TY total overflow volume (MG)															
TY total overflow duration (Hrs)															
TY total number of activations															
TY highest OF event volume (MG)															
TY highest OF event peak flow (MGD)															
Highest Volume (MG)															
2nd Highest Volume (MG)															
3rd Highest Volume (MG)															
4th Highest Volume (MG)															
5th Highest Volume (MG)															
6th Highest Volume (MG)															
7th Highest Volume (MG)															
8th Highest Volume (MG)															
9th Highest Volume (MG)															
10th Highest Volume (MG)															
11th Highest Volume (MG)															
12th Highest Volume (MG)															
13th Highest Volume (MG)															
Highest Peak Flow (MGD)															
2nd Peak Flow (MGD)															
3rd Peak Flow (MGD)															
4th Peak Flow (MGD)															
5th Peak Flow (MGD)															
6th Peak Flow (MGD)															
7th Peak Flow (MGD)															
8th Peak Flow (MGD)															
9th Peak Flow (MGD)															
10th Peak Flow (MGD)															
11th Peak Flow (MGD)															
12th Peak Flow (MGD)															
13th Peak Flow (MGD)															

Category	Blueprint DSRs - Miller Kelton									Blueprint DSRs - Barthman Parsons								
Description	DSR 177 (Miller Kelton)	DSR 181 (Miller Kelton)	DSR 189 (Miller Kelton)	DSR 179 (Miller Kelton)	DSR 188 (Miller Kelton)	DSR 190 (Miller Kelton)	DSR 185 (Miller Kelton)	DSR 199 (Miller Kelton)	DSR 193 (Miller Kelton)	DSR 203 (Barthman)	DSR 201 (Barthman)	DSR 211 (Barthman)	DSR 207 (Barthman)	DSR 208 (Barthman)	DSR 206 (Barthman)	DSR 205 (Barthman)	DSR 210 (Barthman)	DSR 213 (Barthman)
Level of Service	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y
TY total overflow volume (MG)																		
TY total overflow duration (Hrs)																		
TY total number of activations																		
TY highest OF event volume (MG)																		
TY highest OF event peak flow (MGD)																		
Highest Volume (MG)																		
2nd Highest Volume (MG)																		
3rd Highest Volume (MG)																		
4th Highest Volume (MG)																		
5th Highest Volume (MG)																		
6th Highest Volume (MG)																		
7th Highest Volume (MG)																		
8th Highest Volume (MG)																		
9th Highest Volume (MG)																		
10th Highest Volume (MG)																		
11th Highest Volume (MG)																		
12th Highest Volume (MG)																		
13th Highest Volume (MG)																		
Highest Peak Flow (MGD)																		
2nd Peak Flow (MGD)																		
3rd Peak Flow (MGD)																		
4th Peak Flow (MGD)																		
5th Peak Flow (MGD)																		
6th Peak Flow (MGD)																		
7th Peak Flow (MGD)																		
8th Peak Flow (MGD)																		
9th Peak Flow (MGD)																		
10th Peak Flow (MGD)																		
11th Peak Flow (MGD)																		
12th Peak Flow (MGD)																		
13th Peak Flow (MGD)																		

Category	Blueprint DSRs - Hilltop				Blueprint DSRs - Linden/Northeast Area								Blueprint DSRs - Clintonville														PR DSRs
Description	DSR 250 (Early Ditch)	DSR 254 (Early Ditch)	DSR 252 (Early Ditch)	DSR 256 (Early Ditch)	DSR 314 (NWAC)	DSR 307 (NWAC)	DSR 305 (NWAC)	DSR 306 (NWAC)	DSR 312 (NWAC)	DSR 315 (NWAC)	DSR 339 (NWAC)	DSR 952 (NWAC)	DSR 326 (CVM)	DSR 323 (CVM)	DSR 335 (CVM)	DSR 352 (CVM)	DSR 346 (CVM)	DSR 351 (CVM)	DSR 360 (CVM)	DSR 337 (CVM)	DSR 349 (CVM)	DSR 368 (CVM)	DSR 285 (Walhalla)	DSR 328 (Walhalla)	DSR 898 (Walhalla)	DSR 329 (Walhalla)	DSR 364 (Plum Ridge)
Level of Service	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y
TY total overflow volume (MG)																											
TY total overflow duration (Hrs)																											
TY total number of activations																											
TY highest OF event volume (MG)																											
TY highest OF event peak flow (MGD)																											
Highest Volume (MG)																											
2nd Highest Volume (MG)																											
3rd Highest Volume (MG)																											
4th Highest Volume (MG)																											
5th Highest Volume (MG)																											
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11th Highest Volume (MG)																											
12th Highest Volume (MG)																											
13th Highest Volume (MG)																											
Highest Peak Flow (MGD)																											
2nd Peak Flow (MGD)																											
3rd Peak Flow (MGD)																											
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10th Peak Flow (MGD)																											
11th Peak Flow (MGD)																											
12th Peak Flow (MGD)																											
13th Peak Flow (MGD)																											

Models: IP Models\BLU\SSCM12_RPM_BLU+_wACISACTCleanup_woRamping_OptCEPT_TY.inp
Cutoff Values: Volume: 0.01 MG; Peak: 0.1 MGD; Duration: 0.25 hours

TABLE 6.6.1 » SCORING CRITERIA FOR RANKING BLUEPRINT AREAS

Weight	Category	Score Basis	0 Points	1 Point	2 Points	3 Points	4 Points	5 Points
40%	SSOs	Number of SSO Locations	0 - 1	2 - 3	4 - 5	6 - 7	8 - 9	10+
		Number of SSO Activations	0 - 15	16 - 30	31 - 45	46 - 60	61 - 75	76+
25%	Exposure Risk	SSO activations to tributaries	0	1 - 5	6 - 10	11 - 15	16 - 20	21+
		SSO activations near parks (500 ft.)	0	N/A	1 - 5	6 - 10	11 - 15	16+
		SSO activations near schools (500 ft.)	0	1 - 5	6 - 10	11 - 15	16 - 20	21+
25%	WIBs	Number of wet weather WIBs	0 - 20	21 - 40	41 - 60	61 - 80	81 - 100	101+
10%	Structural/ O&M	Length of pipe with SCREAM* score of 90-100	0 - 2,000	2,001 - 4,000	4,001 - 6,000	6,001 - 8,000	8,001 - 10,000	10,000+
Social Implementability		Used as a validation as to the next area to go to, utilizing the 7 objective criteria above as the initial criteria. This criteria will validate and finalize the ranking once community readiness is assessed.						

* SCREAM© is the name of the database used to track sewer system conditions.

TABLE 6.6.2 PRIORITIZATION RESULTS AND SCHEDULE

Rank	Blueprint Project Areas	SSOs	Pts	Act	Pts	Trib	Pts	Park	Pts	Schl.	Pts	WIBs	Pts	SCREAM	Pts	Score
1	Clintonville 1	5	2	82	5	14	3	23	5	0	0	74	3	1,805	0	2.82
2	North Linden 1	7	3	83	5	83	5	0	0	83	5	273	5	16,653	5	4.18
3	Hilltop 1 + Miller Kelton	8	4	55	3	55	5	16	5	28	5	185	5	7,753	3	4.20
4	Fifth by Northwest + West Franklinton + Hilltop 4	16	5	174	5	16	4	21	5	16	4	122	5	14,114	5	4.83
5	Clintonville 3	7	3	73	4	17	4	66	5	0	0	121	5	3,083	1	3.50
6	Near South	7	3	95	5	0	0	0	0	0	0	74	3	15,678	5	2.85
7	Clintonville 2	4	2	29	1	1	1	29	5	0	0	74	3	417	0	1.85
8	James Livingston 5 + Plum Ridge	1	0	7	0	7	2	0	0	0	0	101	5	9,441	4	1.82
9	Hilltop 2	1	0	3	0	3	1	3	1	0	0	81	4	6,689	3	1.47
10	North Linden 2	0	0	0	0	0	0	0	0	0	0	178	5	4,588	2	1.45
11	James Livingston 3	1	0	1	0	1	1	0	0	0	0	101	5	3,997	1	1.43
12	South Linden	0	0	0	0	0	0	0	0	0	0	96	4	8,759	4	1.40
13	James Livingston 2	0	0	0	0	0	0	0	0	0	0	146	5	2,989	1	1.35
14	James Livingston 4	0	0	0	0	0	0	0	0	0	0	114	5	2,998	1	1.35
15	Hilltop 3	0	0	0	0	0	0	0	0	0	0	80	3	6,274	3	1.05
16	James Livingston 1	0	0	0	0	0	0	0	0	0	0	71	3	2,814	1	0.85
17	Near East	0	0	0	0	0	0	0	0	0	0	76	3	1,025	0	0.75

FIGURE 6.5.1 » PHASE 2 OF THE LOWER OLENTANGY TUNNEL (LOT2) FOR THE BLUEPRINT ALTERNATIVE

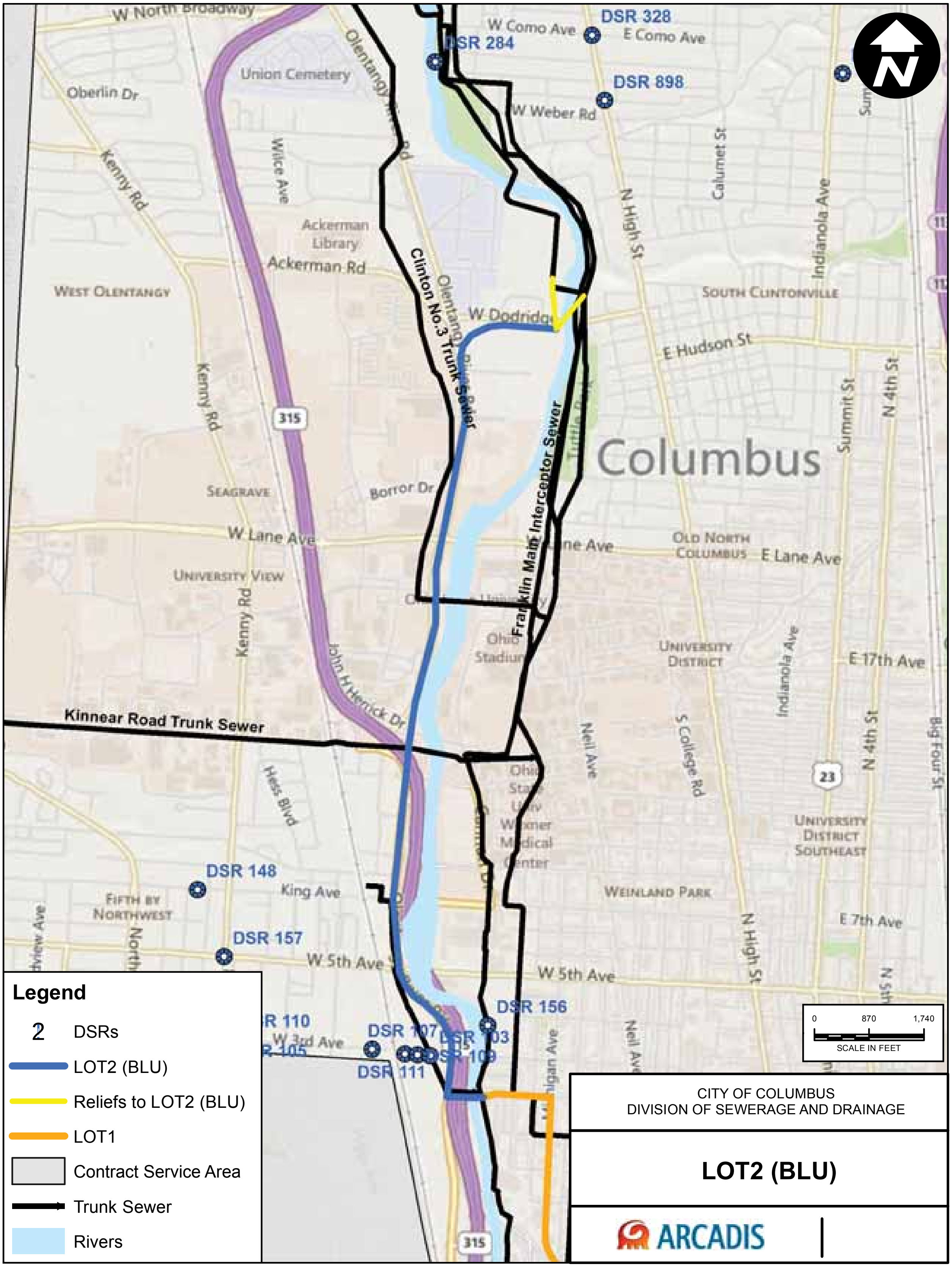


FIGURE 6.5.2 » THE SECOND INTERCONNECTOR BARREL

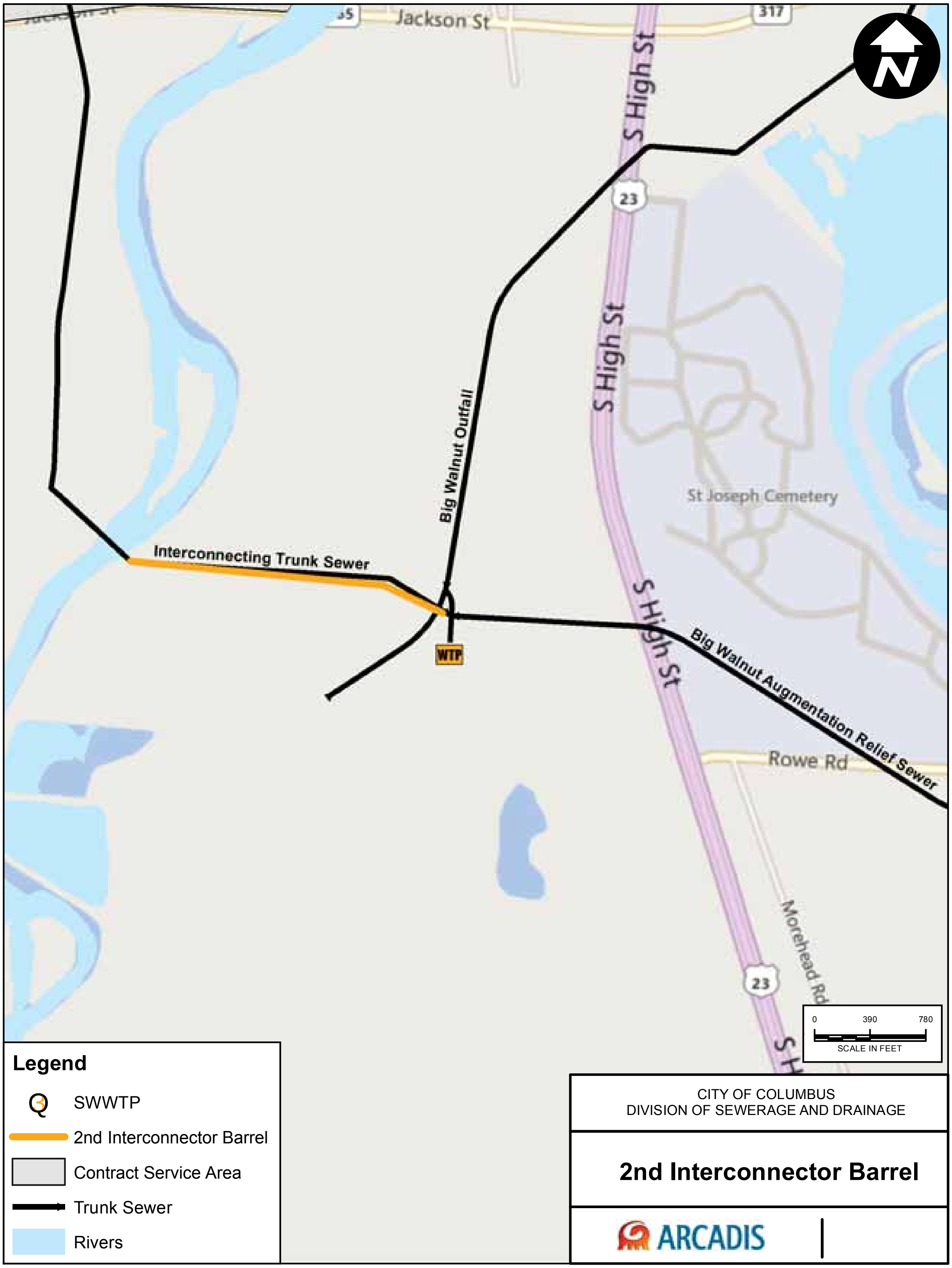


FIGURE 6.5.3 » DSR 873 RELIEF

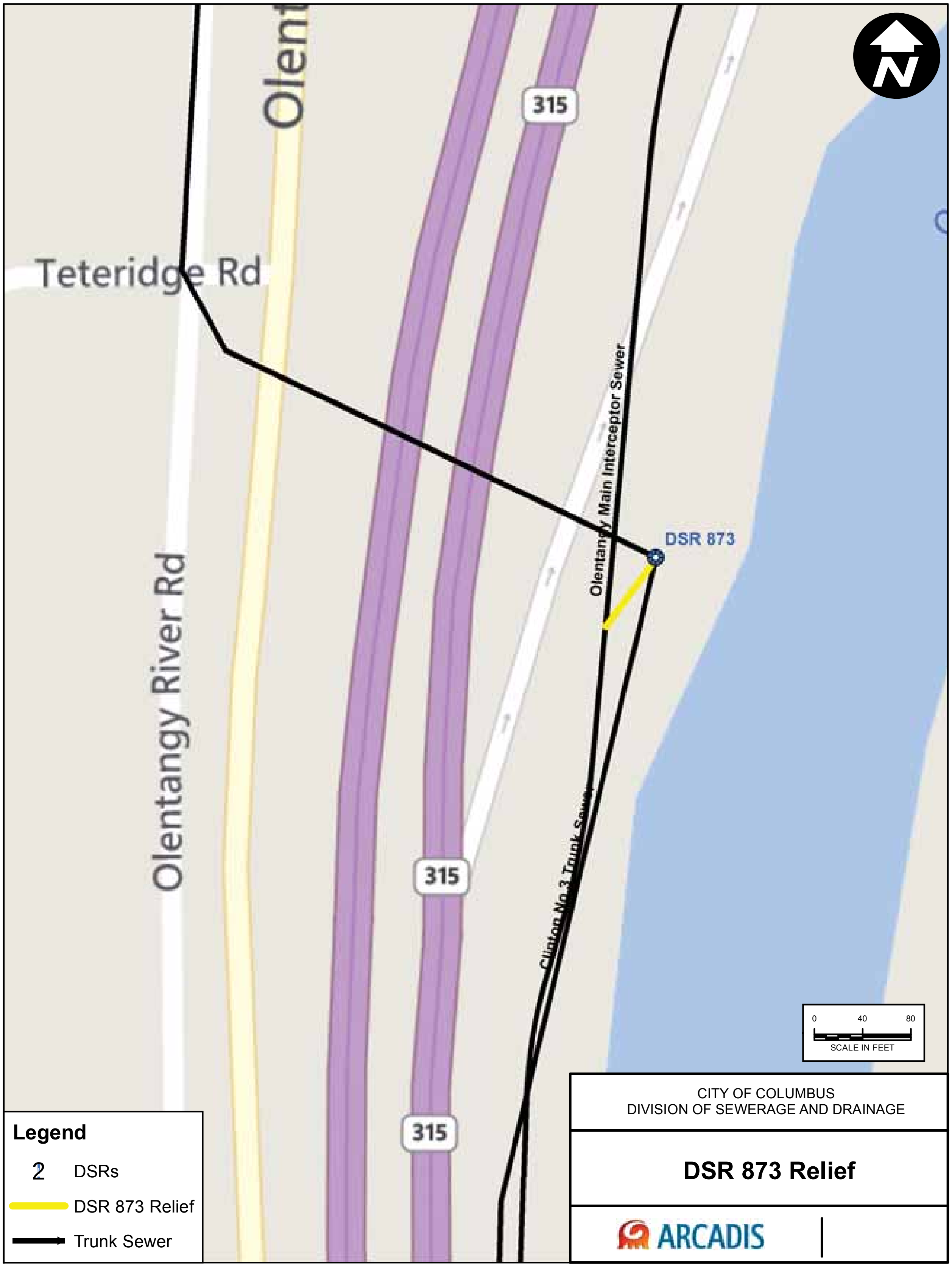


FIGURE 6.5.4 » CLINTONVILLE BLUEPRINT ALTERNATIVE – PROJECTS LOCATION

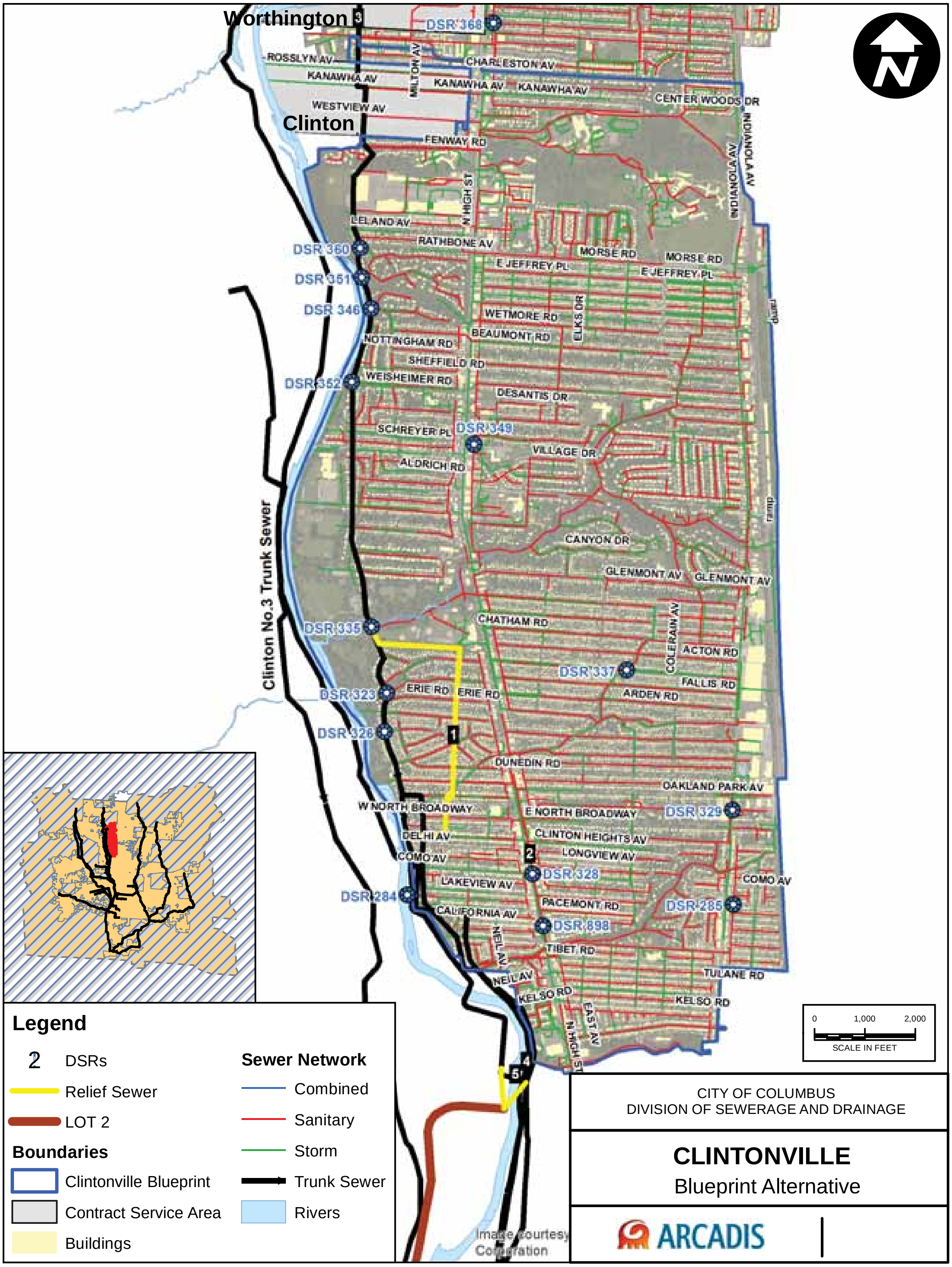


FIGURE 6.5.5 » HILLTOP BLUEPRINT ALTERNATIVE – PROJECTS LOCATION

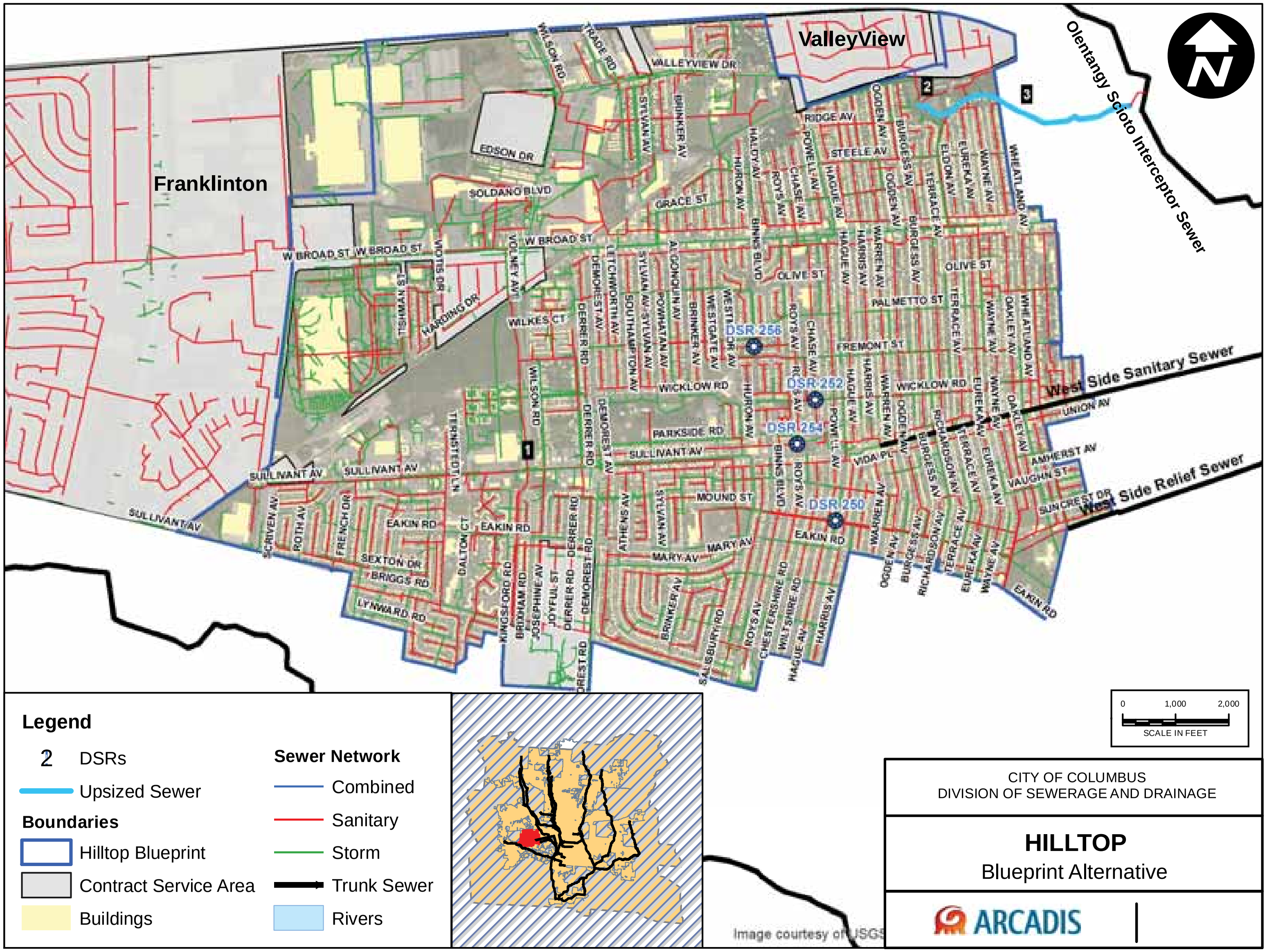


FIGURE 6.5.6 » LINDEN BLUEPRINT ALTERNATIVE – PROJECTS LOCATION

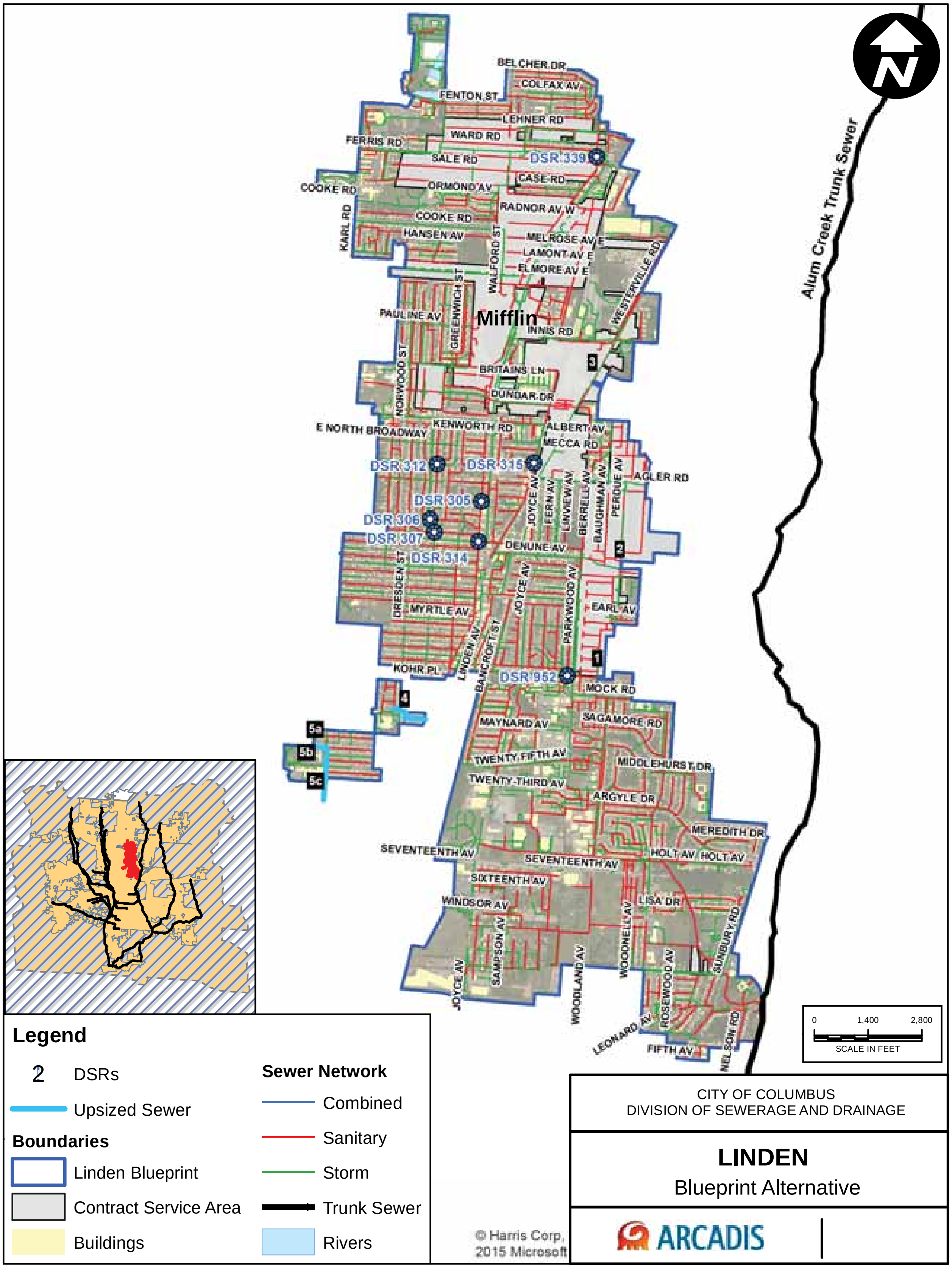


FIGURE 6.5.7 » MILLER KELTON BLUEPRINT ALTERNATIVE – PROJECTS LOCATION

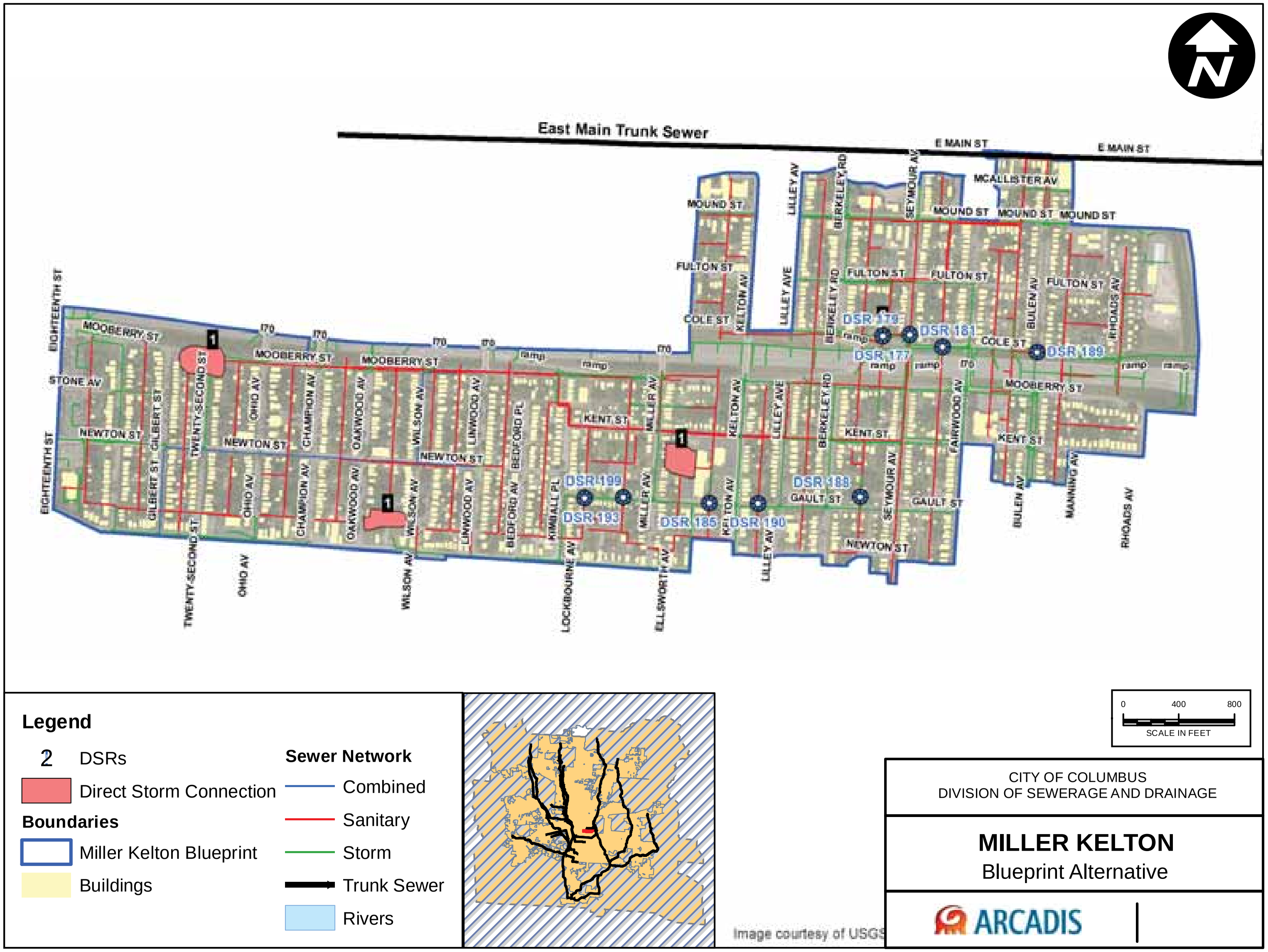


FIGURE 6.5.8 » PLUM RIDGE BLUEPRINT ALTERNATIVE – PROJECTS LOCATION

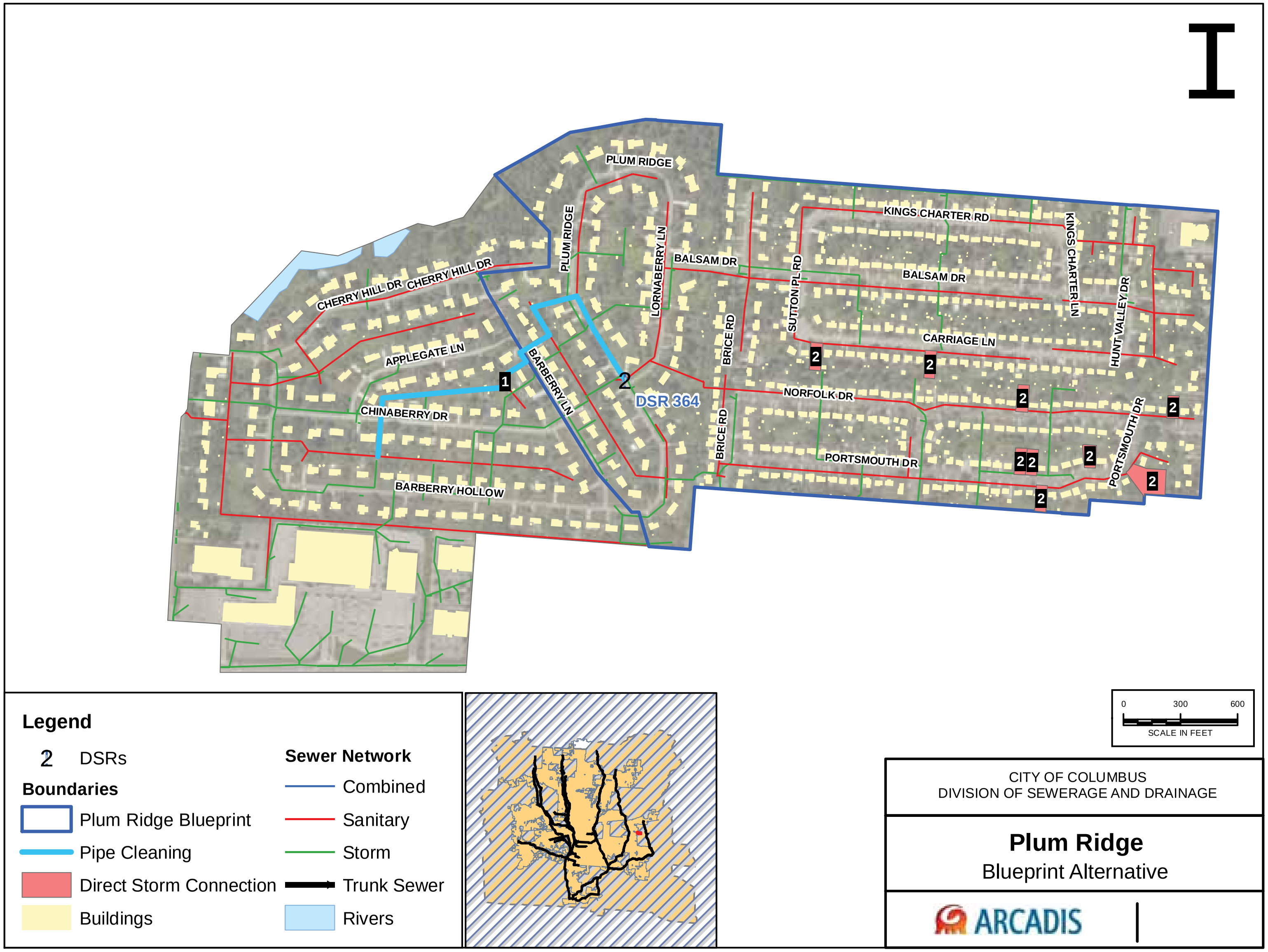


FIGURE 6.5.9 » NEAR SOUTH BLUEPRINT ALTERNATIVE – PROJECTS LOCATION

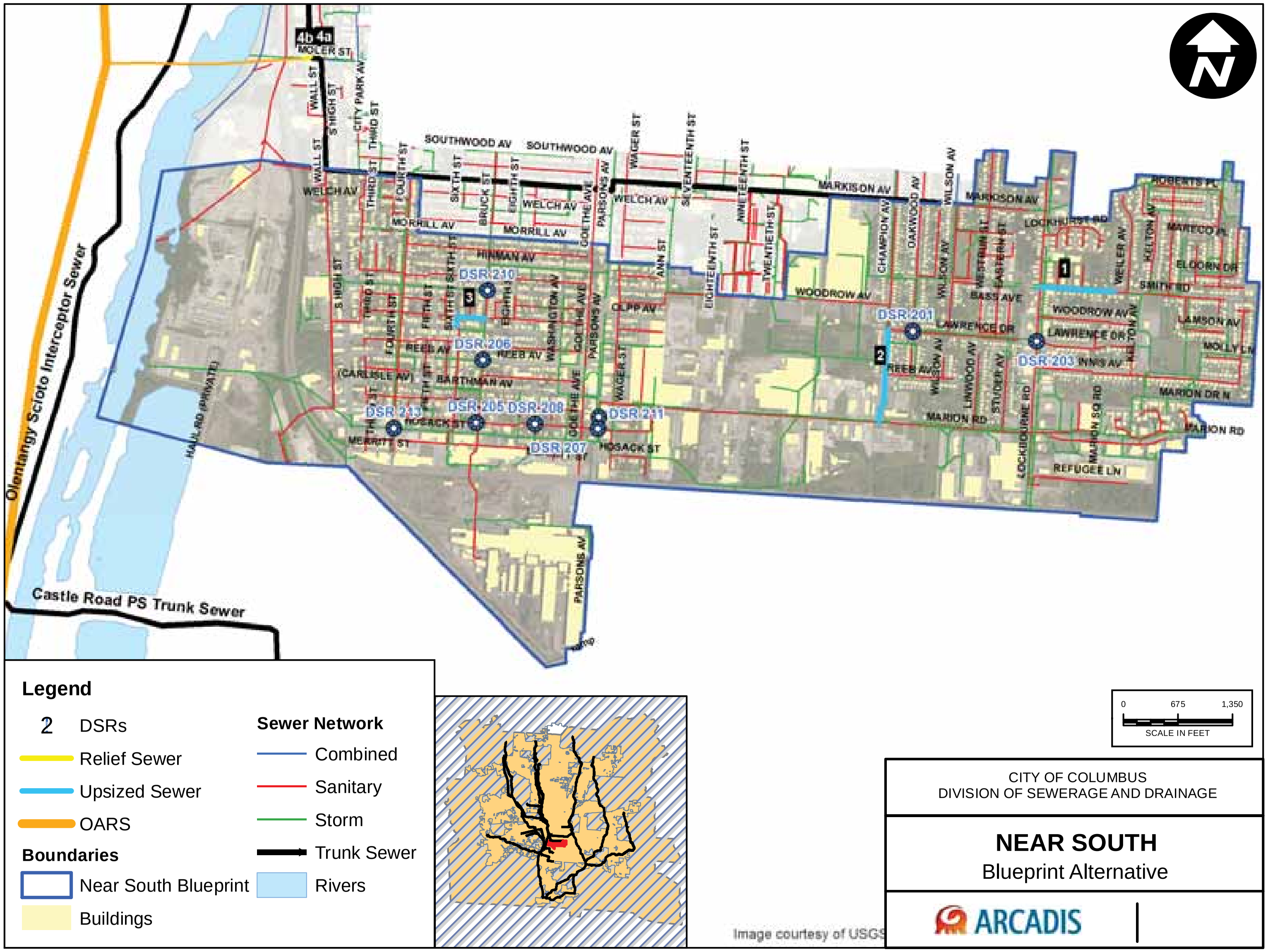


FIGURE 6.5.10 » FIFTH BY NORTHWEST BLUEPRINT ALTERNATIVE – PROJECTS LOCATION

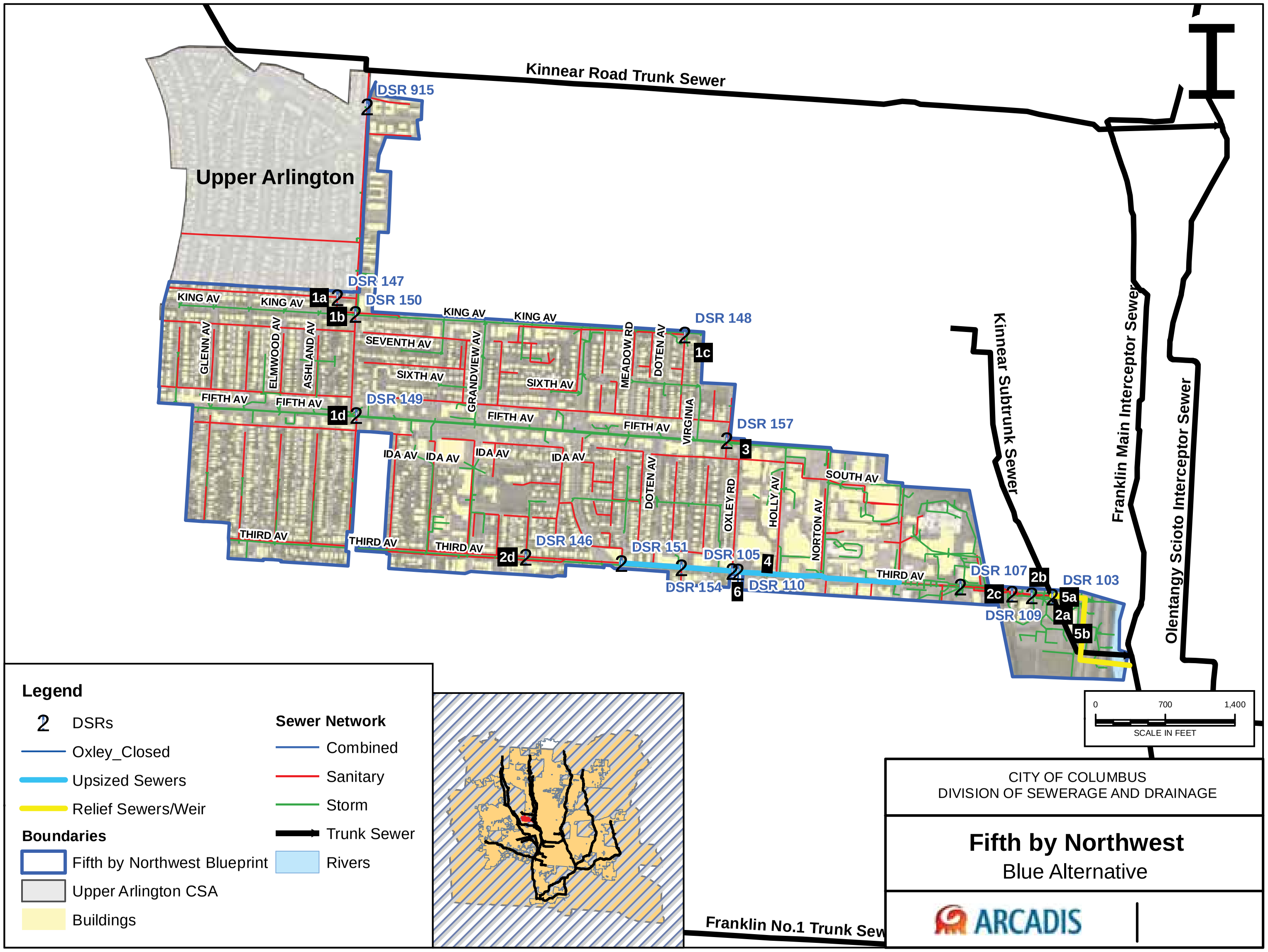


FIGURE 6.5.11 » WEST FRANKLINTON BLUEPRINT ALTERNATIVE – PROJECTS LOCATION

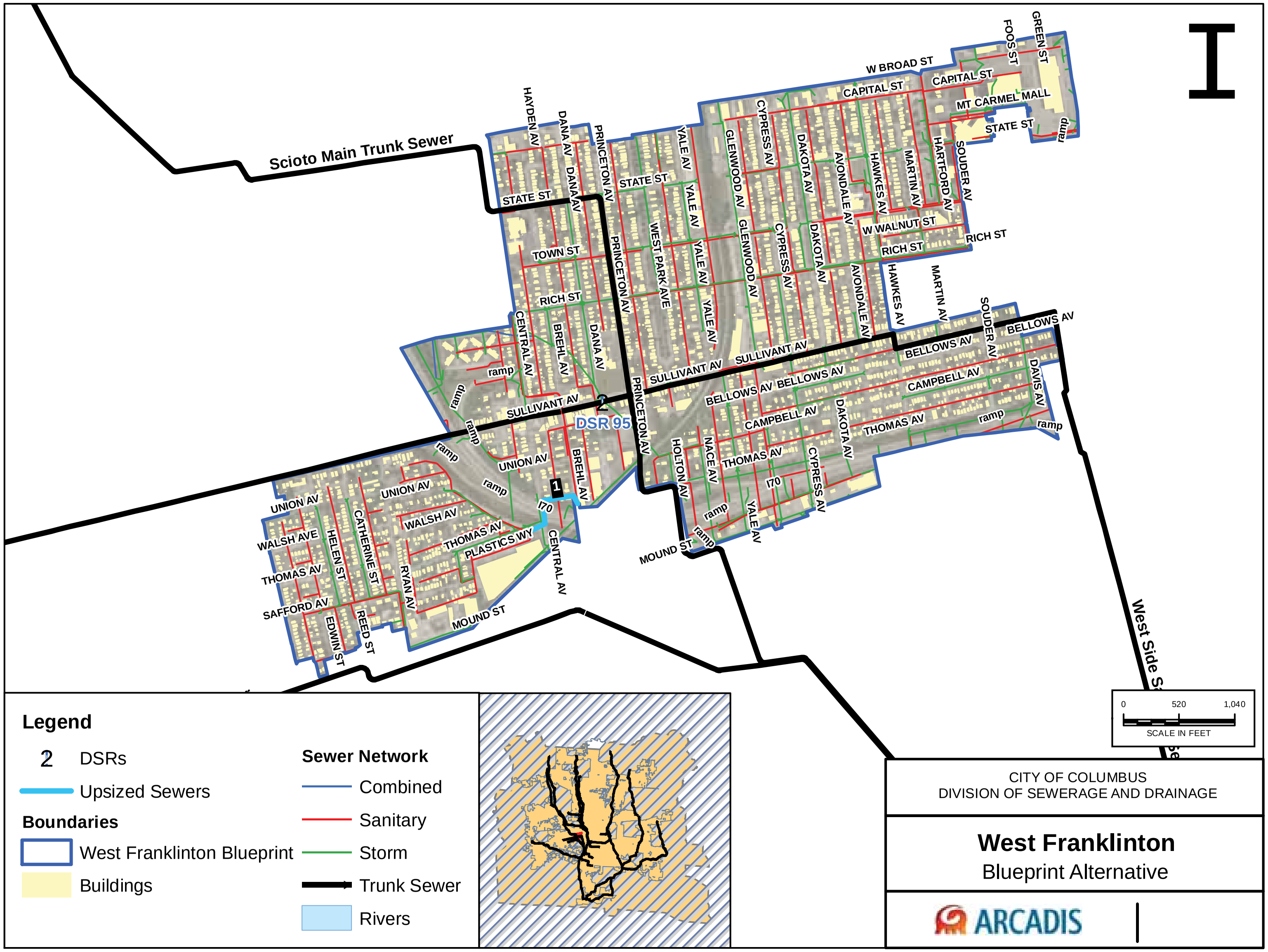


FIGURE 6.5.12 » SYSTEMWIDE BLUEPRINT ALTERNATIVE – WATER IN BASEMENTS (WIBS)

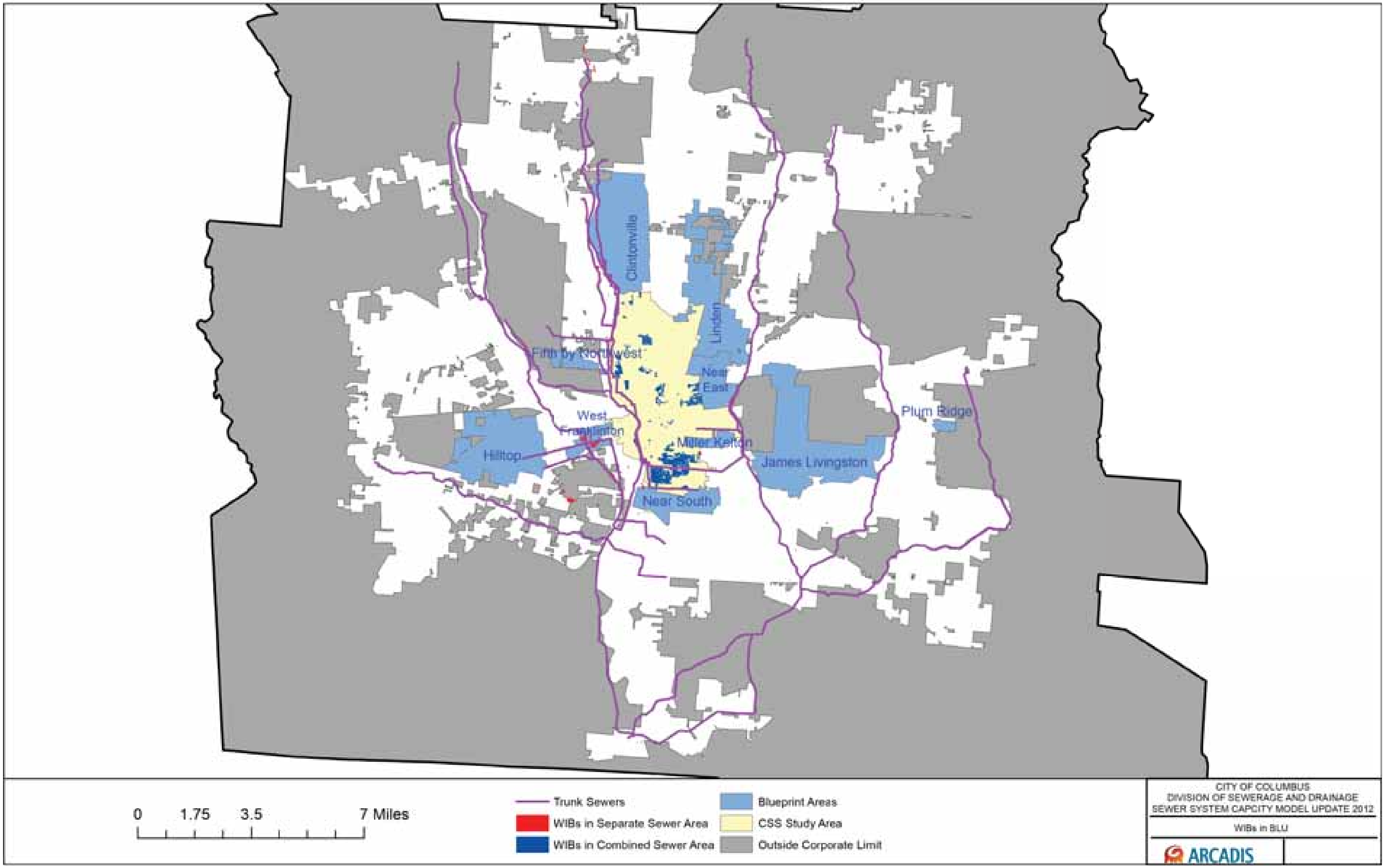
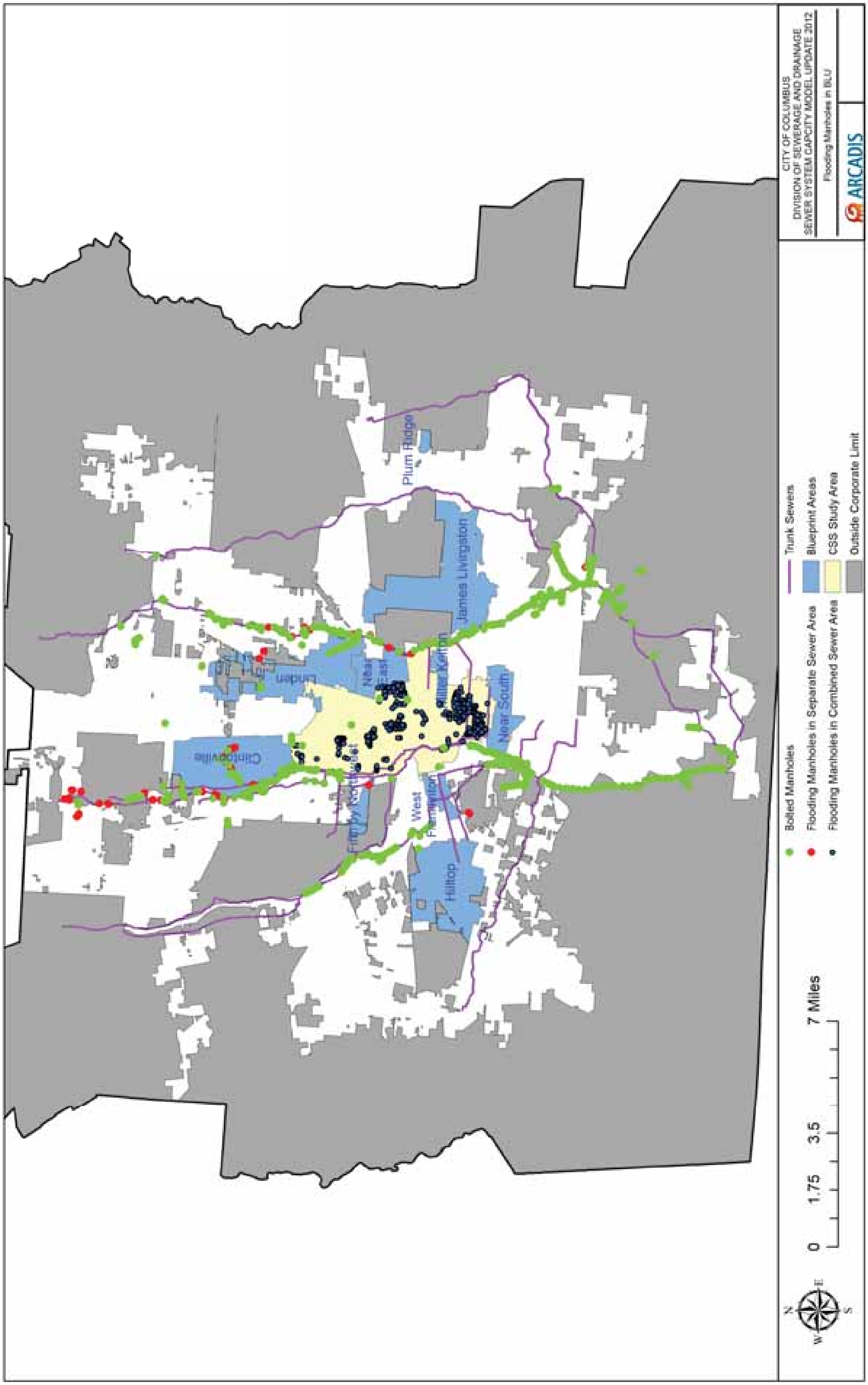


FIGURE 6.5.13 » SYSTEMWIDE BLUEPRINT ALTERNATIVE FLOODING MANHOLES



SECTION 7

7

2015 WET WEATHER MANAGEMENT PLAN

(GRAY ALTERNATIVE)

THE CITY OF COLUMBUS
MICHAEL B. COLEMAN, MAYOR

DEPARTMENT OF PUBLIC UTILITIES

The Integrated Plan and
2015 WWMP Update Report

Clean streams. Strong neighborhoods.

BLUE PRINT COLUMBUS
Clean streams.
Strong neighborhoods.

7 2015 WET WEATHER MANAGEMENT PLAN (GRAY ALTERNATIVE)

This section describes the updated gray alternative to improve the hydraulic deficiency conditions in the collection system. Deficiencies are locations where the desired level of service (LOS) is not met.

7.1. Gray Alternative

The gray alternative (or 2015 WWMP) reflects an updated version of the original 2005 Wet Weather Management Plan (WWMP). The gray alternative does not rely on inflow and infiltration (I/I) mitigation technologies to achieve the desired LOS. Instead, it makes use of gray technologies such as conveyance improvements, deep tunnels and local storage. It was desirable to update the original alternative for the following reasons:

- The pipe network has changed since the time that the original alternative was developed.
- Improvements have been made within the collection system model with respect to how the system hydrology is represented.
- The collection system model has been recalibrated using more recent flow data.
- The original alternative was developed based on a 1-foot above crown maximum hydraulic grade line criterion, which is overly conservative and contrary to maximizing the collection system.

7.1.1 System-wide Large System Strategy (LSSS) Gray Alternative

System-wide deficiencies require large scale solutions. These solutions solve hydraulic deficiencies in the main trunk sewers and provide free outfall for the local areas. The system-wide LSS included in the gray alternative are summarized in Table 7.1.1 and described in the following subsections.

7.1.1.1 Lower Olentangy Tunnel Phase 2

Phase 2 of the Lower Olentangy Tunnel (LOT2) (Figure 7.1.1) for the gray alternative is a 9-foot diameter tunnel that extends phase 1 (LOT1) which is described in Section 5 as part of the system base condition in 2025 from its upstream terminal point to north past Stinchcomb Drive. The gray alternative version of the LOT2 tunnel is longer in length than the Blueprint alternative version of LOT2. The proposed alignment is along Olentangy River Road, with a total length of 16,100 ft. LOT2 provides hydraulic relief to the collection system at three points:

- Clinton #3 trunk sewer close to manhole 0126S0187 (near Olentangy River Road north of Stinchcomb Drive)
- Franklin Main Interceptor Sewer (FMI) close to manhole 0126S0249 (east of the intersection of Dorris Avenue and Sunset Drive)
- Olentangy Main Interceptor (OMI) sewer close to manhole 0126S0255 (near Sunset Cove)

LOT2 provides the following benefits:

- Reduces the peak hydraulic grade line (HGL) along the Clinton #3 trunk sewer, FMI and OMI sewer during large events.
- Assists with the attainment of the 10-year LOS for designed sanitary relief (DSR) 284, a mainline DSR on the FMI.
- Assists with the attainment of the 10-year LOS for DSR 898, a Walhalla area DSR.
- Assists with the closure of DSR 328, a Walhalla area DSR.

7.1.1.2 Lower Olentangy Tunnel Phase 3

Phase 3 of the Lower Olentangy Tunnel (LOT3) (Figure 7.1.2) is a 9-foot diameter tunnel that starts at the upstream termination point of LOT2 and ends south of Knightsbridge Boulevard. LOT3 is only part of the gray alternative. The proposed alignment is along Olentangy River Road, with a total length of 13,500 ft. LOT3 provides hydraulic relief to the collection system at six points:

- Clintonville Main trunk sewer close to manhole 0175S0159 (manhole associated with DSR 326)
- Clintonville Main trunk sewer close to manhole 0232S0156 (near DSR 335)
- Clintonville Main trunk sewer close to manhole 0232S0152 (south of Ceramic Drive)
- Clintonville Main trunk sewer close to manhole 0297S0118 (manhole associated with DSR 346)
- Clintonville Main trunk sewer close to manhole 0370S0195 (manhole associated with DSR 360)
- OMI sewer close to manhole 0297S0110 (south of Bethel Road)

LOT3 provides the following benefits:

- Reduces the peak HGL along the Clintonville Main trunk and OMI sewer during large events.
- Assists with the closure of the following Clintonville area DSRs: 326, 335, 346, and 360.

7.1.1.3 Alum Creek Relief Tunnel

The Alum Creek Relief Tunnel (ART) is a 12-foot diameter tunnel that starts at a point north of Interstate I-270 and west of Alum Creek Drive and ends at a point on Nelson Road south of Clifton Avenue. The ART tunnel is only part of the gray alternative, and is not needed as part of the Bluerprint alternative. The proposed alignment is along Alum Creek Drive for the southern portion of ART, and along Nelson Road for the northern portion (Figure 7.1.3). The total proposed length is 38,800 feet. ART provides hydraulic relief at four locations:

- Alum Creek trunk sewer close to manhole 0063S0218 (near DSR 244)
- Alum Creek trunk sewer close to manhole 0061S0147 (across from the Alum Creek storm tank)
- Alum Creek Interceptor Sewer close to manhole 0061S0039 (near the Alum Creek storm tank)
- Alum Creek trunk sewer close to manhole 0033S1225 (south of Clifton Avenue)

ART provides the following benefits:

- Reduces the peak HGL along the Alum Creek trunk sewer and Alum Creek Interceptor Sewer during large events.
- Provides storage that can be used to reduce bypasses at Southerly Wastewater Treatment Plant (SWWTP), as well as to reduce the use of Chemically Enhanced Primary Treatment (CEPT) at SWWTP.

7.1.1.4 Interconnector to SWWTP Second Barrel

The Interconnector trunk sewer (INT) routes flow above the treatment capacity of Jackson Pike Wastewater Treatment Plant (JPWWTP) to SWWTP. The existing INT sewer consists of a 13-foot diameter sewer for most of its length. However, the INT is connected to SWWTP through an 8.5-foot sewer. To alleviate this bottleneck, a parallel 8.5-foot diameter sewer was added, with a total length of 2,175 feet (Figure 7.1.4). This project is the same for both the gray and Blueprint alternatives.

The second INT barrel to SWWTP provides the following benefits:

- Reduces the peak HGL along the INT sewer and the upstream tributary sewers during large events.
- Reduces the activations for DSR 95, a mainline DSR on the west side sanitary sewer.

7.1.1.5 DSR 873 Relief

DSR 873 is a mainline DSR located on the Clinton #3 trunk sewer. In order to be able to attain the desired 10-year LOS at this DSR, a 70-feet-long 2-feet diameter relief pipe was added from manhole 0232S0083 (DSR 873) on the Clinton #3 trunk sewer to manhole 0232S0340 on the OMI sewer (Figure 7.1.5). This project is the same for both the gray and Blueprint alternatives.

7.1.2 Local Areas Gray Alternative

This section describes the proposed solutions to local areas deficiencies. Based on the hydraulic model results, there are ten local areas that have potential DSR activations and/or high water in basement (WIB) recurrence in less than a 10-year return frequency. These areas are:

1. Clintonville
2. Hilltop
3. Linden
4. Miller Kelton
5. Plum Ridge
6. Near South
7. James Livingston
8. Fifth by Northwest
9. West Franklinton
10. Near East

Figure 7.1.6 presents the location of these areas.

The gray alternative solution to these local areas is mainly dependent on additional relief sewers, upsizing existing sewers, cleaning and lining sewers and local storages.

Each local area will be described and the selected solution will be detailed. Frequency of deficiencies after applying the solutions will be presented and discussed.

7.1.2.1 Clintonville Gray Alternative

The gray alternative includes projects aimed to address DSR activations and WIBs identified from the analysis of base conditions. In the base conditions, 11 out of 14 DSRs did not meet the 10-year LOS. See Table 7.1.2. As shown in Table 7.1.2, gray alternative improves the LOS for the DSRs to 10 years or more. Exhibit 7.1.1 below shows the reduction in model-predicted WIBs in the Clintonville Blueprint area in comparison to the base conditions for the gray alternative.

EXHIBIT 7.1.1 » MODEL PREDICTED WIBs IN CLINTONVILLE BLUEPRINT AREA

	Base Model	Gray Alternative
Model Predicted WIBs in a 20-Year Simulation	1547	9

In the gray alternative, the Clintonville Main Trunk Sewer (CVM) is significantly influenced by the construction of two 9-foot tunnels: LOT3 and LOT2. Along the Clintonville Main trunk, wet weather flow is relieved at five locations and conveyed into LOT3. Three relief points allow for the closing of four DSRs (360, 346, 335, and 326).

Activations of DSR 349 are addressed by raising the weir elevation to the pipe crown (from 0.73 feet to 1.25 feet) and upsizing downstream pipes. DSR 328 is closed. Upsizing of pipes starting upstream of DSR 328 to the Franklin Main Interceptor Sewer addresses activations of DSR 898 and local WIBs. DSR 329 meets the 10-year LOS by upsizing the pipes between manholes 0176S0243 and 0176S0053. Additional upsizing and relief projects are planned to mitigate WIBs across the basin. All the projects for the Clintonville gray alternative are described below and listed in detail in Table 7.1.3 and their location is shown in Figure 7.1.7. The project IDs link the projects shown in the table to those shown in the figure.

7.1.2.2 Hilltop Gray Alternative

The Hilltop gray alternative includes a series of projects aimed to address DSR activations and WIBs that resulted from the analysis of base conditions. In the base conditions, three out of four DSRs would not meet the 10-year LOS (Exhibit 7.1.2). As shown in Exhibit 7.1.2, gray alternative improves the LOS for the DSRs to more than10 years with no activations over 20 years. Exhibit 7.1.3 below shows the reduction in model-predicted WIBs in the Hilltop Blueprint area in comparison to the base conditions for the gray alternative.

EXHIBIT 7.1.2 » HILLTOP AREA DSRs, BASE VERSUS GRAY ALTERNATIVE MODEL CONDITIONS

DSR ID >		250	254	252	256
Base Model Simulation	Number of Activations in 20 Years	29	18	1	6
	Level of Service (LOS)	0.7	1.1	33.2	3.6
Gray Alternative Model Simulation	Number of Activations in 20 Years	-	-	-	-
	Level of Service (LOS)	-	-	-	-

EXHIBIT 7.1.3 » MODEL PREDICTED WIBs IN HILLTOP BLUEPRINT AREA

	Base Model	Gray Alternative
Model Predicted WIBs in a 20-Year Simulation	1819	2

A combination of upsized and relief sewers along and in proximity of Parkside Road, Roys Avenue and Wicklow Road is planned to mitigate overflows from DSR 254, while new pipes along Binns Boulevard and Wicklow Road are planned to address DSR 256. Overflows at DSR 250 are mitigated by redirecting the sanitary flow to the Big Run trunk sewer. Additional upsizing and relief sewers are planned to address WIBs across the basin. Table 7.1.4 provides a comprehensive list of all the projects involved in the Hilltop gray alternative along with detailed information. Figure 7.1.8 shows their locations across the basin. The project IDs link the projects shown in the table to those shown in the figure.

7.1.2.3 Linden Gray Alternative

In the Linden gray alternative, projects are expected to solve DSR activations and WIBs identified during the analysis of the base conditions. In the base conditions, four out of eight DSRs would not meet the 10-year LOS (Exhibit 7.1.4). As shown in Exhibit 7.1.4, gray alternative improves the LOS for the DSRs to more than 10 years with no activations over 20 years. Exhibit 7.1.5 below shows the reduction in model-predicted WIBs in the Linden Blueprint area in comparison to the base conditions for the gray alternative.

EXHIBIT 7.1.4 » LINDEN AREA DSRs, BASE VERSUS GRAY ALTERNATIVE MODEL CONDITIONS

DSR ID >		314	307	305	306	312	315	339	952
Base Model Simulation	Number of Activations in 20 Years	-	-	39	7	-	17	9	-
	Level of Service (LOS)	-	-	0.5	3.0	-	1.2	2.3	-
Gray Alternative Model Simulation	Number of Activations in 20 Years	-	-	-	-	-	-	-	-
	Level of Service (LOS)	-	-	-	-	-	-	-	-

EXHIBIT 7.1.5 » MODEL PREDICTED WIBs IN LINDEN BLUEPRINT AREA

	Base Model	Gray Alternative
Model Predicted WIBs in a 20-Year Simulation	1260	10

The Ferris Road relief sewer aims to reduce overflows at DSR 339. The relief sewer along both Suwanee Road and the railroad mitigates both DSR 315 and DSR 305. An additional relief sewer is planned for DSR 305 along Lakeview Avenue sewer upsizing along Melrose Avenue and Weber Road, which reduces DSR 306 overflows. Additional relief and upsized sewers mitigate WIBs within the basin. Moreover, the four weirs regulating the flow relieved into the Alum Creek trunk sewer on the east boundary of the basin are removed. Upsizing existing sewers address the WIBs identified in base conditions in the smaller area on the southwest side of the basin. All the projects included in the gray alternative for Linden are reported in detail in Table 7.1.5 and their location is shown in Figure 7.1.9. The project IDs link the projects shown in the table to those shown in the figure.

7.1.2.4 Miller Kelton Gray Alternative

The Miller Kelton gray alternative involves projects aimed to mitigate DSR activations and WIBs identified in the base conditions. In the base conditions, five out of nine DSRs would not meet the 10-year LOS (Exhibit 7.1.6.) As shown in Exhibit 7.1.6, gray alternative improves the LOS for the DSRs to more than 10 years with no activations over 20 years. Exhibit 7.1.7 below shows the reduction in model-predicted WIBs in the Miller Kelton Blueprint area in comparison to the base conditions for the gray alternative.

EXHIBIT 7.1.6 » MILLER KELTON AREA DSRs, BASE VERSUS GRAY ALTERNATIVE MODEL CONDITIONS

DSR ID >		177	181	189	179	188	190	185	199	193
Base Model Simulation	Number of Activations in 20 Years	76	3	8	5	-	-	6	-	-
	Level of Service (LOS)	0.3	7.7	2.6	4.3	-	-	3.6	-	-
Gray Alternative Model Simulation	Number of Activations in 20 Years	-	-	-	-	-	-	-	-	-
	Level of Service (LOS)	-	-	-	-	-	-	-	-	-

EXHIBIT 7.1.7 » MODEL PREDICTED WIBs IN MILLER KELTON BLUEPRINT AREA

	Base Model	Gray Alternative
Model Predicted WIBs in a 20-Year Simulation	59	0

Upsizing of the sewer downstream of DSR 177, from Cole St. to East Main Street, reduces its overflows. A relief sewer along Cole Street and Bulen Avenue until East Main Street diverts the flow away from DSRs 179, 181 and 189. Raising the weir elevation at DSR 185 addresses its overflows. No further projects are necessary to address WIBs within the basin. However, the gray alternative includes the redirection of the stormwater contribution derived from three identified areas of public source inflow.

All the projects included in the gray alternative for Miller Kelton are reported in Table 7.1.6 and their location is shown in Figure 7.1.10. The project IDs link the projects shown in the table to those shown in the figure.

7.1.2.5 Plum Ridge Gray Alternative

The gray alternative solutions for Plum Ridge include upsizing the existing sewer pipes, adding new relief sewers into the system, and removing the known driveway drain stormwater inflow. In base conditions, DSR 364 would not meet the 10-year LOS. As shown in Exhibit 7.1.8, gray alternative improves the LOS for the DSR 364 to more than10 years with no activations over 20 years. Exhibit 7.1.9 below shows the reduction in model-predicted WIBs in the Plum Ridge Blueprint area in comparison to the base conditions for the gray alternative.

EXHIBIT 7.1.8 » PLUM RIDGE AREA DSRs, BASE VERSUS GRAY ALTERNATIVE MODEL CONDITIONS

	DSR ID >	364
Base Model Simulation	Number of Activations in 20 Years	49
	Level of Service (LOS)	0.4
Gray Alternative Model Simulation	Number of Activations in 20 Years	-
	Level of Service (LOS)	-

EXHIBIT 7.1.9 » MODEL PREDICTED WIBs IN PLUM RIDGE BLUEPRINT AREA

	Base Model	Gray Alternative
Model Predicted WIBs in a 20-Year Simulation	152	0

Table 7.1.7 shows all the projects associated with the gray alternative solutions for the Plum Ridge Blueprint area with detailed information associated with the project type, description, length, the original pipe size (for upsized pipes) and the new proposed pipe size. The location of each project is shown in Figure 7.1.11 with the corresponding project ID indicated in Table 7.1.7.

7.1.2.6 Near South Gray Alternative

The Near South gray alternative consists of projects planned to address both DSR overflows and WIBs that emerged during the analysis of base conditions. In the base conditions, six out of nine DSRs would not meet the 10-year LOS (Exhibit 7.1.10). As shown in Exhibit 7.1.10, gray alternative improves the LOS for the DSRs to more than 10 years with no activations over 20 years. Exhibit 7.1.11 below shows the reduction in model-predicted WIBs in the Near South Blueprint area in comparison to the base conditions for the gray alternative.

EXHIBIT 7.1.10 » NEAR SOUTH AREA DSRs, BASE VERSUS GRAY ALTERNATIVE MODEL CONDITIONS

DSR ID >		201	203	205	206	207	208	210	211	213
Base Model Simulation	Number of Activations in 20 Years	92	17	17	10	-	-	43	17	-
	Level of Service (LOS)	0.22	1.20	1.20	2.08	-	-	0.47	1.20	-
Gray Alternative Model Simulation	Number of Activations in 20 Years	-	-	-	-	-	-	-	-	-
	Level of Service (LOS)	-	-	-	-	-	-	-	-	-

EXHIBIT 7.1.11 » MODEL PREDICTED WIBs IN NEAR SOUTH BLUEPRINT AREA

	Base Model	Gray Alternative
Model Predicted WIBs in a 20-Year Simulation	392	0

Upsizing of existing sewers at several locations mitigates both DSRs and WIBs across the basin. Specifically, for DSRs 201 and 203 on the east side, conveyance improvements are planned along Smith-Lockbourne Road and Wilson-Champion Avenue, respectively. On the west side, Hinnman-Bruck and Woodrow-Parsons upsizing addresses DSRs 210 and 211 respectively. DSRs 205, 206 and 208 overflows are reduced by upsizing the sewer along Marion Road and Sixth Street. Additional projects involving upsizing of existing sewers solve WIBs identified in base conditions. Few relief sewers within the basin have been identified as preferable solutions to avoid upsizing existing pipes located on private properties and in proximity of building foundations. These reliefs are located along and in proximity of Berkley Road in the northeast corner of the basin and at Marion Road in the central portion of the basin.

The Near South gray alternative includes upsized and relief sewers along Markison Avenue. Although these sewers are not within the Blueprint area, they collect the sanitary flow of the basin. Both upsizing and relief sewers are planned to mitigate the Markison combined sewer overflow (CSO); specifically, the relief sewer provides additional conveyance to the OARS tunnel aiming to reduce the Markison CSO for the typical year of service. The point of connection to the relief into the tunnel is in common with the Moler regulator located in proximity of the intersection of Moler and Front Streets.

All the projects included in the gray alternative for Near South are listed in detail in Table 7.1.8 and their location is shown in Figure 7.1.12. The project IDs link the projects shown in the table to those shown in the figure.

7.1.2.7 James Livingston Gray Alternative

For the James Livingston basin projects, the gray alternative aims to solve the clusters of high-density WIBs identified during the analysis of base conditions because there are no DSRs in this Blueprint area. A relief sewer mitigates the main cluster of WIBs on the east side; the sewer is located in the central portion of the basin running from east to west along Livingston Avenue, Courtright Road, Roswell Drive and finally Scottwood Road. Upsizing of existing sewers along Fourth Avenue addresses WIBs in the northwest corner of the basin; a relief sewer along Etna Street solves WIBs in proximity of the northeast boundary of the Blueprint area toward Maplewood Avenue. A combination of both relief and upsized sewers is being adopted as solutions for the remaining clusters of WIBs in the northwest side of the basin.

Exhibit 7.1.12 below shows the reduction in model-predicted WIBs in the James Livingston Blueprint area in comparison to the base conditions for the gray alternative.

EXHIBIT 7.1.12 MODEL PREDICTED WIBs IN JAMES LIVINGSTON BLUEPRINT AREA

	Base Model	Gray Alternative
Model Predicted WIBs in a 20-Year Simulation	1849	1

Table 7.1.9 summarizes the projects in the gray alternative for James Livingston and Figure 7.1.13 shows their location. The project IDs link the projects shown in the table to those shown in the figure.

7.1.2.8 Fifth by Northwest Gray Alternative

The gray alternative solutions for the Fifth by Northwest Blueprint area include upsizing the existing sewer pipes on Third Avenue and adding new relief sewers at a number of different locations. In the base conditions, ten out of fifteen DSRs would not meet the 10-year LOS (Table 7.1.10). As shown in Table 7.1.10, gray alternative improves the LOS for the DSRs to 10 years or more. Exhibit 7.1.13 below shows the reduction in model-predicted WIBs in the Fifth by Northwest Blueprint area in comparison to the base conditions for the gray alternative.

EXHIBIT 7.1.13 » MODEL PREDICTED WIBs IN FIFTH BY NORTHWEST BLUEPRINT AREA

	Base Model	Gray Alternative
Model Predicted WIBs in a 20-Year Simulation	103	0

Table 7.1.11 shows all the projects associated with the gray alternative solutions for the Fifth by Northwest Blueprint area with detailed information associated with the project type, description, length, the original pipe size (for upsized pipes) and the new proposed pipe size. The location of each project is shown in Figure 7.1.14 with the corresponding project IDs indicated in Table 7.1.11.

7.1.2.9 West Franklinton Gray Alternative

The gray alternative solutions for West Franklinton include upsizing a few sewer pipes around Safford Avenue and southeast of Thomas Avenue. Exhibit 7.1.14 below shows the reduction in model-predicted WIBs in the West Franklinton Blueprint area in comparison to the base conditions for the gray alternative. There are no local DSRs in this Blueprint area.

EXHIBIT 7.1.14 » MODEL PREDICTED WIBs IN WEST FRANKLINTON BLUEPRINT AREA

	Base Model	Gray Alternative
Model Predicted WIBs in a 20-Year Simulation	1292	4

Table 7.1.12 shows all the projects associated with the gray alternative solutions for West Franklinton Blueprint area with detailed information associated with the project type, description, length, the original pipe size (for the upsized pipes) and the new proposed pipe size. The location of each project is shown in Figure 7.1.15 with the corresponding project IDs indicated in Table 7.1.12.

7.1.2.10 Near East Gray Alternative

The gray alternative solutions for the Near East alternative include upsizing a number of existing sewer pipes and lining and cleaning a few pipes at a number of different locations. Exhibit 7.1.15 below shows the reduction in model-predicted WIBs in the Near East Blueprint area in comparison to the base conditions for the gray alternative. There are no DSRs in this Blueprint area.

EXHIBIT 7.1.15 » MODEL PREDICTED WIBs IN NEAR EAST BLUEPRINT AREA

	Base Model	Gray Alternative
Model Predicted WIBs in a 20-Year Simulation	473	1

Table 7.1.13 shows all the projects associated with the gray alternative solutions for the Near East Blueprint area with detailed information associated with the project type, description, length, the original pipe size (for upsized pipes) and the new proposed pipe size."The location of each project is shown in Figure 7.1.16 with the corresponding project IDs indicated in Table 7.1.13.

7.1.3 Gray Alternatives System-wide Model Summary

The overflow statistics for 20 years (1995–2014) and for a typical year from the system-wide model for gray alternatives are shown in Table 7.1.14 and Table 7.1.15. As discussed in the Section 5 base model, the CSO LOS is achieved for all CSOs in 2025, which is the required compliance date provided in the CSO consent order. The LOS is also achieved in the 20-Year scenario results for all sanitary sewer overflows (SSOs) and bypasses.

The system-wide gray alternative WIBs are shown in Figure 7.1.17 and the system-wide flooding manholes that do not meet the 10-year LOS are shown in Figure 7.1.18. In comparison with the base system presented in Section 5, the gray alternative now meets the desired WIB LOS. There are still isolated WIBs that remain, and these isolated WIBs will be addressed by Project Dry Basement or local pump stations. The WIBs observed in the CSO area require ongoing investigation. Additional model refinement in this area is needed to determine if these WIBs are real or a model anomaly. In order to address these WIBs, $13,000 per acre was budgeted and incorporated into the affordability analysis, but this cost is not included in the overall gray alternative cost.

The gray alternative also requires a number of manholes to be bolted down. The cost for bolting down these manholes is captured in the gray alternative cost and is part of the overall affordability analysis.

7.2 Prioritization

Once the projects required to meet the desired LOS were identified with the collection system model for the 2015 WWMP, the order of implementation of the projects was considered. Like the WWMP, the prioritization of the projects is mostly concerned with constructability and overall system impacts. There are two main components of the 2015 WWMP: the tunnels and the local gray area. In several instances the local gray area solution is dependent upon completion of a tunnel to transport flows away from the area.

In the 2015 WWMP there are two main tunnel projects: the Lower Olentangy Tunnel (LOT) and the ART, both of which are broken into two construction phases.

The first construction phase of LOT contains Phases 1 and 2 as described above. Phase 1 of the first LOT construction phase must be completed and operational by 2025 in order to satisfy the CSO consent order deadline. Similarly, the Fifth by Northwest local gray area solution requires completion of Phase 1 of the first construction phase of LOT. Phase 2 of the first LOT construction phase will support the mitigation of the mainline DSRs on the Clinton #3 trunk sewer and the FMI. The second LOT construction phase extends the tunnel further north and is referred to as Phase 3 above. The Clintonville local gray area solution requires completion of the second construction phase of LOT.

The ART is similarly broken into two construction phases. The James Livingston local gray area solution should be completed with the first construction phase of ART. The Near East and Linden local gray areas should be completed with the second construction phase of ART.

Construction priority for the other projects was determined by the impact of the priority area construction on the main trunks. Construction of the local gray area improvements generally starts on the southern end of town and moves northward as tunnels are completed and put into service. A typical prioritization of local gray areas proceeds as follows in Exhibit 7.2.1.

EXHIBIT 7.2.1 » LOCAL GRAY AREAS LINKED TO TUNNELS

Local Gray Area	Tunnel Project Link
Near South	--
Miller Kelton	--
Plum Ridge	--
Hilltop	--
West Franklinton	--
Fifth by Northwest	LOT, first construction phase
James Livingston	ART, first construction phase
Clintonville	LOT, second construction phase
Near East	ART, second construction phase
Linden	ART, second construction phase

7.3 Gray Plan Costs

This section of the report summarizes the costs for the gray alternative. For a detailed discussion on the unit costs used for this analysis, please see Appendix E. Exhibit 7.3.1 shows the capital costs for the gray plan.

The estimated cost for the gray alternative is $1.58 billion. The entire cost for the plan is derived from conventional infrastructure projects. A projected $1.08 billion in costs are related to the LOT and the ART. It is key to note that collection system modeling indicated that a 9-to-10-foot diameter LOT would be required, and the cost for 10-foot diameter tunnel was estimated. Likewise, the modeling indicated a 12-to-14-foot tunnel size for ART, and the 14-foot diameter was used. Another approximately $330 million are derived from various collection system improvements in the local gray areas, like relief pipes and weir raises. An expected $100 million is related to the CEPT facility at Southerly. The remaining cost is related to bolting down manholes and the consent order projects already in the city's capital plan.

EXHIBIT 7.3.1 » GRAY ALTERNATIVE ESTIMATED COSTS

GRAY	
Conventional Infrastructure	
System-wide tunnels	$1,080,000,000
System-wide conveyance improvements	$8,000,000
Local gray areas, conveyance improvements	$327,000,000
Chemically Enhanced Primary Treatment	$99,000,000
Bolt down manhole cost	$27,000,000
Consent order projects from capital plan	$41,000,000
Consent Order Total	$1,582,000,000

TABLE 7.1.1 » SYSTEMWIDE GRAY ALTERNATIVE PROJECTS

DSR/ WIBs	Project ID	Type	Description	New Diameter [ft]	Length [ft]
DSR 284, DSR 328, DSR 898 and WIBs	1	Tunnel	LOT2 Tunnel from near Tulane Road to LOT1 (near 2nd Avenue)	9	16,092
	2	New Relief Weir	Relief of CL3 at 0126S0187, Inlet offset = 2.5 ft, Length = 5 ft	N/A	N/A
	3	New Relief Pipe	Relief of CL3 at 0126S0187 to LOT2	5	125
	4	New Relief Weir*	Relief of FMN at 0126S0249, Inlet offset = 1.5 ft, Length = 13 ft	N/A	N/A
	5	New Relief Pipe*	Relief of FMN at 0126S0249 to LOT2	4	280
	6	New Relief Weir	Relief of OMI at 0126S0255, Inlet offset = 3.5 ft, Length = 7 ft	N/A	N/A
	7	New Relief Pipe	Relief of OMI at 0126S0255 to LOT2	6	70
	8	New Relief Pipe	Relief of FMN at 0126S0249 and OMI at 0126S0255 to LOT2	8	1,800
DSR 326, DSR 335, DSR 346, DSR 360, DSR 873 and WIBs	9	Tunnel	LOT3 Tunnel from near DSR 346 to LOT2 (near Tulane Road)	9	13,536
	10	New Relief Weir*	Relief of CVM at 0370S0195, Inlet offset = 1.55 ft, Length = 7 ft	N/A	N/A
	11	New Relief Pipe*	Relief of CVM at 0370S0195 to LOT3	3	4,300
	12	New Relief Weir*	Relief of CVM at 0297S0118, Inlet offset = 1.9 ft, Length = 13 ft	N/A	N/A
	13	New Relief Pipe*	Relief of CVM at 0297S0118 to LOT3	2.5	2,235
	14	New Relief Weir	Relief of OMI at 0297S0110, Inlet offset = 4.4 ft, Length = 21.5 ft	N/A	N/A
	15	New Relief Pipe	Relief of OMI at 0297S0110 to LOT3	5.5	1,370
	16	New Relief Weir*	Relief of CVM at 0232S0152, Inlet offset = 1.5 ft, Length = 4 ft	N/A	N/A
	17	New Relief Pipe*	New relief pipe from 0232S0152 to LOT3	2.5	1,478

TABLE 7.1.1 » SYSTEMWIDE GRAY ALTERNATIVE PROJECTS

DSR/ WIBs	Project ID	Type	Description	New Diameter [ft]	Length [ft]
DSR 326, DSR 335, DSR 346, DSR 360, DSR 873 and WIBs	18	New Relief Weir*	Relief of CVM at 0232S0156, Inlet offset = 2.15 ft, Length = 9.5 ft	N/A	N/A
	19	New Relief Pipe*	Relief of CVM at 0232S0156 to LOT3	2.5	250
	20	New Relief Pipe*	Relief of CVM at 0232S0152 and 0232S0156 to LOT3	3	1,650
	21	New Relief Weir*	Relief of CVM at 0175S0159, Inlet offset = 2.15 ft, Length = 10 ft	N/A	N/A
	22	New Relief Pipe*	Relief of CVM at 0175S0159 to LOT3	2	2,375
Bypass at SWWTP, DSR 83, DSR 244 WIBs in ACT basin	23	Tunnel	ART Tunnel from south of Clifton Avenue to north of I-270	12	38,800
	24	New Relief Weir	Relief of ACT at 0033S1225, Inlet offset = 6.5 ft, Length = 10 ft	N/A	N/A
	25	New Relief Pipe	Relief of ACT at 0033S1225 to ART	5	275
	26	New Relief Weir	Relief of ACIS at 0061S0039, Inlet offset = 4 ft, Length = 20 ft	N/A	N/A
	27	New Relief Pipe	Relief of ACIS at 0061S0039 to ART	5	100
	28	New Relief Weir	Relief of ACT at 0061S0147, Inlet offset = 7 ft, Length = 10 ft	N/A	N/A
	29	New Relief Pipe	Relief of ACT at 0061S0147 to ART	5	500
	30	New Relief Weir	Relief of ACT at 0063S0218, Inlet offset = 8 ft, Length = 8.5 ft	N/A	N/A
	31	New Relief Pipe	Relief of ACT at 0063S0218 to ART	6.5	3230
	32	Remove Bulkhead	Remove bulkhead of ACIS at 0058S0044	N/A	N/A
	33	Bulkhead	Bulkhead pipe from NWAC to ACT at 0058S0044	N/A	N/A
	34	Remove Weir	Remove weir on ACIS at 0061S0015	N/A	N/A

TABLE 7.1.1 » SYSTEMWIDE GRAY ALTERNATIVE PROJECTS

DSR/ WIBs	Project ID	Type	Description	New Diameter [ft]	Length [ft]
Bypass at SWWTP, DSR 83, DSR 244 WIBs in ACT basin	35	Bulkhead	Bulkhead pipe from ACIS to ACT at 0061S0015	N/A	N/A
	36	Pipe Lining	Line (or clean) ACIS/DES from 0061S0015 to 0062S0089	4	2,682
	37	Pipe Lining	Line (or clean) ACIS/DES from 0062S0089 to 0062S0031	5	1,492
	38	Bulkhead	Bulkhead relief pipe from ACT to DES at 0062S0330	N/A	N/A
	39	Bulkhead	Bulkhead northwest pipe out of 0062S0034	N/A	N/A
DSR 873	40	New Relief Pipe	Relief pipe for DSR 873 to OMI from 0232S0083 to 0232S0340	2	70
DSR 95 and WIBs	41	New Relief Pipe	2nd Interconnector Barrel parallel to the existing 8.5' Interconnector Barrel from 0589S0035 to 0589S9982	8.5	2,175

*This project is also listed in the table of Clintonville projects.

TABLE 7.1.2 » CLINTONVILLE AREA DSRs, BASE VERSUS GRAY ALTERNATIVE MODEL CONDITIONS

DSR ID		326	323	335	352	346	351	360	337	349	368	285	328	898	329
Base Model Simulation	Number of Activations in 20 Years	127	26	75	26	68	16	16	-	77	-	-	5 59	19	22
	Level of Service (LOS)	00.2	00.8	00.3	00.8	00.3	11.3	11.3	-	33.0	-	-	00.3	11.1	00.9
Gray Alternative Model Simulation	Number of Activations in 20 Years	-	-	-	-	-	-	-	-	-	-	-	-	22	-
	Level of Service (LOS)	-	-	-	-	-	-	-	-	-		-	-	112.5	-

TABLE 7.1.3 » CLINTONVILLE GRAY ALTERNATIVE PROJECTS

DSR/WIBs	Project ID	Type	Description	New Diameter [ft]	Length [ft]
DSR 326	4a	New Relief Weir	Relief of CVM at 0175S0159 Inlet offset = 2.15 ft, Length = 10 ft	N/A	N/A
	4b	New Relief Pipe*	Relief of CVM at 0175S0159 to LOT3	2	2,375
	4c	Bulkhead	Closed DSR 326 at 0175S0159	N/A	N/A
DSR 323	LOT3	Tunnel	Activations solved by LOT3	N/A	N/A
DSR 335	3a	New Relief Weir	Relief of CVM at 0232S0156 Inlet offset = 2.15 ft, Length = 9.5 ft	N/A	N/A
	3b	New Relief Pipe*	Relief of CVM at 0232S0156 to LOT3	3	1,650
				2.5	250
	3c	Bulkhead	Closed DSR 335 at 0232S0609A	N/A	N/A
DSR 352	LOT3	Tunnel	activations solved by LOT3	N/A	N/A
DSR 346	2a	New Relief Weir	Relief of CVM at 0297S0118 Inlet offset = 1.9 ft, Length = 13 ft	N/A	N/A
	2b	New Relief Pipe*	Relief of CVM at 0297S0118 to LOT3	2.5	2,235
	2c	Bulkhead	Closed DSR 346 at 0297S0118	N/A	N/A
DSR 351	LOT3	Tunnel	activations solved by LOT3	N/A	N/A
DSR 360	1a	New Relief Weir	Relief of CVM at 0370S0195 Inlet offset = 1.55 ft, Length = 7 ft	N/A	N/A
	1b	New Relief Pipe*	Relief of CVM at 0370S0195 to LOT3	3	4,300
	1c	Bulkhead	Closed DSR 360 at 0370S0195	N/A	N/A
DSR 349 and WIBs	10a	Raise Weir Elevation	Raised weir elevation at 0297S0285 from 0.73 ft to 1.25 ft	N/A	N/A
	10b	Upsize Existing Pipes	Upsized pipes from 0297S0284 to 0232S0237	1.25	2,205
DSR 328, DSR 898 and WIBs	15a	Upsize Existing Pipes	Upsized pipes from 0176S0462 to 0127S0095	1.5	4,009
	15b	New Relief Pipe	New relief pipe from 0127S0095 to 0126S0249	1.5	645
	15c	Bulkhead	Closed DSR 328 at 0176S0025	N/A	N/A
	6a	New Relief Weir	Relief of FMN at 0126S0249 Inlet offset = 1.5 ft, Length = 13 ft	N/A	N/A
	6b	New Relief Pipe*	Relief of FMN at 0126S0249 to LOT2	4	280

TABLE 7.1.3 » CLINTONVILLE GRAY ALTERNATIVE PROJECTS

DSR/WIBs	Project ID	Type	Description	New Diameter [ft]	Length [ft]
DSR 329	14	Upsize Existing Pipes	Upsized pipes from 0176S0243 to 0176S0053	1.25	630
WIBs and SSOs	5a	New Relief Weir	Relief of CVM at 0232S0152 Inlet offset = 1.5 ft, Length = 4 ft	N/A	N/A
	5b	New Relief Pipe	New relief pipe from 0232S0152 to LOT3	2.5	1,478
WIBs	9a	Upsize Existing Pipes	Upsized pipes from 0298S0279 to 0298S0383	1.25	2,295
	9b	New Pipe	New pipe from 0298S0383 to 0298S0142	1.5	1,240
	9c	Upsize Existing Pipes	Upsized pipes from 0298S0142 to 0297S0391	1.5	3,669
	9d	Bulkhead	Bulkhead pipe at 0298S0383	N/A	N/A
	7	Upsize Existing Pipes	Upsized pipes from 0370S0059 to 0370S0076	0.83	2,327
	8a	Upsize Existing Pipes	Upsized pipes from 0371S0062 to 0370S0185	1	1,727
	8b	Upsize Existing Pipes	Upsized pipes from 0370S0185 to 0370S0197	1.25	2,692
	11a	New Pipe	New pipe from 0233S0339 to 0233S0166	1.25	2,490
	11b	Upsize Existing Pipes	Upsized pipes from 0233S0166 to 0232S0255	1.25	2,291
	11c	Bulkhead	Bulkhead pipe at 0233S0339	N/A	N/A
	12a	New Pipe	New pipe from 0232S0174 to 0232S0152	2	2,040
	12b	Bulkhead	Bulkhead pipe at 0232S0174	N/A	N/A
	13a	Upsize Existing Pipes	Upsized pipes from 0176S0284 to 0175S0246	1.25	2,173
	13b	Upsize Existing Pipes	Upsized pipes from 0175S0246 to 0175S0242	1.5	942

*This project is also listed in the table of system-wide projects.

Table 7.1.4 » Hilltop Gray Alternative Projects

DSR/WIBs	Project ID	Type	Description	New Diameter [ft]	Length [ft]
DSR 250	18	Flow Limit	Flow Limit to East = 10 cfs at 0115S0240A	N/A	N/A
	19	Flow Limit	Flow Limit to East = 13 cfs at 0115S0096	N/A	N/A
DSR 254	3a	New Pipe	New pipe from 0076S0248 to 0076S0238	1.25	571
	3b	Bulkhead	Bulkhead pipe at 0076S0248	N/A	N/A
	4	Upsize Existing Pipes	Upsized pipes from 0076S0238 to 0076S0235	1.25	297
	5	Upsize Existing Pipes	Upsized pipes from 0076S0249 to 0076S0248	1.25	206
DSR 252	6a	Upsize Existing Pipes	Upsized pipes from 0076S0229 to 0076S0182	3	340
	6b	Upsize Existing Pipes	Upsized pipes from 0076S0182 to 0045S0493	3.5	4,345
	6c	Bulkhead	Bulkhead pipe at 0045S0440	N/A	N/A
	7	Replace/ Rehab	Replaced pipes from 0076S0228 to 0076S0229	0.66	195
	8	Remove Existing Pipes	Removed pipe from 0076S0235 to 0076S1000 Removed pipe from 0076S1000 to 0076S0230 Removed pipe from 0076S0235 to 0076S0230	0.83	75 75 148
DSR 256	1a	New Pipe	New pipe from 0076S0442 to a new manhole downstream of 0076S0484 on Wicklow Rd.	2.5	1,042
	1b	Bulkhead	Bulkhead pipe at 0076S0442	N/A	N/A
	2a	New Pipe	New pipe from 0115S0126 to a new manhole at the intersection of Wicklow Rd. and Huron Ave.	2.5	3,084
	2b	New Pipe	New pipe from a new manhole at the intersection of Wicklow Rd. and Huron Ave to 0076S0229	3	1,090
	2c	Bulkhead	Bulkhead pipe at 0076S0330	N/A	N/A
	2d	Bulkhead	Bulkhead pipe at 0076S0335	N/A	N/A
	2e	Bulkhead	Bulkhead pipe at 0115S0126	N/A	N/A
	2f	Bulkhead	Bulkhead pipe at 0115S0121	N/A	N/A
WIBs and SSOs	9	New Relief Pipe	New relief pipe from a new manhole between 0077S0221 and 0077S0222 (on Westmoor Ave.) to 0076S0426	2	1,686
	10	Upsize Existing Pipes	Upsized pipes from 0076S0426 to 0076S0445	2	987
	11a	New Pipe	New pipe from 0077S0048 to a new manhole downstream of 0077S0207 on Grace St.	1	1,741
	11b	New Pipe	New pipe from a new manhole downstream of 0077S0207 on Grace St. to 0077S0194	1.5	568

Table 7.1.4 » Hilltop Gray Alternative Projects

DSR/WIBs	Project ID	Type	Description	New Diameter [ft]	Length [ft]
WIBs and SSOs	11c	New Pipes	New pipe from 0077S0026 to a new manhole downstream of 0077S0026 on Grace St. New pipe from 0077S0212 to a new manhole downstream of 0077S0212 on Grace St.	0.66	54 63
	11d	Bulkhead	Bulkhead pipe at 0077S0048	N/A	N/A
	11e	Bulkhead	Bulkhead pipe at 0077S0026	N/A	N/A
	11f	Bulkhead	Bulkhead pipe at new manhole between 0077S0036 and 0077S0037 (on Grace St.)	N/A	N/A
	11g	Bulkhead	Bulkhead pipe at 0077S0212	N/A	N/A
	11h	Bulkhead	Bulkhead pipe at 0077S0207	N/A	N/A
	12a	Upsize Existing Pipes	Upsized pipes from 0077S0194 to 0077S0285	1.5	526
	12b	Upsize Existing Pipes	Upsized pipes from 0077S0285 to 0077S0496	2	2,055
	12c	Upsize Existing Pipes	Upsized pipes from 0077S0496 to 0046S0075	2.5	1,287
	16a	New Pipes	New pipe from 0075S0289 to a new manhole at the intersection of Vanderberg Ave. and Harris Ave. New pipe from 0075S0316 to a new manhole at the intersection of Vanderberg Ave. and Harris Ave.	1	211 118
	16b	New Pipe	New pipe from a new manhole at the intersection of Vanderberg Ave. and Harris Ave. to 0075S0302	2	1,196
	16c	New Pipe	New pipe from 0075S0296 to 0075S0302	1	161
	16d	Bulkhead	Bulkhead pipe at 0075S0289	N/A	N/A
	16e	Bulkhead	Bulkhead pipe at 0075S0296	N/A	N/A
	16f	Bulkhead	Bulkhead pipe at 0075S0316	N/A	N/A
	17a	New Pipe	New pipe from a new manhole between 0114S0277 and 0114S0276 (on Glorious Rd.) to 0114S0250	1	2,613
	17b	Bulkhead	Bulkhead pipe at a new manhole between 0114S0277 and 0114S0276 (on Glorious Rd.)	N/A	N/A
	17c	Bulkhead	Bulkhead pipe at a new manhole between 0114S0284 and 0114S0287 (on Glorious Rd.)	N/A	N/A
	17d	Bulkhead	Bulkhead pipe at 0114S0603	N/A	N/A
WIBs	13	New Relief Pipe	New relief pipe from 0076S0211 to a new manhole downstream of 0046S0046 at the intersection of Burgess Ave. and Palmetto St.	1	1,958
	14a	New Pipe	New pipe from 0046S0046 to a new manhole East of 0046S0046 on Burgess Ave.	1	23
	14b	New Pipe	New pipe from a new manhole East of 0046S0046 on Burgess Ave. to a new manhole at the intersection of Wicklow Rd. and Burgess Ave.	2.5	2,866

Table 7.1.4 » Hilltop Gray Alternative Projects

DSR/WIBs	Project ID	Type	Description	New Diameter [ft]	Length [ft]
WIBs	14c	Bulkhead	Bulkhead pipe at 0046S0046	N/A	N/A
	15	New Relief Pipe	New relief pipe from 0045S0418 to a new manhole at the intersection of Wicklow Rd. and Eureka Ave.	1.25	794
	21	Upsize Existing Pipes	Upsized pipes from 0075S0169 to 0076S0055	2.5	736
	22a	New Pipe	New pipe from 0075S0133 to 0075S0172	1.25	1,198
	22b	Bulkhead	Bulkhead pipe at 0075S0133	N/A	N/A
	23a	New Pipe	New pipe from a new manhole between 0075S0023 and 0075S0024 (on Brinker Ave.) to a new manhole at the intersection of Brinker Ave. and S Stephen Dr.	0.83	145
	23b	New Relief Pipe	New relief pipe from 0075S0039 to a new manhole downstream of 0075S0039 at the intersection of Brinker Ave. and S Stephen Dr.	0.83	103
	23c	New Pipe	New pipe from a new manhole at the intersection of Brinker Ave. and S Stephen Dr. to 0075S0172	1.25	3,534
	23d	Bulkhead	Bulkhead pipe at a new manhole between 0075S0023 and 0075S0024 (on Brinker Ave.)	N/A	N/A
	23e	Bulkhead	Bulkhead pipe at a new manhole between 0075S0058 and 0075S0054 (on Salisbury Rd.)	N/A	N/A
	24	Upsize Existing Pipes	Upsized pipes from 0045S0280 to 0045S0258	0.83	311
	25	Upsize Existing Pipes	Upsized pipes from 0046S0346 to 0046S0358	1.5	840
	26a	Upsize Existing Pipes	Upsized pipes from 0046S0334 to 0046S0358	1.25	616
	26b	Upsize Existing Pipes	Upsized pipes from 0046S0358 to 0023S0941	2	4,191
	27	New Relief Pipe	New relief pipe from 0114S0204 to 0114S0249	1	1,272
Additional Improvements	20a	Flow Limit	Flow Limit to South = 5 cfs at 0046S0209	N/A	N/A
	20b	Remove Weir	Removed weir at 0046S0209	N/A	N/A

TABLE 7.1.5 » LINDEN GRAY ALTERNATIVE PROJECTS

DSR/WIBs	Project ID	Type	Description	New Diameter [ft]	Length [ft]
DSR 305, DSR 312, DSR 315 and WIBs	14	Upsize Existing Pipes	Upsized pipes from 0130S0027 to 0130S0024	0.83	381
	15a	New Relief Pipe	New relief pipe from 0130S0024 to a new manhole East of the intersection of Westerville Rd. and Lakeview Ave.	0.83	748
	15b	New Pipe	New pipe from a new manhole East of the intersection of Westerville Rd. and Lakeview Ave. to a new manhole between 0130S0151 and 0130S0152 on Minnesota Ave.	1.5	4,947
DSR 306, DSR 307 and WIBs	16a	Upsize Existing Pipes	Upsized pipes from 0129S0350 to 0129S0396	1.25	802
	16b	Upsize Existing Pipes	Upsized pipes from 0129S0396 to 0130S0130	1.5	871
DSR 339	2	New Relief Pipe	New relief pipe from 0236S0010 to 0301S0043	1.5	1,718
WIBs (Main Basin)	1a	New Pipe	New pipe from a new manhole between 0301S0160 and 0301S0158 (on Fenton St.) to a new manhole East of 0301S0091 on Olen Ave.	1	662
	1b	Bulkhead	Bulkhead pipe at a new manhole between 0301S0160 and 0301S0158 (on Fenton St.)	N/A	N/A
	3	Upsize Existing Pipes	Upsized pipes from 0236S0019 to 0236S0016	1	667
	4	New Pipe	New pipe from 0235S0084 to 0235S0085	0.67	297
	5a	New Relief Pipe	New relief pipe from 0300S0167 to a new manhole between 0235S0255 and 0235S0249 (on Dresden St.)	1	1,394
	5b	New Relief Pipe	New relief pipe from a new manhole between 0235S0255 and 0235S0249 (on Dresden St.) to a new manhole near the intersection of Dresden St. and Cooke Rd.	1.25	542
	6	New Relief Pipe	New relief pipe from 0235S0272 to a new manhole near the intersection of Dresden St. and Cooke Rd.	1.25	205

TABLE 7.1.5 » LINDEN GRAY ALTERNATIVE PROJECTS

DSR/WIBs	Project ID	Type	Description	New Diameter [ft]	Length [ft]
WIBs (Main Basin)	7	New Relief Pipe	New relief pipe from a new manhole near the intersection of Dresden St. and Cooke Rd. to a new manhole at the intersection of Brandon St. and Lamont Ave.	1.5	4,347
	8a	New Relief Pipe	New relief pipe from 0178S0343 to 0178S0409	1	634
	8b	New Relief Pipe	New relief pipe from 0178S0343 to 0178S0417	1.25	785
	8c	New Relief Pipe	New relief pipe from 0178S0417 to 0178S0815	1.5	1,130
	9	Upsize Existing Pipes	Upsized pipes from 0179S0037 to 0179S0048	2	1,093
	10	Upsize Existing Pipes	Upsized pipes from 0178S0295 to 0129S0172	1	753
	11a	New Relief Pipe	New relief pipe from 0129S0272 to 0129S0333	1	1,674
	11b	Replace/ Rehab	Upsized pipes from 0129S0333 to 0129S0407	1.25	708
	12	Upsize Existing Pipes	Upsized pipes from 0178S0451 to 0129S0407	1	1,261
	13	New Relief Pipe	New relief pipe from 0129S0407 to a new manhole East at the intersection of Westerville Rd. and Lakeview Ave.	1.5	1,110
	17a	New Relief Pipe	New relief pipe from 0129S0187 to 0129S0190	0.67	377
	17b	New Relief Pipe	New relief pipe from 0129S0190 to 0129S0206	0.83	1,127
	17c	New Relief Pipe	New relief pipe from 0129S0206 to a new manhole at the intersection of Arlington Ave. and Bremen St.	1	1,355
	17d	New Relief Pipe	New relief pipe from a new manhole at the intersection of Arlington Ave. and Bremen St. to a new manhole between 0129S0444 and 0129S0447 (on Arlington Ave.)	1.25	1,135
	17e	New Relief Pipe	New relief pipe from 0129S0225 to a new manhole at the intersection of Arlington Ave. and Bremen St.	0.67	1,014

TABLE 7.1.5 » LINDEN GRAY ALTERNATIVE PROJECTS

DSR/WIBs	Project ID	Type	Description	New Diameter [ft]	Length [ft]
WIBs (Main Basin)	18a	Upsize Existing Pipes	Upsized pipes from 0056S0166 to 0056S0164	0.83	393
	18b	Upsize Existing Pipes	Upsized pipes from 0056S0164 to 0056S0191	1.25	311
	18c	Upsize Existing Pipes	Upsized pipes from 0056S0190 to 0056S0268	1.5	1,733
	23	Upsize Existing Pipes	Upsized pipes from 0130S0158 to 0130S0136	1.5	868
	24	Upsize Existing Pipes	Upsized pipes from 0130S0186 to 0130S0138	1.5	697
	25	Upsize Existing Pipes	Upsized pipes from 0058S0067 to 0058S0126	1.5	1,695
Additional Improvements	19	Remove Weir	Removed weir at 0089S0262	N/A	N/A
	20	Remove Weir	Removed weir at 0130S0272	N/A	N/A
	21	Remove Weir	Removed weir at 0179S0075	N/A	N/A
	22	Remove Weir	Removed weir at 0301S0367	N/A	N/A
WIBs (South West Smaller Basin)	26a	Upsize Existing Pipes	Upsized pipes from 0088S0451 to 0088S0427	1.25	664
	26b	Upsize Existing Pipes	Upsized pipes from 0088S0427 to 0088S0287	1.5	1,089
	27a	Upsize Existing Pipes	Upsized pipes from 0088S0006 to 0088S0004	0.83	294
	27b	Upsize Existing Pipes	Upsized pipes from 0088S0004 to 0088S0010	1	340
	27c	Upsize Existing Pipes	Upsized pipes from 0088S0010 to 0055S0412	1.25	304
	27d	Upsize Existing Pipes	Upsized pipes from 0055S0412 to 0055S0367	1.5	606
	27e	Upsize Existing Pipes	Upsized pipes from 0055S0367 to 0055S0333	2	765

TABLE 7.1.6 » MILLER KELTON GRAY ALTERNATIVE PROJECTS

DSR/WIBs	Project ID	Type	Description	New Diameter [ft]	Length [ft]
DSR 177	1	Upsize Existing Pipes	Upsized pipes from 0034T0265 to 0034C0417	3.25	2,400
DSRs 181 and 179	7	New Relief Pipe	New relief pipe from 0034S0396 to 0034S0395	3	180
	8a	Replace/Rehab	Replaced pipe from 0034S0293 to 0034S0292	1.5	68
	8b	New Relief Pipe	New relief pipe from 0034S0292 to 0034S0396	2	741
	9	Remove Existing Pipes	Removed pipe from 0034S0293 to 0034S0299 Removed pipe from 0034S0308 to 0034S0306 Removed pipe from 0034S0396 to 0034S0397	N/A	N/A
DSR 189	4	Upsize Existing Pipes	Upsized pipes from 0034S0783 to 0034C0415	3	411
	5	Upsize Existing Pipes	Upsized pipes from 0034S0372 to 0034S0395	1	191
	6	New Relief Pipe	New relief pipe from 0034S0395 to 0034S0783	3	1,000
DSR 185	2	Raise Weir Elevation	Raised weir elevation at 0035S0521 from 0.72 ft to 1.75 ft	N/A	N/A
Additional Improvements	3	Flow Redirection	Redirect stormwater from four identified areas of public source inflow	N/A	N/A

TABLE 7.1.7 » PLUM RIDGE GRAY ALTERNATIVE PROJECTS

DSR/WIBs	Project ID	Type	Description	New Diameter [ft]	Length [ft]
DSR 364 and WIBs	1a	Upsize Existing Pipes	Upsized pipes from 0391S0126 to 0391S0392	1	1,466
	1b	Upsize Existing Pipes	Upsized pipes from 0391S0392 to 0391S0131	1.25	702
	2	Upsize Existing Pipes	Flow Reversing Upsized and reversed flow from 0391S0131 to 0391S0133	1.25	347
	3	Upsize Existing Pipes	Upsized pipes from 0391S0150 to 0391S0147	1.25	639
	4	Upsize Existing Pipes	Upsized pipes from 0391S0174 to 0391S0179	1.25	1,347
	5	Upsize Existing Pipes	Upsized pipes from 0391S0251 to new Junction near 0391S0254	0.83	967
	6	Upsize Existing Pipes	Upsized pipes from 0391S0270 to 0391S0254	0.83	1,385
	7	New Relief Pipe	New relief pipe from new Junction near 0391S0254 to 0391S0127	1	606
	8	New Relief Pipe	New relief pipe from 0391S0133 to 0391S0150	1.25	134
	9	New Relief Pipe	New relief pipe from 0391S0147 to 0391S0174	1.25	344
	10a	New Relief Pipe	New relief pipe from 0391S0179 to downstream of 0391S0179	1.25	570
	10b	New Relief Pipe	New relief pipe from downstream of 0391S0179 to 0391S0393	1.5	348
	11	Flow Redirection	Remove known driveway drain stormwater inflow	NA	NA

TABLE 7.1.8 » NEAR SOUTH GRAY ALTERNATIVE PROJECTS

DSR/WIBs	Project ID	Type	Description	New Diameter [ft]	Length [ft]
DSR 203 and WIBs	7	Upsize Existing Pipes	Upsized pipes from 0038S0300 to 0038S0290	2.5	1003
	10	Upsize Existing Pipes	Upsized pipes from 0038S0290 to 0038S0205	2.5	739
	11c	Upsize Existing Pipes	Upsized pipes from 0038S0205 to 0038S0187	2.5	1852
	11d	Upsize Existing Pipes	Upsized pipes from 0038S0187 to 0038S0186	3.5	35
DSR 201 and WIBs	13b	Upsize Existing Pipes	Upsized pipes from 0038S0246 to 0038S0209	1.5	730
	13c	Upsize Existing Pipes	Upsized pipes from 0038S0209 to 0038S0186	2	1158
	13d	Upsize Existing Pipes	Upsized pipes from 0038S0186 to 0038S0071	3.5	2814
	14	New Relief Pipe	New relief pipe from 0038S0071 to 0039S0445	2	799
	15	Upsize Existing Pipes	Upsized pipes from 0039S0445 to 0039S0443	3.5	171
DSR 211 and WIBs	16c	Upsize Existing Pipes	Upsized pipes from 0039S0415 to 0039S0443	1.5	670
DSRs 205 and 206 and WIBs	16d	Upsize Existing Pipes	Upsized pipes from 0039S0443 to 0039S0674	3.5	2384
	16e	Upsize Existing Pipes	Upsized pipes from 0039S0674 to 0039S0257	4	404
	19a	Upsize Existing Pipes	Upsized pipes from 0039S0257 to 0039S0067	4	550
	19b	Upsize Existing Pipes	Upsized pipes from 0039S0067 to 0039S0008	5	1546

TABLE 7.1.8 » NEAR SOUTH GRAY ALTERNATIVE PROJECTS

DSR/WIBs	Project ID	Type	Description	New Diameter [ft]	Length [ft]
DSRs 205 and 206 and WIBs	19c	Upsize Existing Pipes	Upsized pipes from 0039S0008 to 0018S0155	6	703
	20a	Upsize Existing Pipes	Upsized pipes from Markison Regulator to 0017S0499	5.5	18
	20b	Upsize Existing Pipes	Upsized pipes from relief weir downstream of Markison Regulator to 0017S0173	6	2207
	21	New Relief Pipe	New relief pipe from 0017S0173 to 0017S0190	3	358
	22	Upsize Existing Pipes	Upsized pipes from 0017S0190 to 0018S0046	6	4331
	23	Upsize Existing Pipes	Upsized pipes from 0018S0046 to 0018S0014	6	660
	24	New Pipe	New pipe from 0018S0014 to the Moler overflow conveyance pipe to OARS	6	1960
DSR 210 and WIBs	17d	Upsize Existing Pipes	Upsized pipes from 0039S0224 to 0039S0251	1.5	522
	17e	Upsize Existing Pipes	Upsized pipes from 0039S0251 to 0039S0257	2	667
WIBs	1a	New Pipe	New pipe from downstream of 0036S0039 to downstream of 0037S0222	1	1198
	1b	Bulkhead	Bulkhead existing sewer between 0036S0039 and 0036S0040 at a point downstream of the intersection with the new pipe listed in 1a	NA	NA
	1c	Bulkhead	Bulkhead existing sewer between 0036S0052 and 0036S0041 at a point downstream of the intersection with the new pipe listed in 1a	NA	NA
	1d	New Relief Pipe	New relief pipe from 0037S0197 to intersection with the new relief pipe listed in 1a	1	162
	2	Upsize Existing Pipes	Upsized pipes from 0037S0206 to 0037S0197	0.83	306

TABLE 7.1.8 » NEAR SOUTH GRAY ALTERNATIVE PROJECTS

DSR/WIBs	Project ID	Type	Description	New Diameter [ft]	Length [ft]
WIBs	3	Upsize Existing Pipes	Upsized pipes from downstream of 0037S0222 to 0037S0154	1.5	380
	4	Upsize Existing Pipes	Upsized pipes from 0037S0154 to 0038S0300	2	1356
	5	Upsize Existing Pipes	Upsized pipes from 0036S0010 to 0037S0152	0.83	835
	6	Upsize Existing Pipes	Upsized pipes from 0038S0304 to 0038S0300	1.5	288
	8	Upsize Existing Pipes	Upsized pipes from 0037S0143 to 0038S0297	0.83	309
	9a	Upsize Existing Pipes	Upsized pipes from 0037S0123 to 0037S0114	0.83	699
	9b	Upsize Existing Pipes	Upsized pipes from 0037S0114 to 0037S0109	1	535
	9c	Upsize Existing Pipes	Upsized pipes from 0037S0109 to 0038S0290	1.25	1190
	11a	Upsize Existing Pipes	Upsized pipes from 0037S0047 to 0037S0023	1	1154
	11b	Upsize Existing Pipes	Upsized pipes from 0037S0023 to 0038S0205	1.25	240
	12a	Upsize Existing Pipes	Upsized pipes from 0017S0236 to 0038S0334	0.83	909
	12b	Upsize Existing Pipes	Upsized pipes from 0038S0334 to 0038S0246	1	704
	13a	Upsize Existing Pipes	Upsized pipes from 0038S0256 to 0038S0246	1	593
	16a	Upsize Existing Pipes	Upsized pipes from 0038S0256 to 0038S0247	0.83	635

TABLE 7.1.8 » NEAR SOUTH GRAY ALTERNATIVE PROJECTS

DSR/WIBs	Project ID	Type	Description	New Diameter [ft]	Length [ft]
WIBs	16b	Upsize Existing Pipes	Upsized pipes from 0038S0256 to 0038S0248	1.25	2395
	17a	Upsize Existing Pipes	Upsized pipes from 0039S0474 to 0039S0212	0.83	818
	17b	Upsize Existing Pipes	Upsized pipes from 0039S0212 to 0039S0224	1.25	327
	17c	Upsize Existing Pipes	Upsized pipes from 0039S0229 to 0039S0224	0.83	404
	18	Upsize Existing Pipes	Upsized pipes from 0039S0475 to 0039S0251	1	365

TABLE 7.1.9 » JAMES LIVINGSTON GRAY ALTERNATIVE PROJECTS

DSR/ WIBs	Project ID	Type	Description	New Diameter [ft]	Length [ft]
WIBs	1	Upsize Existing Pipes	Upsized pipes from 0095S0145 to 0095S0164	1	283
	2a	New Relief Pipe	New relief pipe from 0095S0164 to East of 0095S0164	1	175
	2b	New Relief Pipe	New relief pipe from East of 0095S0164 to downstream of 0095S0222	1.5	910
	3	New Relief Pipe	New relief pipe from downstream of 0096S0289 to 0096S0318	1.5	1,702
	4a	Upsize Existing Pipes	Upsized pipes from 0096S0318 to 0096S0239	1.5	1,092
	4b	Upsize Existing Pipes	Upsized pipes from 0096S0239 to 0096S0232	2	720
	5	New Relief Pipe	New relief pipe from 0138S0270 to 0138S0328	0.67	364
	6	Upsize Existing Pipes	Upsized pipes from 0094S0359 to 0094S0355	2	1,024
	7a	New Relief Pipe	New relief pipe from 0191S0318 to 0140S0255	3	4,991
	7b	New Relief Pipe	New relief pipe from 0140S0255 to 0098S0212	4	7,363

TABLE 7.1.10 » FIFTH BY NORTHWEST AREA DSRs, BASE VERSUS GRAY ALTERNATIVE MODEL CONDITIONS

DSR ID >		103	109	111	107	110	105	154	151	146	149	150	147	915	148	157
Base Model Simulation	Number of Activations in 20 Years	-	7	-	-	479	364	-	76	20	27	17	10	-	25	70
	Level of Service (LOS)	-	3.02	-	-	0.04	0.05	-	0.26	1.02	0.75	1.2	2.08	-	0.81	0.29
Gray Alternative Simulation	Number of Activations in 20 Years	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-
	Level of Service (LOS)	-	-	-	-	-	-	-	-	12.5	-	-	-	-	-	-

TABLE 7.1.11 » FIFTH BY NORTHWEST GRAY ALTERNATIVE PROJECTS

DSR/SIBs	Project ID	Type	Description	New Diameter [ft]	Length [ft]
DSR 103 WIBs	2a	New Relief Weir	Relief KST at 0010S1394 Inlet Offset = 2 ft, Weir Length = 10 ft	N/A	N/A
	2b	New Relief Pipe	Relief KST at 0010S1394 to LOT 1	3	1,448
DSR 109	NA	NA	Closed	N/A	N/A
DSR 111	NA	NA	Closed	N/A	N/A
DSR 107	NA	NA	NA	N/A	N/A
DSR 110	3e	New Relief Pipe	Relief at 0027S0028 Inlet Offset = 2.16 ft	1.25	35
DSR 105		New Relief Pipe	Relief at 0027S0003 Inlet Offset = 1.54 ft	1.25	39
DSR 154	3d	New Relief Pipe	Relief at 0026S0477 Inlet Offset = 1.7 ft	1.25	31
DSR 151	3a	New Relief Pipe	Relief at 0026S0418 Inlet Offset = 1.54 ft	1.25	65
		New Relief Pipe	New relief pipes from downstream of 0026S0418 to near 0026S0478	1.5	1042

TABLE 7.1.11 » FIFTH BY NORTHWEST GRAY ALTERNATIVE PROJECTS

DSR/SIBs	Project ID	Type	Description	New Diameter [ft]	Length [ft]
DSR 110, 105, 154 and 151	6c	New Relief Pipe	Relief at 0026S0334 Inlet Offset = 0.15 ft	0.67	147
	6d	New Relief Pipe	Relief at 0026S0375 Inlet Offset = 0.2 ft	0.67	65
	6e	New Relief Pipe	Relief at 0026S0371 Inlet Offset = 0.25 ft	0.67	57
DSR 110, 105, 154 and 151 WIBs	3b	New Relief Pipe	New relief pipes from downstream of 0026S0418 to 0010S1523	1.75	192
	3c	New Relief Pipe		2	1,559
	3f	New Relief Pipe		0.83	784
DSR 146 DSR 149	1	Upsize Existing Pipes	Upsized pipes from 0026S0354 to 0026S0364	1.5	611
DSR 150	5	New Relief Pipe	New relief pipes from 0026S0164 to downstream of 0026S0418	1.25	2,957
	6a	New Relief Pipe		1.5	1,824
DSR 147	4	New Relief Pipe	Relief at 0026C0040 Inlet Offset = 0.69 ft	1	364
DSR 915	N/A	N/A	N/A	N/A	N/A
DSR 148	8	New Relief Pipe	Relief at 0026S0288	1	1,634
DSR 157	9a	New Relief Pipe	Relief at 0027S0054	1.25	1,340
	9b	New Relief Pipe	Relief at 0026S0460	0.67	219

TABLE 7.1.11 » FIFTH BY NORTHWEST GRAY ALTERNATIVE PROJECTS

DSR/SIBs	Project ID	Type	Description	New Diameter [ft]	Length [ft]
WIBs	6b	New Relief Pipe	Relief at 0026S0237	0.83	466
	7a	New Relief Pipe	New relief pipes from 0026S0426 to 0026S0423	0.83	642
	7b	Upsize Existing Pipe	Upsized pipe from 0026S0423 to 0026S0422	0.83	161
	10a	New Relief Pipe	New relief pipes from 0026S0220 to new junction downstream of 0026S0220	0.67	181
	10b		New relief pipes from 0026S0317 to new junction downstream of 0026S0317	0.67	176
	10c		New relief pipes from 0026S0324 to New junction downstream of 0026S0324	0.67	98
	10d			0.83	163
NA	11	Bulkhead	Bulkhead Oxley Road relief pipe at 0027S0028	N/A	N/A

TABLE 7.1.12 » WEST FRANKLINTON GRAY ALTERNATIVE PROJECTS

DSR/WIBs	Project ID	Type	Description	New Diameter [ft]	Length [ft]
WIBs	1	Upsize Existing Pipes	Upsized pipes from 0022S0380 to 0007S0197	1.25	1,174
			Upsized pipes from 0022S0317 to 0022S0380	1	1,727

TABLE 7.1.13 » NEAR EAST GRAY ALTERNATIVE PROJECTS

DSR/WIBs	Project ID	Type	Description	New Diameter [ft]	Length [ft]
WIBs	1	Line/Clean	Cleaned pipes from 0031S0044 to 0031S0298 (Roughness reduced from 0.02 to 0.013)	1.5	831
	2	Upsize Existing Pipes	Upsized pipes from 0031S0047 to 0031S0044	1.25	972
	3a	Upsize Existing Pipes	Upsized pipes from 0031S0234 to 0031S0236	1	426
	3b	Upsize Existing Pipes	Upsized pipes from 0031S0236 to 0031S0461	1.25	581
	4	Upsize Existing Pipes	Upsized pipes from 0030S0162 to 0030S0161	1	314
		Upsize Existing Pipes	Upsized pipes from 0030S0161 to 0030S0157		1,017
	5a	Upsize Existing Pipes	Upsized pipes from 0013S0771 to 0032S0042	1	1,929
	5b		Upsized pipes from 0032S0042 to 0032S0033	1.25	1,146
	5c		Upsized pipes from 0032S0033 to 0032S1091	1.5	94
	5d		Upsized pipes from 0032S1091 to 0032S0031		201
			Upsized pipes from 0032S0076 to 0032S0037	1	867
	5e		Upsized pipes from 0032S0071 to 0032S0040	0.83	748
	6a	New Relief Pipe	New relief pipes from downstream of 0033S0618 to 0033S0567	1	505
	6b	Upsize Existing Pipes	Upsized pipes from 0033S0560 to 0033S0556	1.25	397

TABLE 7.1.13 » NEAR EAST GRAY ALTERNATIVE PROJECTS

DSR/WIBs	Project ID	Type	Description	New Diameter [ft]	Length [ft]
WIBs	6c	Upsize Existing Pipes	Upsized pipes from 0033S0556 to 0033C0544	1.5	600
	7a	Upsize Existing Pipes	Upsized pipes from 0033S0521 to 0033S0517	0.83	420
	7b		Upsized pipes from 0033S0524 to 0033S0513	0.83	359
	8	Line/Clean	Cleaned pipes from 0013S0768 to 0032S0058 (Roughness reduced from 0.02 to 0.013)	1	1,379
	9a	Upsize Existing Pipes	Upsized pipes from 0014S0532 to 0014S0331	1.25	813
	9b		Upsized pipes from 0014S0323 to 0033S0625	1.5	386
	10a	Upsize Existing Pipes	Upsized pipes from 0033S0191 to 0033S0194	0.83	285
	10b		Upsized pipes from 0033S0189 to 0033S0193	0.83	360
	10c		Upsized pipes from 0033S0182 to 0033S1286	0.83	412
	10d		Upsized pipes from 0033S0194 to 0033S0332	1.25	1,485
	11	Upsize Existing Pipes	Upsized pipes from 0059S0042 to 0059S0007	1.5	2,003

Category	Overall Summary				OARS/WWTP/ACST								Mainline DSRs									CSO Regulator		Downtown CSO								Olentangy CSO Regulators							CSO Manholes							
Description	Total SSO (MG)	Total CSO (MG)	Total Bypasses (MG)	Total System Overflow (MG)	OARS OF	WSST Weir OF	WSST Emergency Gates	ACST	JPWWTP Mech Bypass	JPWWTP Gravity Bypass	SWWTP Gravity Bypass	CEPT	DSR 083 Deschler	DSR 095 West Side Sanitary	DSR 399 McKinley	DSR 873 Francisco Teteridge	DSR 284 FMN Pacemont Dr	DSR 156 FMN North of Hill Ave	DSR 244 Livingston James	DSR 246 Castle Rd PS	DSR 322 Williams Rd PS	Markison	Dodge Park	Town	State	Capital	Broad	Long	Spring	Chestnut	Henry	First	Third	King	Indianola	Frambes	Doe Alley	Hudson	Mound/Grant	Noble/Grant	Town/Fourth	Rich/Fifth	Cherry/Fourth	Noble/Fourth	Mound e/71	Kerr/Russel
Level of Service	N/A	N/A	N/A	N/A	4/TY	TY	TY	TY	10Y	10Y	1.4Y	N/A	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	TY	TY	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	TY	TY	TY	TY	TY	TY	TY	TY	TY	TY	TY	TY	TY	TY	TY
20Y Total Overflow Volume (MG)	1.2	5981	627	6609	5859	10.01	4.79	18.5			627	4176		0.59					0.48			1.68	2.85					0.40	0.87				1.99	0.48	54.9	2.86	0.89	3.71			9.00	0.41	8.36	0.10		0.20
20Y Total Overflow Duration (Hrs)					769	68.5	57.5	10.5			148	948		4.5					3.5			2	6.75					0.5	0.5				1.25	4.25	18.5	2.75	3	5.75			10.5	0.5	5.25	1		0.5
20Y Total Number of Activations					53	5	4	10			11	68		1					1			3	7					1	1				2	4	17	3	3	7			18	1	8	2		1
20Y LOS(in years)					N/A	N/A	N/A	N/A			1.9	N/A		33.2					33.2			N/A	N/A					33.2	33.2				N/A	N/A	N/A	N/A	N/A	N/A			N/A	N/A	N/A	N/A		N/A
10yr LOS Target Volume (MG)					N/A	N/A	N/A	N/A	Met	Met	N/A	N/A	Met	Met	Met	Met	Met	Met	Met	Met	Met	N/A	N/A	Met	Met	Met	Met	Met	Met	Met	Met	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10yr LOS Target Peak Flow (MGD)					N/A	N/A	N/A	N/A	Met	Met	N/A	N/A	Met	Met	Met	Met	Met	Met	Met	Met	Met	N/A	N/A	Met	Met	Met	Met	Met	Met	Met	Met	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Highest Volume (MG)					675.9	5.29	2.45	4.93			228.2	380.3		0.59					0.48			1.07	1.41					0.40	0.87				1.17	0.32	9.18	1.60	0.32	1.15			3.52	0.41	2.97	0.08		0.20
2nd Highest Volume (MG)					551.6	2.02	1.26	3.15			216.3	251.5										0.40	0.53										0.82	0.10	8.54	0.64	0.31	0.83			0.91		1.69	0.02		
3rd Highest Volume (MG)					539.4	1.85	1.05	2.93			111.7	243.3										0.21	0.28											0.04	6.31	0.62	0.26	0.83			0.58		0.94			
4th Highest Volume (MG)					302.8	0.80	0.03	2.83			20.2	164.4											0.20											0.02	5.64			0.30			0.53		0.83			
5th Highest Volume (MG)					274.8	0.07		2.23			16.8	158.7											0.18												3.51			0.27			0.52		0.79			
6th Highest Volume (MG)					274.2			1.46			14.5	149.2											0.17												3.47			0.20			0.46		0.63			
7th Highest Volume (MG)					242.2			0.42			7.9	139.6											0.07												3.36			0.13			0.41		0.50			
8th Highest Volume (MG)					183.8			0.31			5.1	127.5																							3.00						0.38		0.01			
9th Highest Volume (MG)					180.8			0.14			2.6	124.5																							2.48						0.36					
10th Highest Volume (MG)					162.3			0.10			2.2	116.1																							1.99						0.33					
11th Highest Volume (MG)					156.4						1.5	106.2																							1.80						0.27					
12th Highest Volume (MG)					152.9							105.4																							1.77						0.19					
13th Highest Volume (MG)					148.5							104.9																							1.61						0.13					
14th Highest Volume (MG)					141.5							104.3																							0.86						0.13					
15th Highest Volume (MG)					129.9							100.2																							0.82						0.12					
16th Highest Volume (MG)					129.2							96.4																							0.28						0.07					
17th Highest Volume (MG)					115.5							95.3																							0.26						0.06					
18th Highest Volume (MG)					112.7							93.5																													0.04					
19th Highest Volume (MG)					103.2							80.4																																		
20th Highest Volume (MG)					100.1							73.4																																		
Highest Peak Flow (MGD)					2636	118.3	32.1	104.0			425.4	110		4.79					5.20			53.3	42.3					32.0	66.2				85.9	9.19	216.6	74.1	25.4	69.1			155.9	19.7	148.6	5.99		18.4
2nd Peak Flow (MGD)					895.8	109.0	17.5	82.4			362.2	110										20.2	13.1										31.9	2.68	213.7	50.2	14.5	35.1			54.8		88.3	1.37		
3rd Peak Flow (MGD)					894.5	78.9	10.1	74.8			350.0	110										17.9	12.2											1.96	204.3	31.9	9.67	32.2			54.0		85.4			
4th Peak Flow (MGD)					769.1	58.5	0.13	62.6			59.5	110											11.2											1.36	191.3			24.8			50.2		39.2			
5th Peak Flow (MGD)					739.1	0.31		57.3			50.2	110											9.9												179.3			19.4			38.9		37.9			
6th Peak Flow (MGD)					591.5			56.0			49.3	110											8.4												177.8			11.5			32.2		36.0			
7th Peak Flow (MGD)					589.9			34.0			48.7	110											3.3												126.9			11.2			29.0		34.6			
8th Peak Flow (MGD)					576.2			16.1			34.7	110																							116.9						25.4		0.82			
9th Peak Flow (MGD)					520.8			11.9			21.6	110																							107.7						25.3					
10th Peak Flow (MGD)					479.5			7.65			18.6	110																							92.8						19.8					
11th Peak Flow (MGD)					473.0						13.1	110																							90.4						15.7					
12th Peak Flow (MGD)					457.1							110																							80.0						13.4					
13th Peak Flow (MGD)					428.6							110																							79.8						7.76					
14th Peak Flow (MGD)					403.8							110																							75.6						7.49					
15th Peak Flow (MGD)					364.9							110																							28.8						6.50					
16th Peak Flow (MGD)					348.7							110																							24.1						5.76					
17th Peak Flow (MGD)					334.2							110																							14.4						3.90					
18th Peak Flow (MGD)					312.7							110																													3.77					
19th Peak Flow (MGD)					308.1							110																																		
20th Peak Flow (MGD)					301.5							110																																		

Models: IP Models\GRY\SSCM12_RPM_GRY+_wACISACTCleanup_woRamping_OptCEPT_1995-2014.inp
Cutoff Values: Volume: 0.01 MG; Peak: 0.1 MGD; Duration: 0.25 hours

TABLE 7.1.14 » GRAY ALTERNATIVE 20-YEAR MODEL RUN SUMMARY OF RESULTS, 2050 CONDITIONS

Category	Blueprint DSRs - Fifth by Northwest								Blueprint DSRs - Miller Kelton									Blueprint DSRs - Barthman Parsons									Blueprint DSRs - Hilltop				Blueprint DSRs - Linden/Northeast Area								Blueprint DSRs - Clintonville														PR DSRs
Description	DSR 103 (West Fifth)	DSR 107 (West Fifth)	DSR 146 (West Fifth)	DSR 149 (West Fifth)	DSR 150 (West Fifth)	DSR 915 (West Fifth)	DSR 148 (West Fifth)	DSR 157 (West Fifth)	DSR 177 (Miller Kelton)	DSR 181 (Miller Kelton)	DSR 189 (Miller Kelton)	DSR 179 (Miller Kelton)	DSR 188 (Miller Kelton)	DSR 190 (Miller Kelton)	DSR 185 (Miller Kelton)	DSR 199 (Miller Kelton)	DSR 193 (Miller Kelton)	DSR 203 (Barthman)	DSR 201 (Barthman)	DSR 211 (Barthman)	DSR 207 (Barthman)	DSR 208 (Barthman)	DSR 206 (Barthman)	DSR 205 (Barthman)	DSR 210 (Barthman)	DSR 213 (Barthman)	DSR 250 (Early Ditch)	DSR 254 (Early Ditch)	DSR 252 (Early Ditch)	DSR 256 (Early Ditch)	DSR 314 (NWAC)	DSR 307 (NWAC)	DSR 305 (NWAC)	DSR 306 (NWAC)	DSR 312 (NWAC)	DSR 315 (NWAC)	DSR 339 (NWAC)	DSR 952 (NWAC)	DSR 326 (CVM)	DSR 323 (CVM)	DSR 335 (CVM)	DSR 352 (CVM)	DSR 346 (CVM)	DSR 351 (CVM)	DSR 360 (CVM)	DSR 337 (CVM)	DSR 349 (CVM)	DSR 368 (CVM)	DSR 285 (Walhalla)	DSR 328 (Walhalla)	DSR 898 (Walhalla)	DSR 329 (Walhalla)	DSR 364 (Plum Ridge)
Level of Service	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y
20Y Total Overflow Volume (MG)			0.01																								0.03																								0.05		
20Y Total Overflow Duration (Hrs)			0.5																								1.75																								3.25		
20Y Total Number of Activations			1																								2																								1		
20Y LOS(in years)			33.2																								12.5																								33.2		
10yr LOS Target Volume (MG)	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met
10yr LOS Target Peak Flow (MGD)	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met
Highest Volume (MG)			0.01																								0.02																								0.05		
2nd Highest Volume (MG)																											0.01																										
3rd Highest Volume (MG)																																																					
4th Highest Volume (MG)																																																					
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18th Highest Volume (MG)																																																					
19th Highest Volume (MG)																																																					
20th Highest Volume (MG)																																																					
Highest Peak Flow (MGD)			1.14																								0.66																								0.58		
2nd Peak Flow (MGD)																											0.46																										
3rd Peak Flow (MGD)																																																					
4th Peak Flow (MGD)																																																					
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18th Peak Flow (MGD)																																																					
19th Peak Flow (MGD)																																																					
20th Peak Flow (MGD)																																																					

Models: IP Models\GRY\SSCM12_RPM_GRY+_wACISACTCleanup_woRamping_OptCEPT_1995-2014.inp
Cutoff Values: Volume: 0.01 MG; Peak: 0.1 MGD; Duration: 0.25 hours

TABLE 7.1.15 » GRAY ALTERNATIVE TYPICAL YEAR MODEL RUN SUMMARY OF RESULTS, 2050 CONDITIONS

Category	Overall Summary				OARS/WWTP/ACST							
Description	Total SSO (MG)	Total CSO (MG)	Total Bypasses (MG)	Total System Overflow (MG)	OARS OF	WSST Weir OF	WSST Emergency Gates	ACST	JPWWTP Mech Bypass	JPWWTP Gravity Bypass	SWWTP Gravity Bypass	CEPT
Level of Service	N/A	N/A	N/A	N/A	4/TY	TY	TY	TY	1.4Y	1.4Y	1.4Y	N/A
TY total overflow volume (MG)					16.5							88.5
TY total overflow duration (Hrs)					7.25							20.8
TY total number of activations		16.5		16.5	2							4
TY highest OF event volume (MG)					15.92							47.6
TY highest OF event peak flow (MGD)					102.4							110
Highest Volume (MG)					15.9							47.6
2nd Highest Volume (MG)					0.60							22.9
3rd Highest Volume (MG)												14.5
4th Highest Volume (MG)												3.44
5th Highest Volume (MG)												
6th Highest Volume (MG)												
7th Highest Volume (MG)												
8th Highest Volume (MG)												
9th Highest Volume (MG)												
10th Highest Volume (MG)												
11th Highest Volume (MG)												
12th Highest Volume (MG)												
13th Highest Volume (MG)												
Highest Peak Flow (MGD)					102.4							110
2nd Peak Flow (MGD)					57.73							110
3rd Peak Flow (MGD)												110
4th Peak Flow (MGD)												110
5th Peak Flow (MGD)												
6th Peak Flow (MGD)												
7th Peak Flow (MGD)												
8th Peak Flow (MGD)												
9th Peak Flow (MGD)												
10th Peak Flow (MGD)												
11th Peak Flow (MGD)												
12th Peak Flow (MGD)												
13th Peak Flow (MGD)												

Category	Mainline DSRs									CSO Regulator	
Description	DSR 083 Deschler	DSR 095 West Side Sanitary	DSR 399 McKinley	DSR 873 Francisco Teteridge	DSR 284 FMN Pacemont Dr	DSR 156 FMN North of Hill Ave	DSR 244 Livingston James	DSR 246 Castle Rd PS	DSR 322 Williams Rd PS	Markison	Dodge Park
Level of Service	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	TY	TY
TY total overflow volume (MG)											
TY total overflow duration (Hrs)											
TY total number of activations											
TY highest OF event volume (MG)											
TY highest OF event peak flow (MGD)											
Highest Volume (MG)											
2nd Highest Volume (MG)											
3rd Highest Volume (MG)											
4th Highest Volume (MG)											
5th Highest Volume (MG)											
6th Highest Volume (MG)											
7th Highest Volume (MG)											
8th Highest Volume (MG)											
9th Highest Volume (MG)											
10th Highest Volume (MG)											
11th Highest Volume (MG)											
12th Highest Volume (MG)											
13th Highest Volume (MG)											
Highest Peak Flow (MGD)											
2nd Peak Flow (MGD)											
3rd Peak Flow (MGD)											
4th Peak Flow (MGD)											
5th Peak Flow (MGD)											
6th Peak Flow (MGD)											
7th Peak Flow (MGD)											
8th Peak Flow (MGD)											
9th Peak Flow (MGD)											
10th Peak Flow (MGD)											
11th Peak Flow (MGD)											
12th Peak Flow (MGD)											
13th Peak Flow (MGD)											

Category	Downtown CSO								Olentangy CSO Regulators						
Description	Town	State	Capital	Broad	Long	Spring	Chestnut	Henry	First	Third	King	Indianola	Frambes	Doe Alley	Hudson
Level of Service	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	TY	TY	TY	TY	TY	TY	TY
TY total overflow volume (MG)															
TY total overflow duration (Hrs)															
TY total number of activations															
TY highest OF event volume (MG)															
TY highest OF event peak flow (MGD)															
Highest Volume (MG)															
2nd Highest Volume (MG)															
3rd Highest Volume (MG)															
4th Highest Volume (MG)															
5th Highest Volume (MG)															
6th Highest Volume (MG)															
7th Highest Volume (MG)															
8th Highest Volume (MG)															
9th Highest Volume (MG)															
10th Highest Volume (MG)															
11th Highest Volume (MG)															
12th Highest Volume (MG)															
13th Highest Volume (MG)															
Highest Peak Flow (MGD)															
2nd Peak Flow (MGD)															
3rd Peak Flow (MGD)															
4th Peak Flow (MGD)															
5th Peak Flow (MGD)															
6th Peak Flow (MGD)															
7th Peak Flow (MGD)															
8th Peak Flow (MGD)															
9th Peak Flow (MGD)															
10th Peak Flow (MGD)															
11th Peak Flow (MGD)															
12th Peak Flow (MGD)															
13th Peak Flow (MGD)															

Category	CSO Manholes							
Description	Mound/Grant	Noble/Grant	Town/Fourth	Rich/Fifth	Cherry/Fourth	Noble/Fourth	Mound e/71	Kerr/Russel
Level of Service	TY	TY	TY	TY	TY	TY	TY	TY
TY total overflow volume (MG)								
TY total overflow duration (Hrs)								
TY total number of activations								
TY highest OF event volume (MG)								
TY highest OF event peak flow (MGD)								
Highest Volume (MG)								
2nd Highest Volume (MG)								
3rd Highest Volume (MG)								
4th Highest Volume (MG)								
5th Highest Volume (MG)								
6th Highest Volume (MG)								
7th Highest Volume (MG)								
8th Highest Volume (MG)								
9th Highest Volume (MG)								
10th Highest Volume (MG)								
11th Highest Volume (MG)								
12th Highest Volume (MG)								
13th Highest Volume (MG)								
Highest Peak Flow (MGD)								
2nd Peak Flow (MGD)								
3rd Peak Flow (MGD)								
4th Peak Flow (MGD)								
5th Peak Flow (MGD)								
6th Peak Flow (MGD)								
7th Peak Flow (MGD)								
8th Peak Flow (MGD)								
9th Peak Flow (MGD)								
10th Peak Flow (MGD)								
11th Peak Flow (MGD)								
12th Peak Flow (MGD)								
13th Peak Flow (MGD)								

Models: IP Models\GRY\SSCM12_RPM_GRY+_wACISACTCleanup_woRamping_OptCEPT_TY.inp
Cutoff Values: Volume: 0.01 MG; Peak: 0.1 MGD; Duration: 0.25 hours

TABLE 7.1.15 » GRAY ALTERNATIVE TYPICAL YEAR MODEL RUN SUMMARY OF RESULTS, 2050 CONDITIONS

Category	Blueprint DSRs - Fifth by Northwest								Blueprint DSRs - Miller Kelton								
Description	DSR 103 (West Fifth)	DSR 107 (West Fifth)	DSR 146 (West Fifth)	DSR 149 (West Fifth)	DSR 150 (West Fifth)	DSR 915 (West Fifth)	DSR 148 (West Fifth)	DSR 157 (West Fifth)	DSR 177 (Miller Kelton)	DSR 181 (Miller Kelton)	DSR 189 (Miller Kelton)	DSR 179 (Miller Kelton)	DSR 188 (Miller Kelton)	DSR 190 (Miller Kelton)	DSR 185 (Miller Kelton)	DSR 199 (Miller Kelton)	DSR 193 (Miller Kelton)
Level of Service	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y
TY total overflow volume (MG)																	
TY total overflow duration (Hrs)																	
TY total number of activations																	
TY highest OF event volume (MG)																	
TY highest OF event peak flow (MGD)																	
Highest Volume (MG)																	
2nd Highest Volume (MG)																	
3rd Highest Volume (MG)																	
4th Highest Volume (MG)																	
5th Highest Volume (MG)																	
6th Highest Volume (MG)																	
7th Highest Volume (MG)																	
8th Highest Volume (MG)																	
9th Highest Volume (MG)																	
10th Highest Volume (MG)																	
11th Highest Volume (MG)																	
12th Highest Volume (MG)																	
13th Highest Volume (MG)																	
Highest Peak Flow (MGD)																	
2nd Peak Flow (MGD)																	
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11th Peak Flow (MGD)																	
12th Peak Flow (MGD)																	
13th Peak Flow (MGD)																	

Category	Blueprint DSRs - Barthman Parsons									Blueprint DSRs - Hilltop				Blueprint DSRs - Linden/Northeast Area							
Description	DSR 203 (Barthman)	DSR 201 (Barthman)	DSR 211 (Barthman)	DSR 207 (Barthman)	DSR 208 (Barthman)	DSR 206 (Barthman)	DSR 205 (Barthman)	DSR 210 (Barthman)	DSR 213 (Barthman)	DSR 250 (Early Ditch)	DSR 254 (Early Ditch)	DSR 252 (Early Ditch)	DSR 256 (Early Ditch)	DSR 314 (NWAC)	DSR 307 (NWAC)	DSR 305 (NWAC)	DSR 306 (NWAC)	DSR 312 (NWAC)	DSR 315 (NWAC)	DSR 339 (NWAC)	DSR 952 (NWAC)
Level of Service	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y
TY total overflow volume (MG)																					
TY total overflow duration (Hrs)																					
TY total number of activations																					
TY highest OF event volume (MG)																					
TY highest OF event peak flow (MGD)																					
Highest Volume (MG)																					
2nd Highest Volume (MG)																					
3rd Highest Volume (MG)																					
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13th Highest Volume (MG)																					
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10th Peak Flow (MGD)																					
11th Peak Flow (MGD)																					
12th Peak Flow (MGD)																					
13th Peak Flow (MGD)																					

Category	Blueprint DSRs - Clintonville														PR
Description	DSR 326 (CVM)	DSR 323 (CVM)	DSR 335 (CVM)	DSR 352 (CVM)	DSR 346 (CVM)	DSR 351 (CVM)	DSR 360 (CVM)	DSR 337 (CVM)	DSR 349 (CVM)	DSR 368 (CVM)	DSR 285 (Walhalla)	DSR 328 (Walhalla)	DSR 898 (Walhalla)	DSR 329 (Walhalla)	DSR 364 (Plum Ridge)
Level of Service	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y	10Y
TY total overflow volume (MG)															
TY total overflow duration (Hrs)															
TY total number of activations															
TY highest OF event volume (MG)															
TY highest OF event peak flow (MGD)															
Highest Volume (MG)															
2nd Highest Volume (MG)															
3rd Highest Volume (MG)															
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11th Highest Volume (MG)															
12th Highest Volume (MG)															
13th Highest Volume (MG)															
Highest Peak Flow (MGD)															
2nd Peak Flow (MGD)															
3rd Peak Flow (MGD)															
4th Peak Flow (MGD)															
5th Peak Flow (MGD)															
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9th Peak Flow (MGD)															
10th Peak Flow (MGD)															
11th Peak Flow (MGD)															
12th Peak Flow (MGD)															
13th Peak Flow (MGD)															

Models: IP Models\GRY\SSCM12_RPM_GRY+_wACISACTCleanup_woRamping_OptCEPT_TY.inp
Cutoff Values: Volume: 0.01 MG; Peak: 0.1 MGD; Duration: 0.25 hours

FIGURE 7.1.1 » PHASE 2 OF THE LOWER OLENTANGY TUNNEL (LOT2) FOR THE GRAY ALTERNATIVE

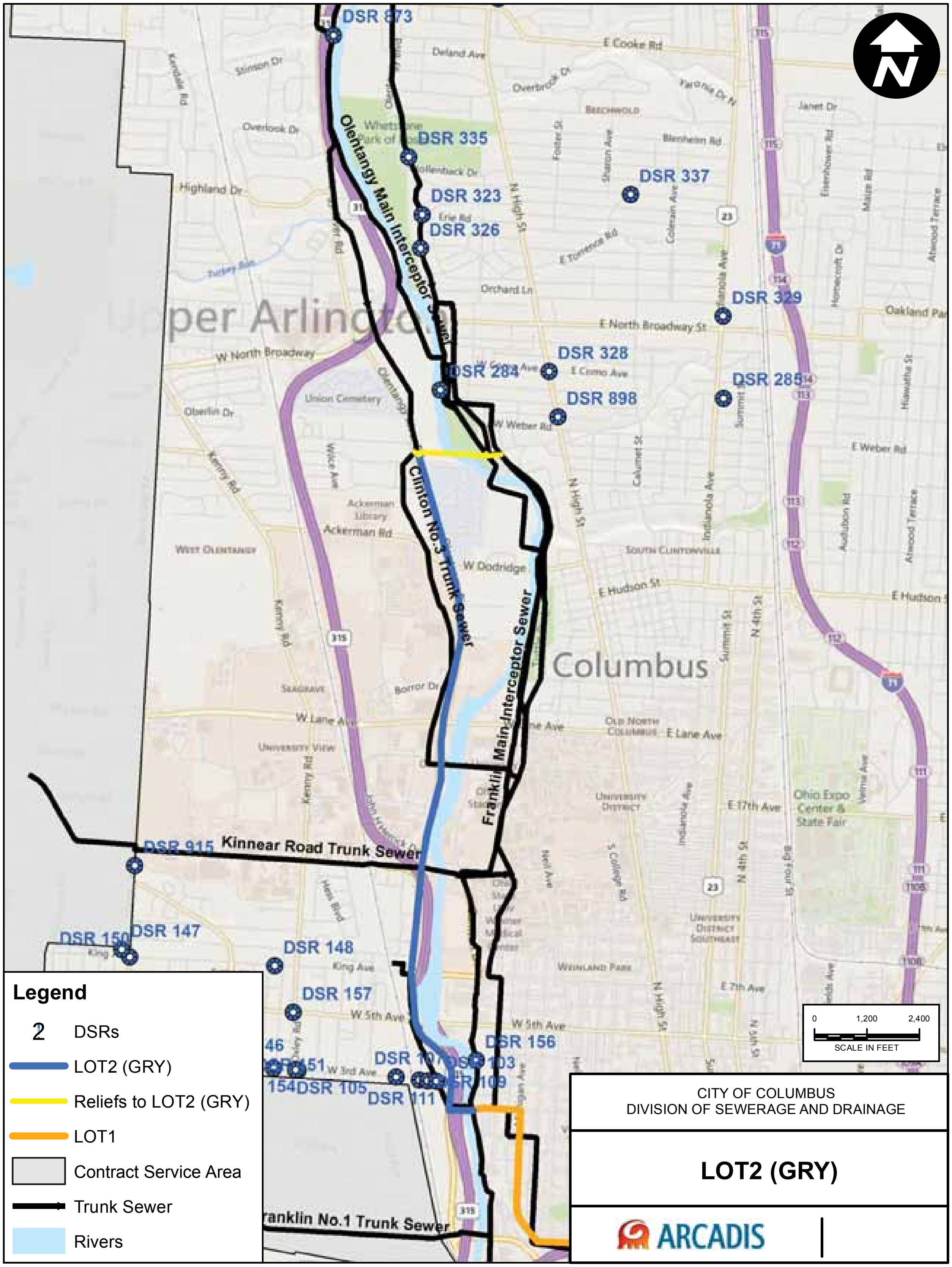
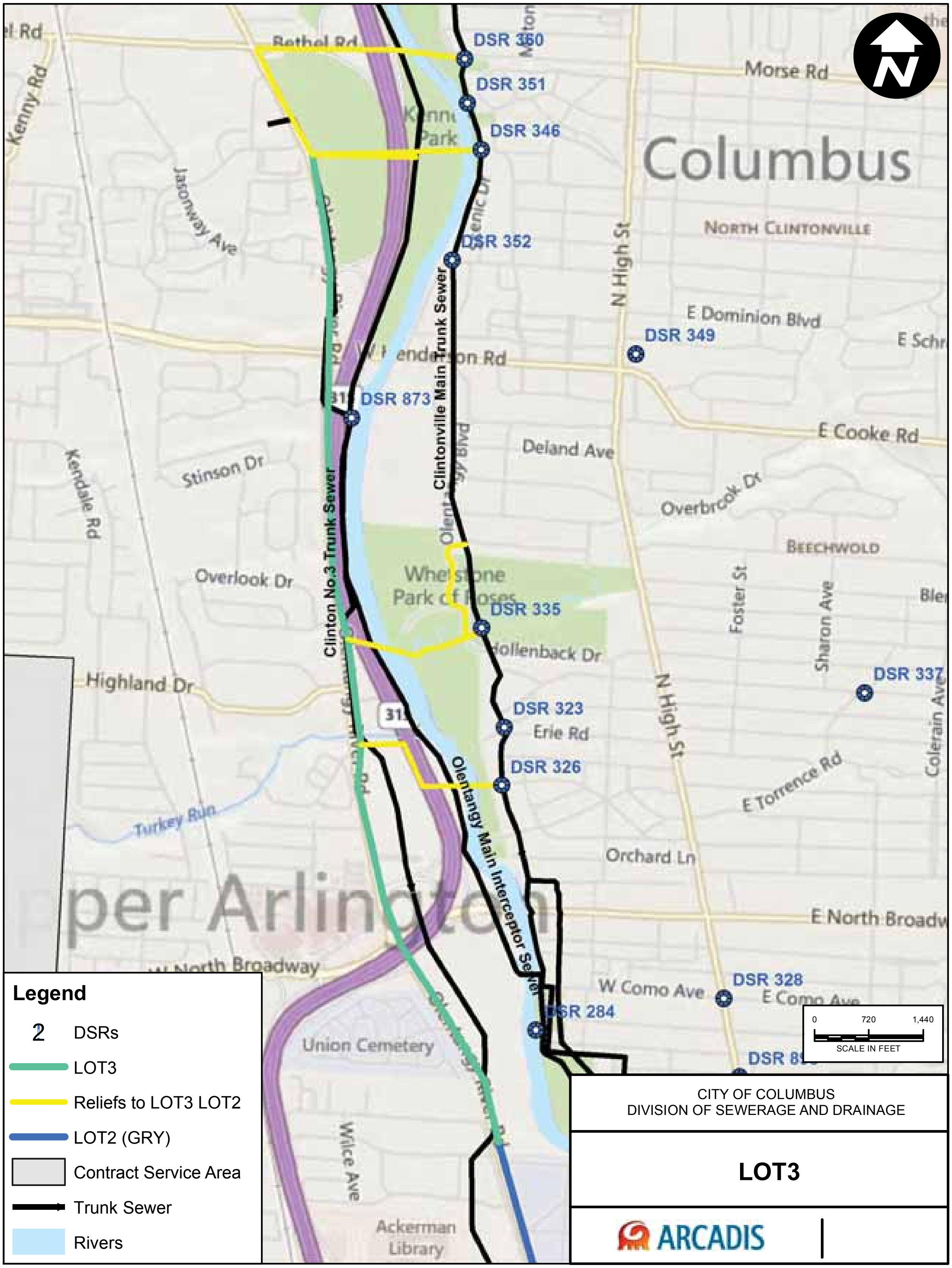


FIGURE 7.1.2 » PHASE 3 OF THE LOWER OLENTANGY TUNNEL (LOT3)



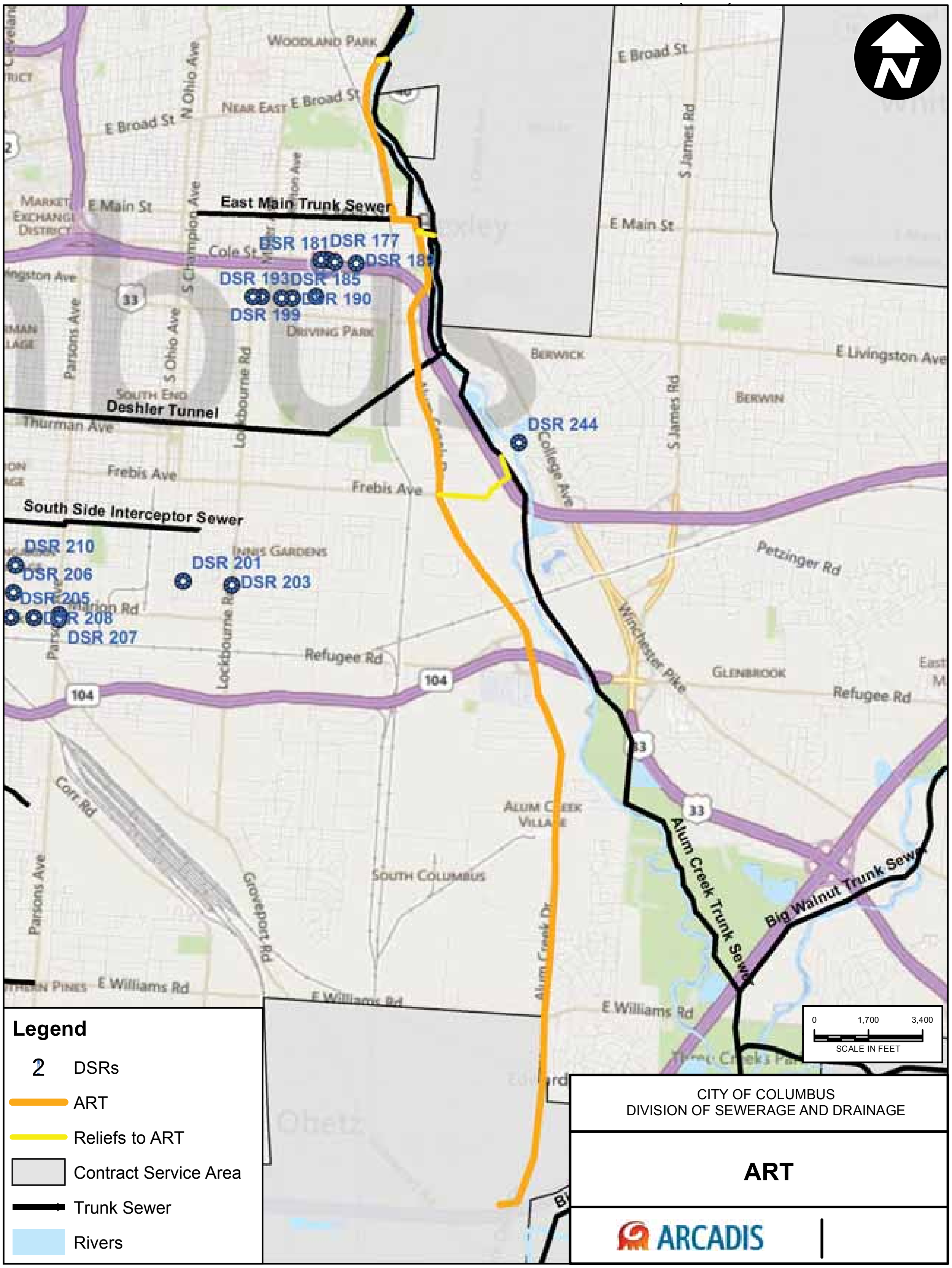

Woodland Park
E Broad St
Near East
N Ohio Ave
Market Exchange District
E Main St
East Main Trunk Sewer
Bexley
Cole St
DSR 181
DSR 177
DSR 18
DSR 193
DSR 185
DSR 190
DSR 199
Driving Park
S Champion Ave
S Ohio Ave
Parsons Ave
Lockbourne Rd
South End
Deshler Tunnel
Thurman Ave
Berwick
E Livingston Ave
Berwin
S James Rd
DSR 244
College Ave
Frebis Ave
South Side Interceptor Sewer
DSR 210
DSR 206
DSR 205
DSR 208
DSR 207
DSR 201
DSR 203
Innis Gardens
Marion Rd
Petzinger Rd
Winchester Pike
Refugee Rd
Glenbrook
104
33
Corr Rd
Groveport Rd
Alum Creek Village
South Columbus
Alum Creek Dr
Alum Creek Trunk Sewer
Big Walnut Trunk Sew
E Williams Rd
0
1,700
3,400
SCALE IN FEET
Legend
DSRs
ART
Reliefs to ART
Contract Service Area
Trunk Sewer
Rivers
CITY OF COLUMBUS
DIVISION OF SEWERAGE AND DRAINAGE
ART
ARCADIS

FIGURE 7.1.4 » THE SECOND INTERCONNECTOR BARREL

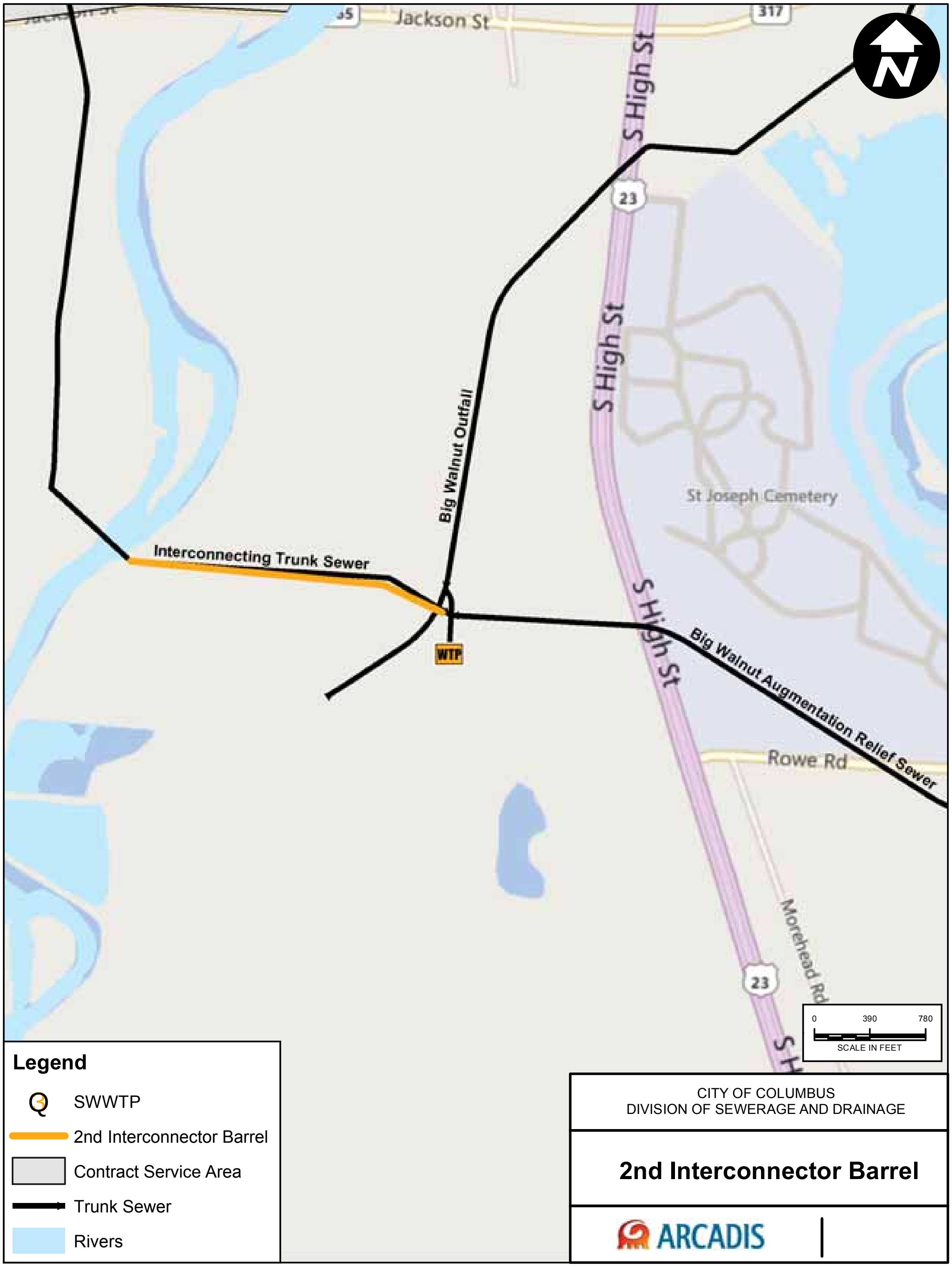


FIGURE 7.1.5 » DSR 873 RELIEF

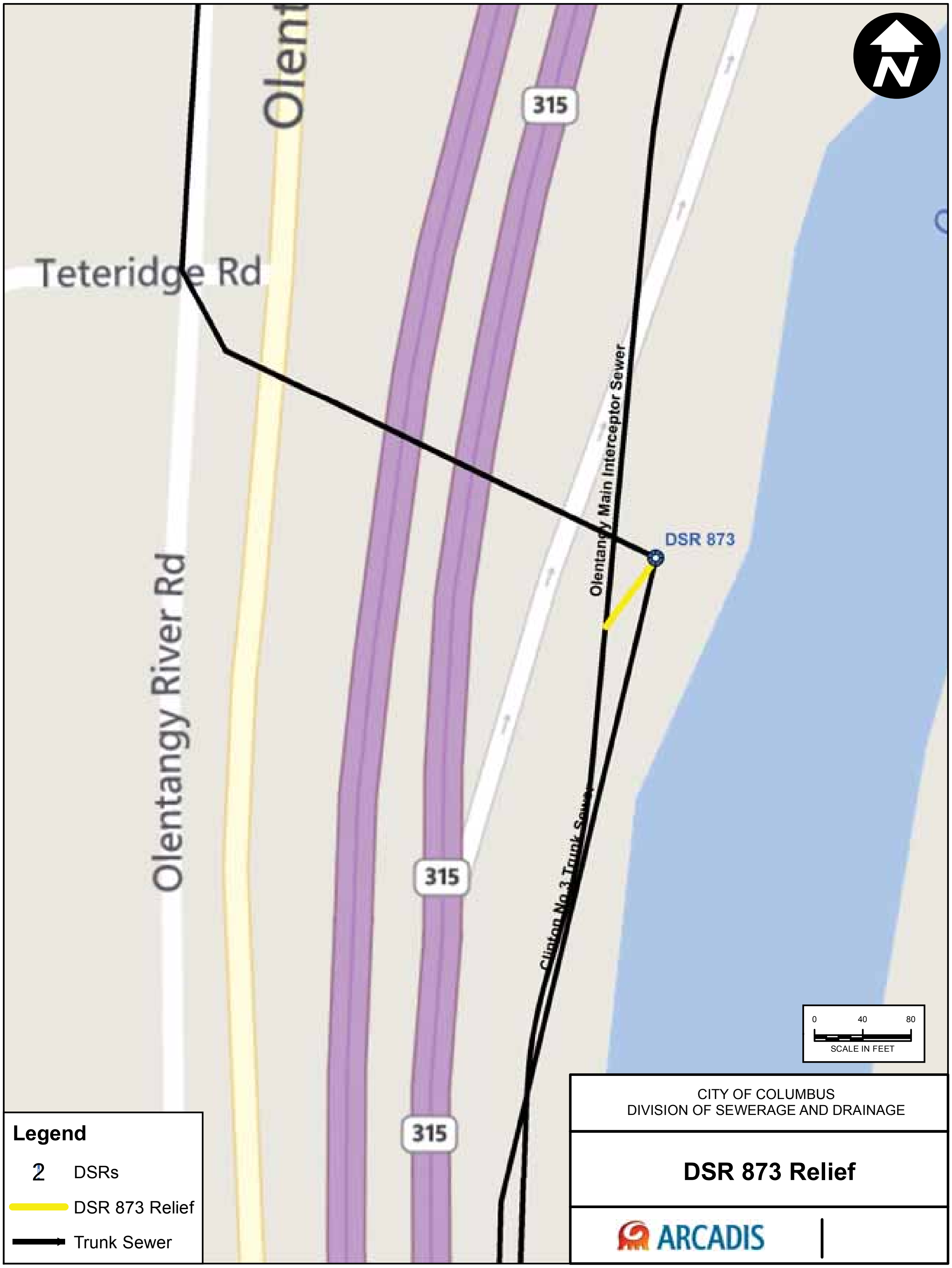


FIGURE 7.1.6 » LOCATION OF LOCAL GRAY PROJECT AREAS
(LOCAL GRAY AREAS ARE SHOWN IN BLUE)

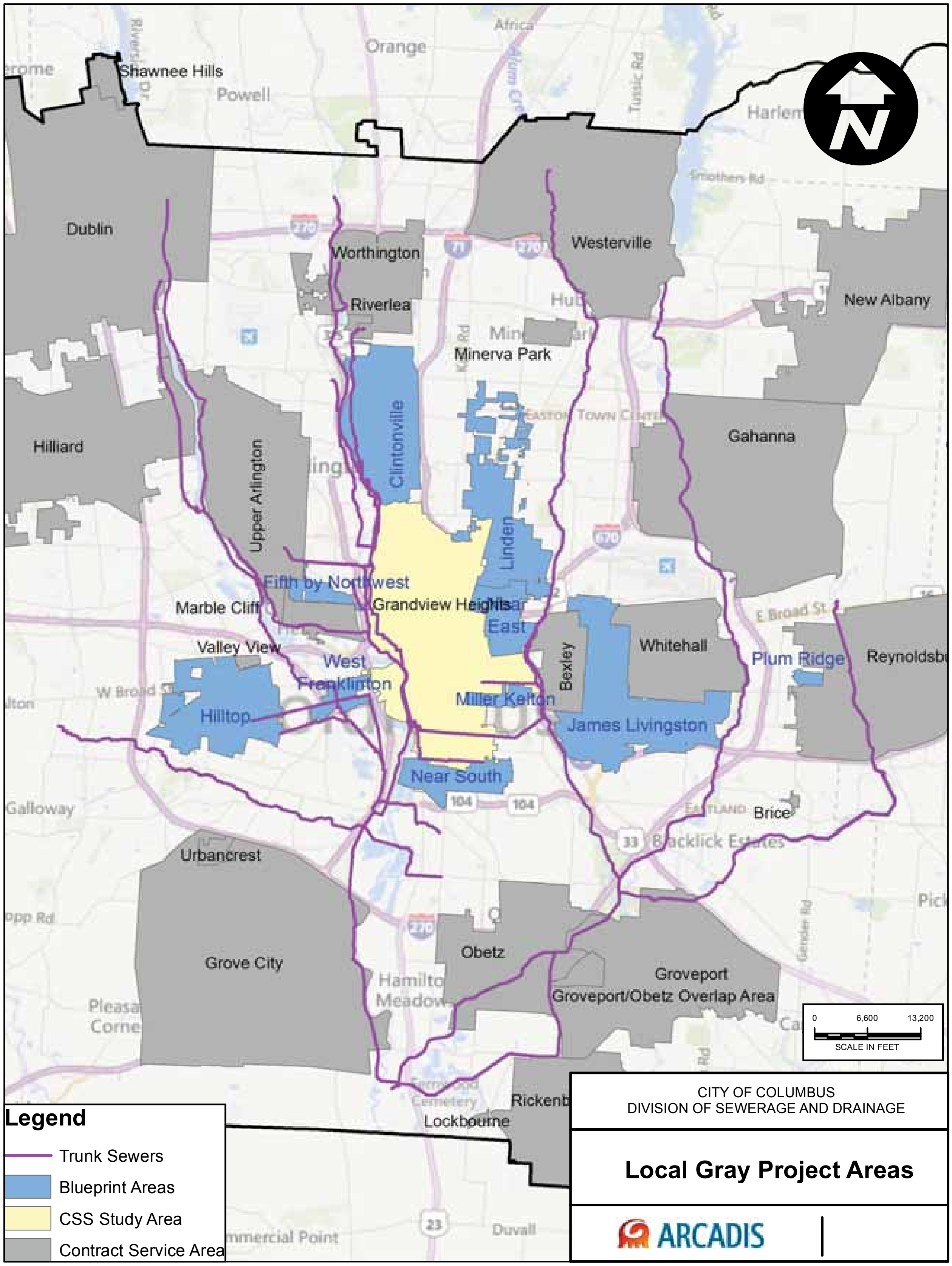


FIGURE 7.1.7 » CLINTONVILLE GRAY ALTERNATIVE – PROJECTS LOCATION

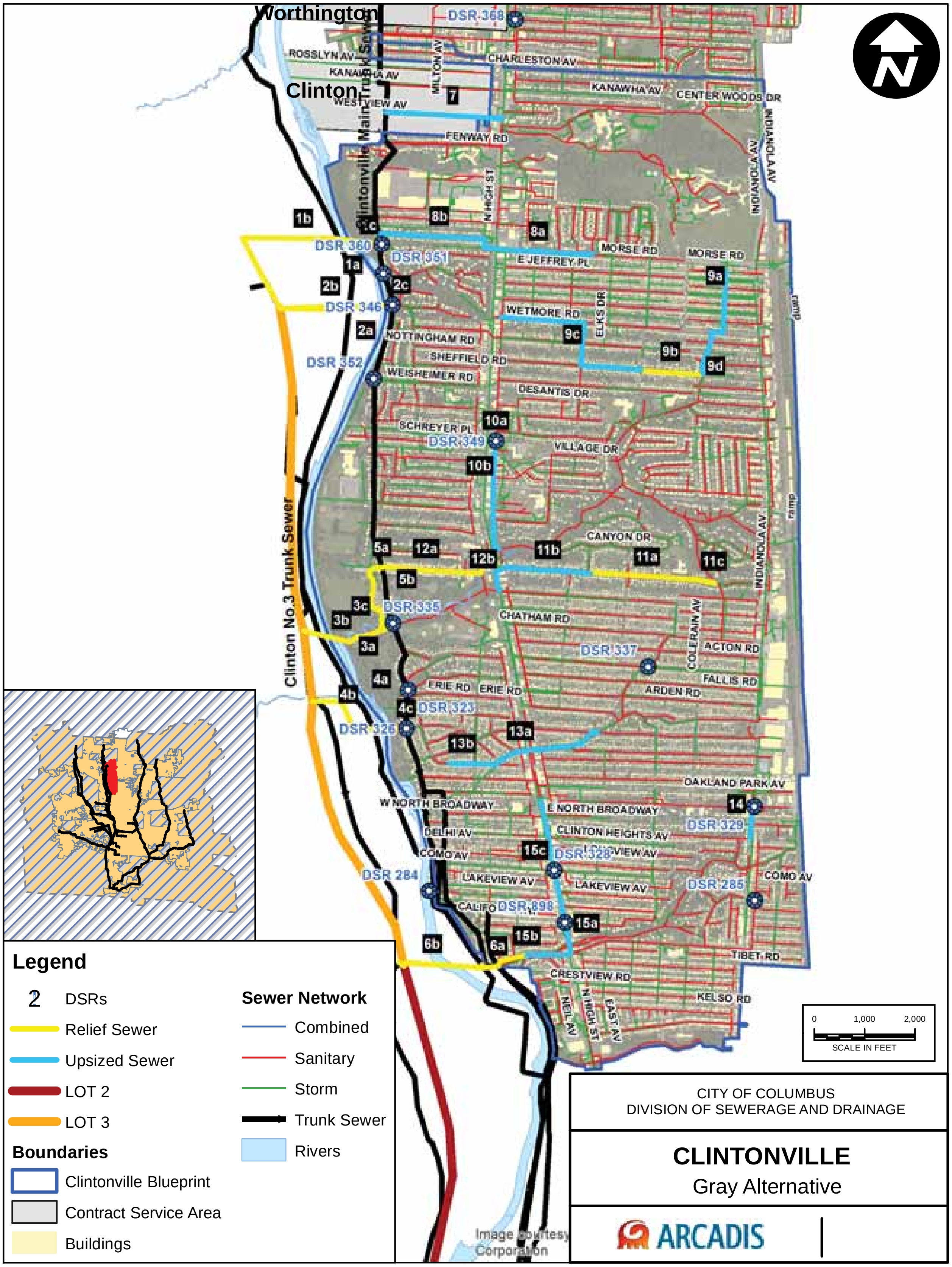


FIGURE 7.1.8 » HILLTOP GRAY ALTERNATIVE – PROJECTS LOCATION

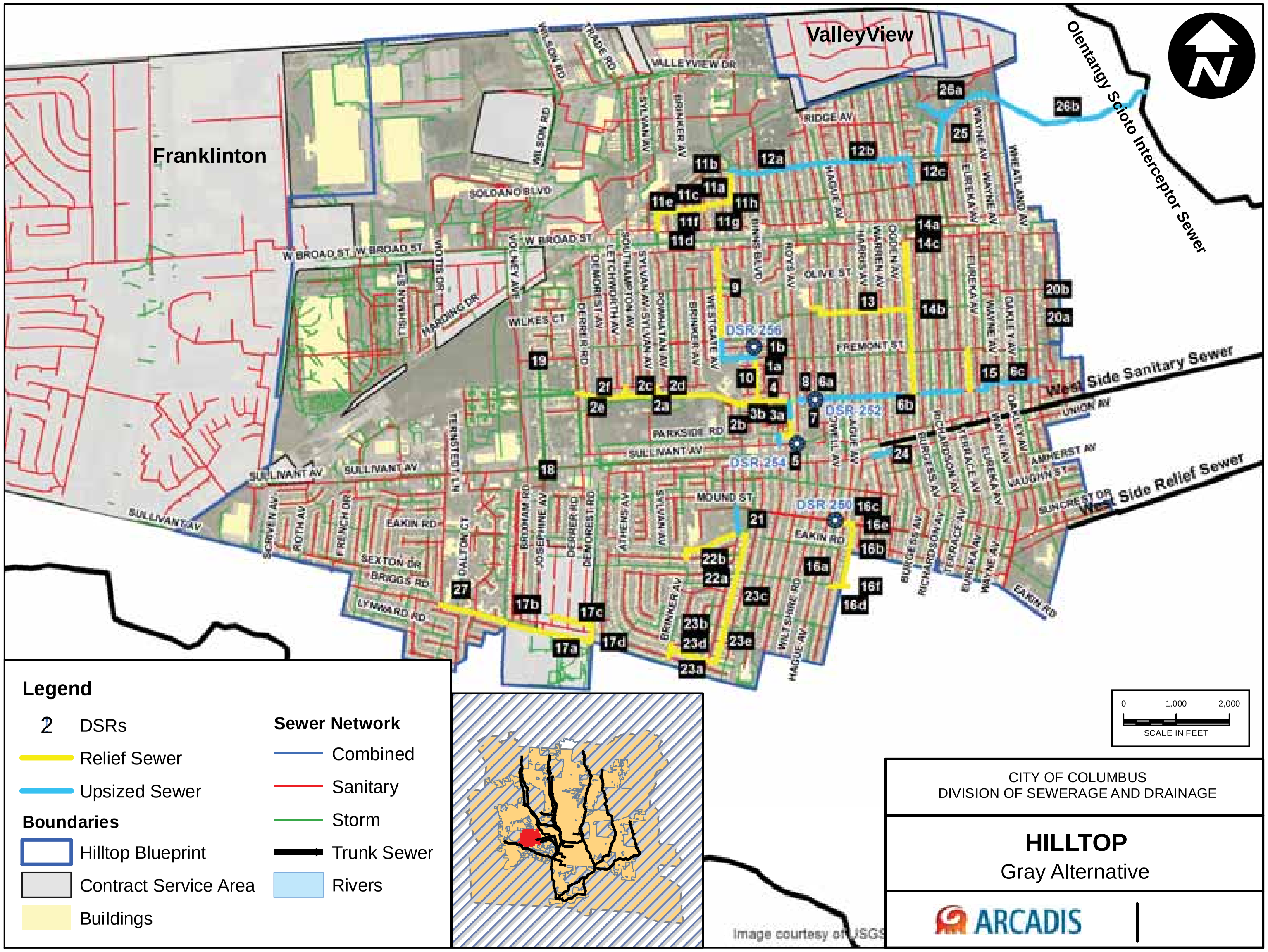


FIGURE 7.1.9 » LINDEN GRAY ALTERNATIVE – PROJECTS LOCATION

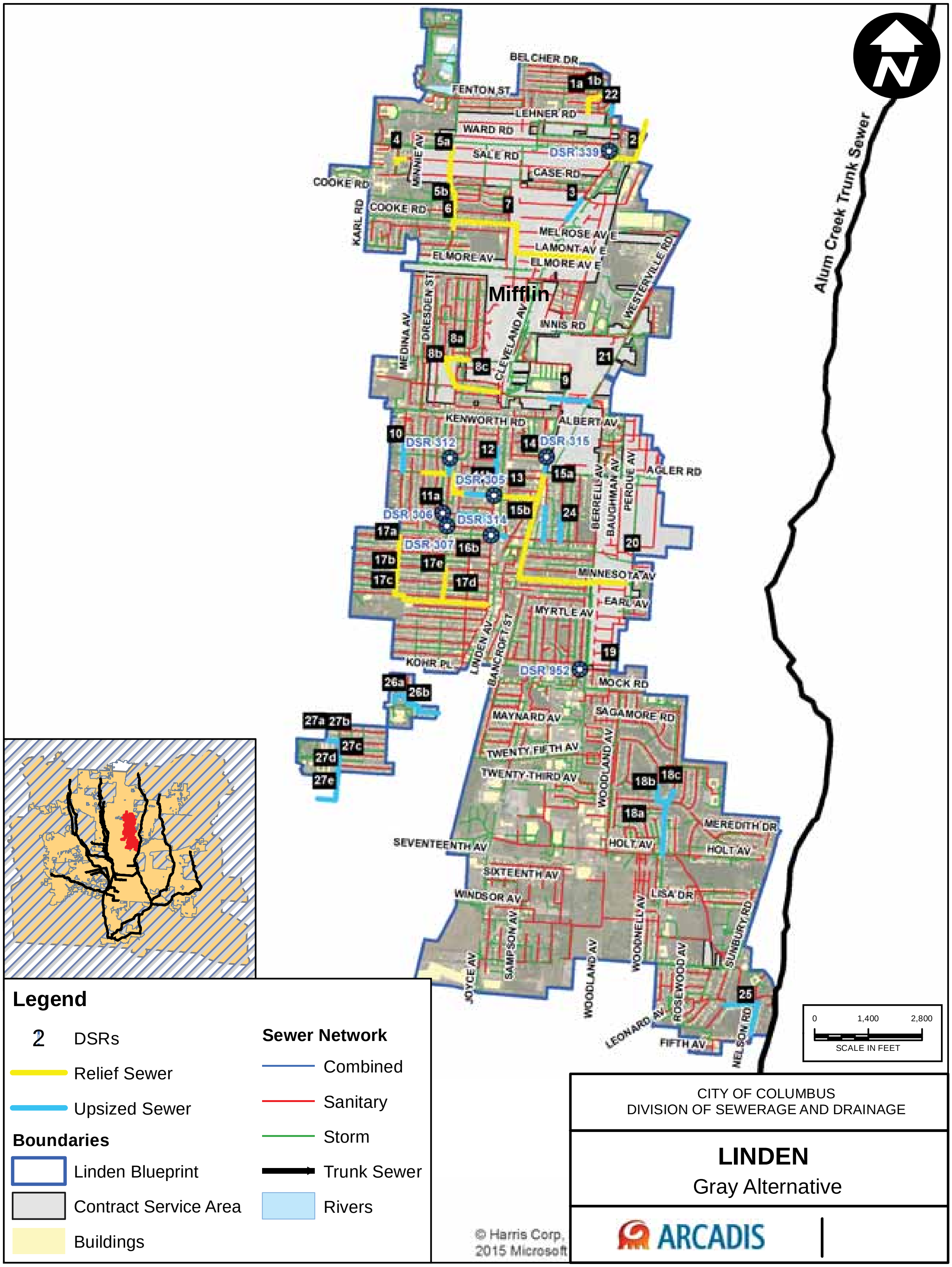


FIGURE 7.1.10 » MILLER KELTON GRAY ALTERNATIVE – PROJECTS LOCATION

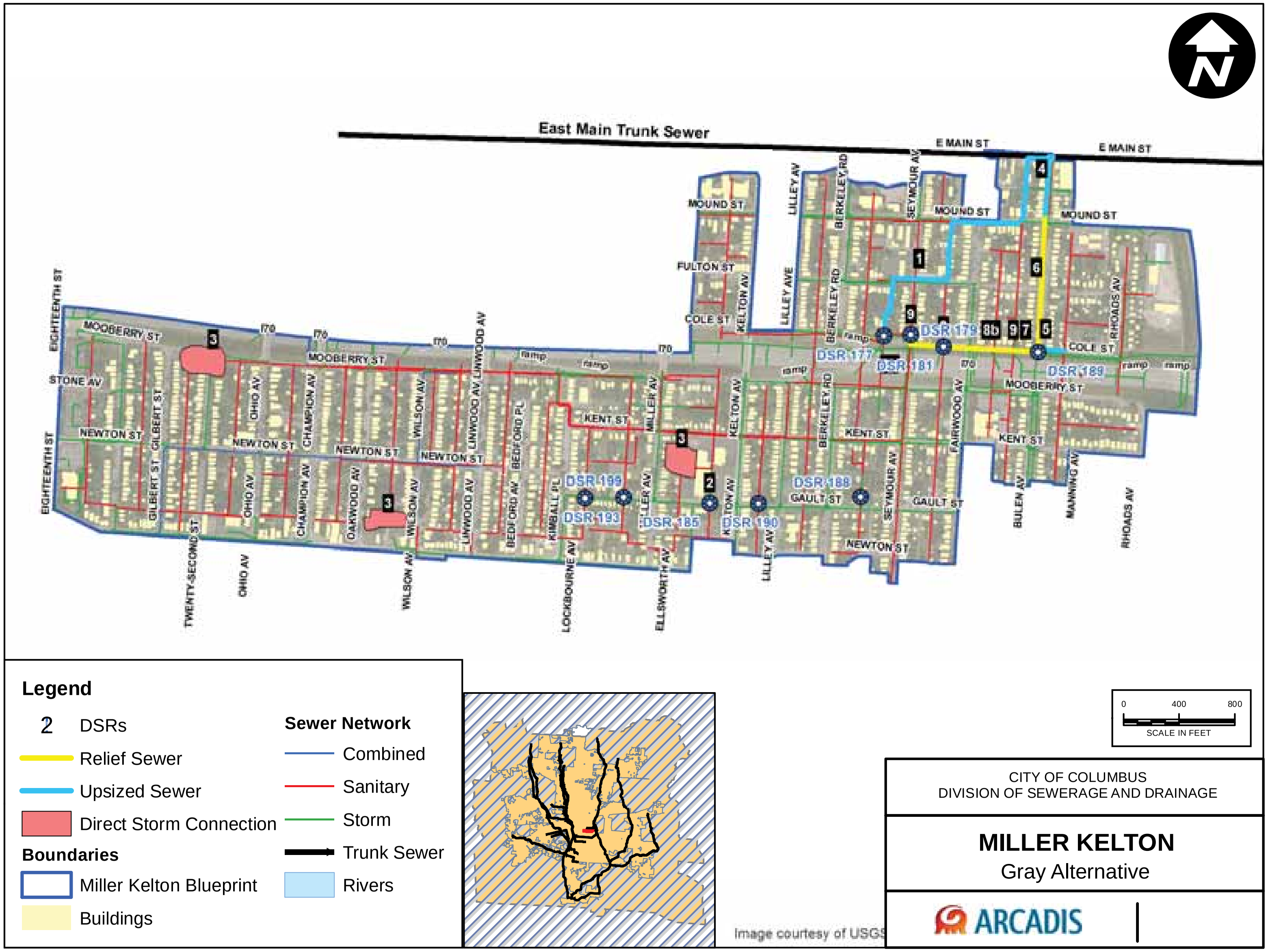


FIGURE 7.1.11 » PLUM RIDGE GRAY ALTERNATIVE – PROJECTS LOCATION

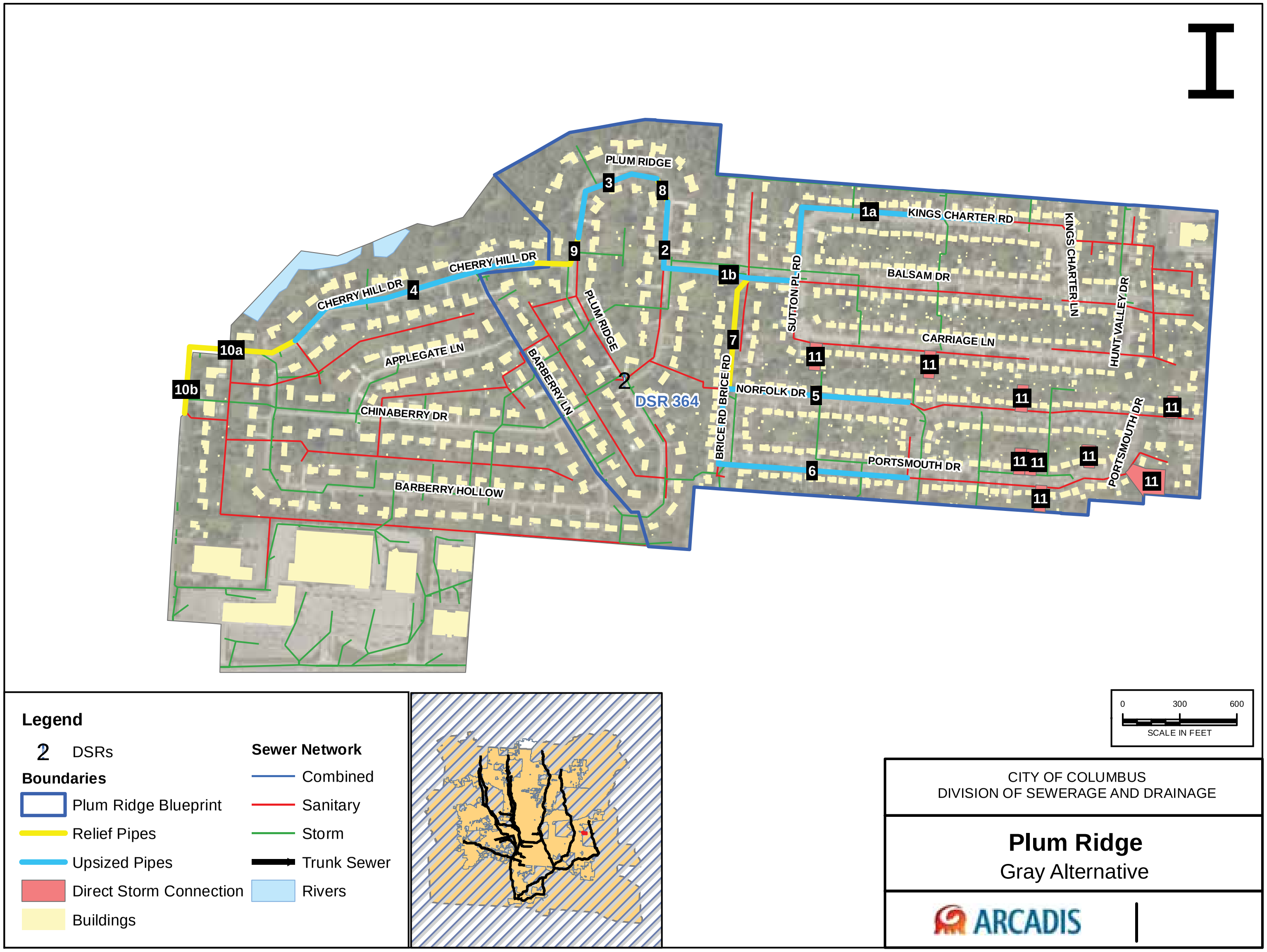


FIGURE 7.1.12 » NEAR SOUTH GRAY ALTERNATIVE – PROJECTS LOCATION

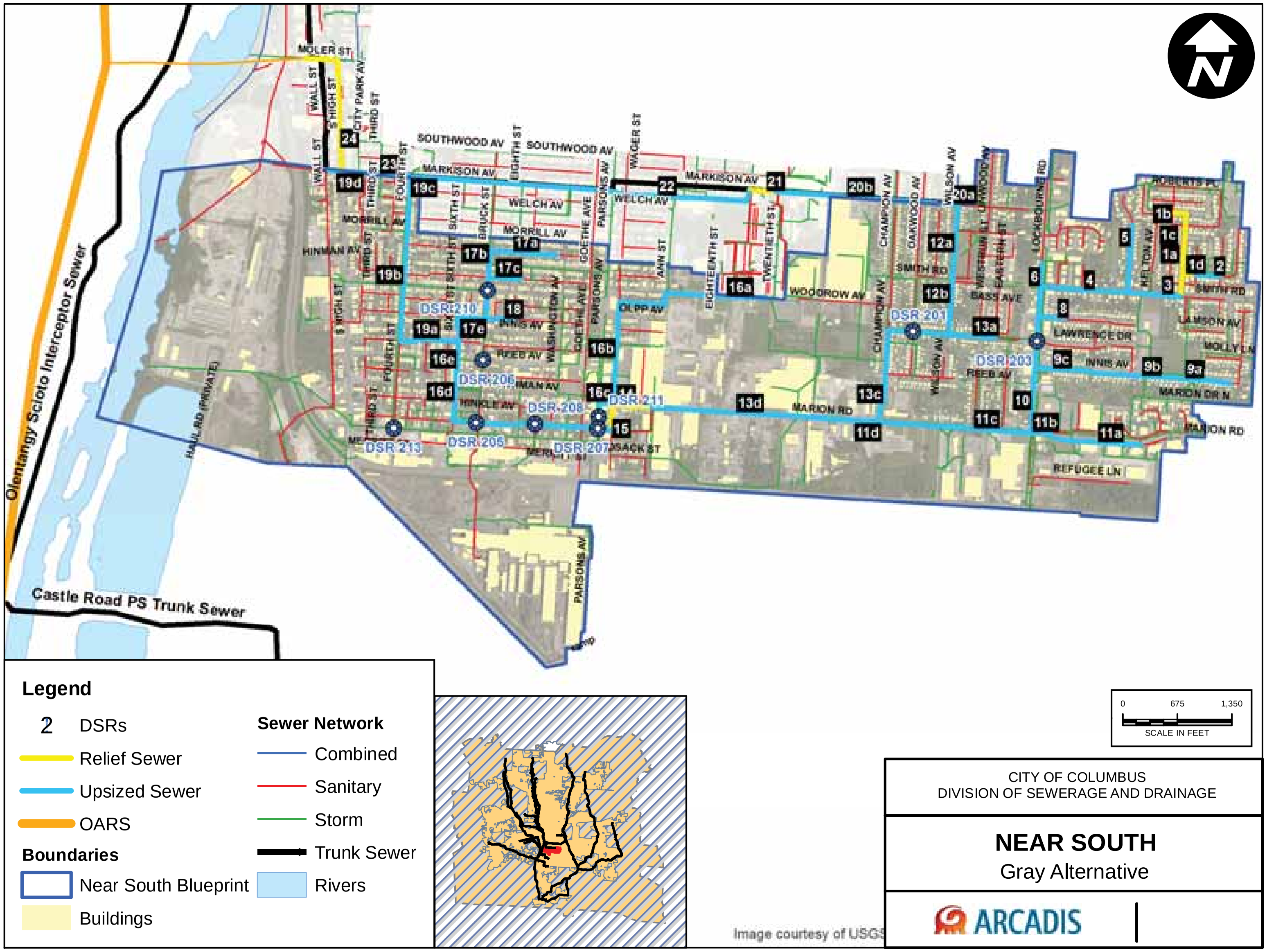


FIGURE 7.1.13 » JAMES LIVINGSTON GRAY ALTERNATIVE – PROJECTS LOCATION

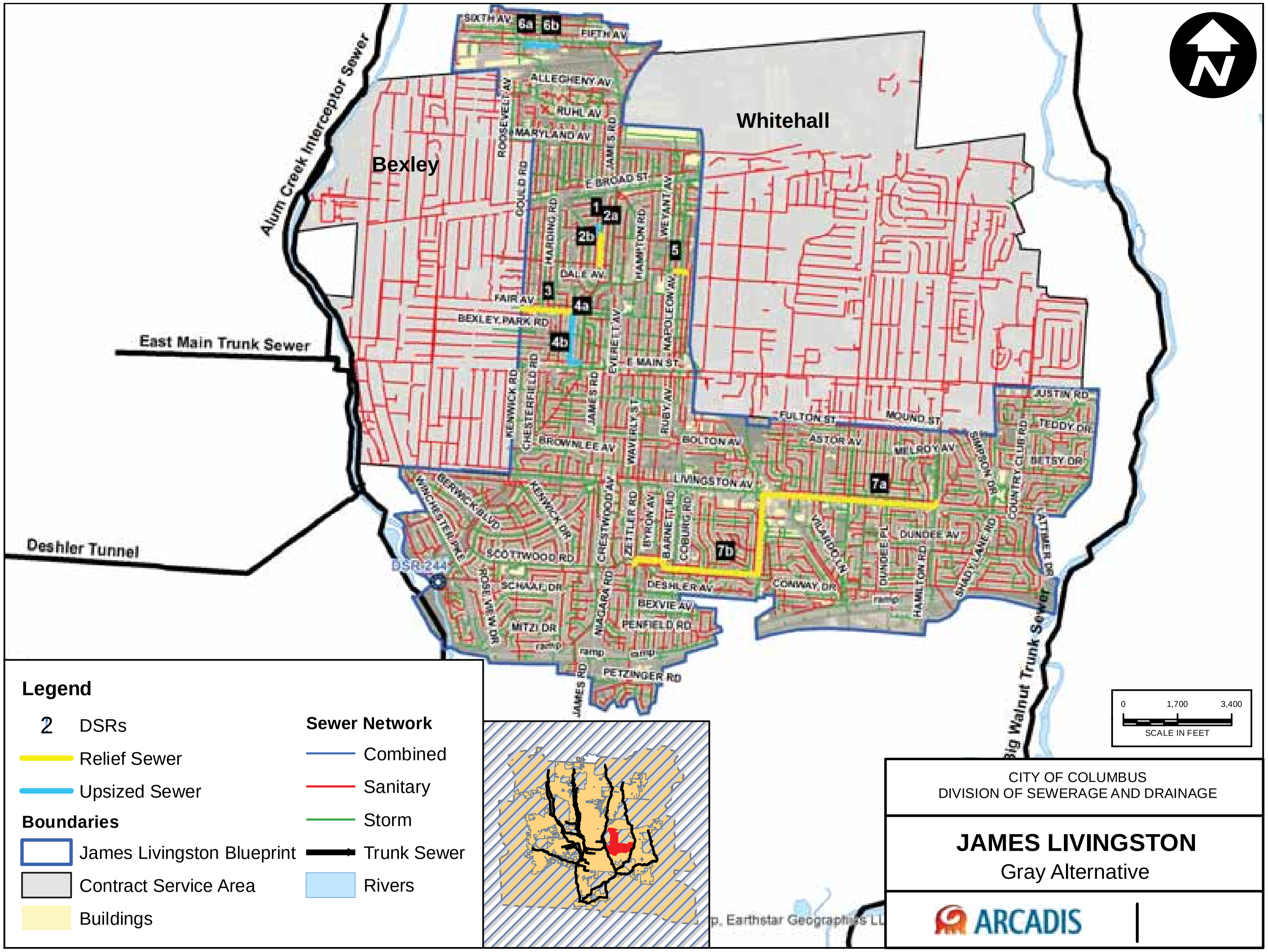


FIGURE 7.1.14 » FIFTH BY NORTHWEST GRAY ALTERNATIVE – PROJECTS LOCATION

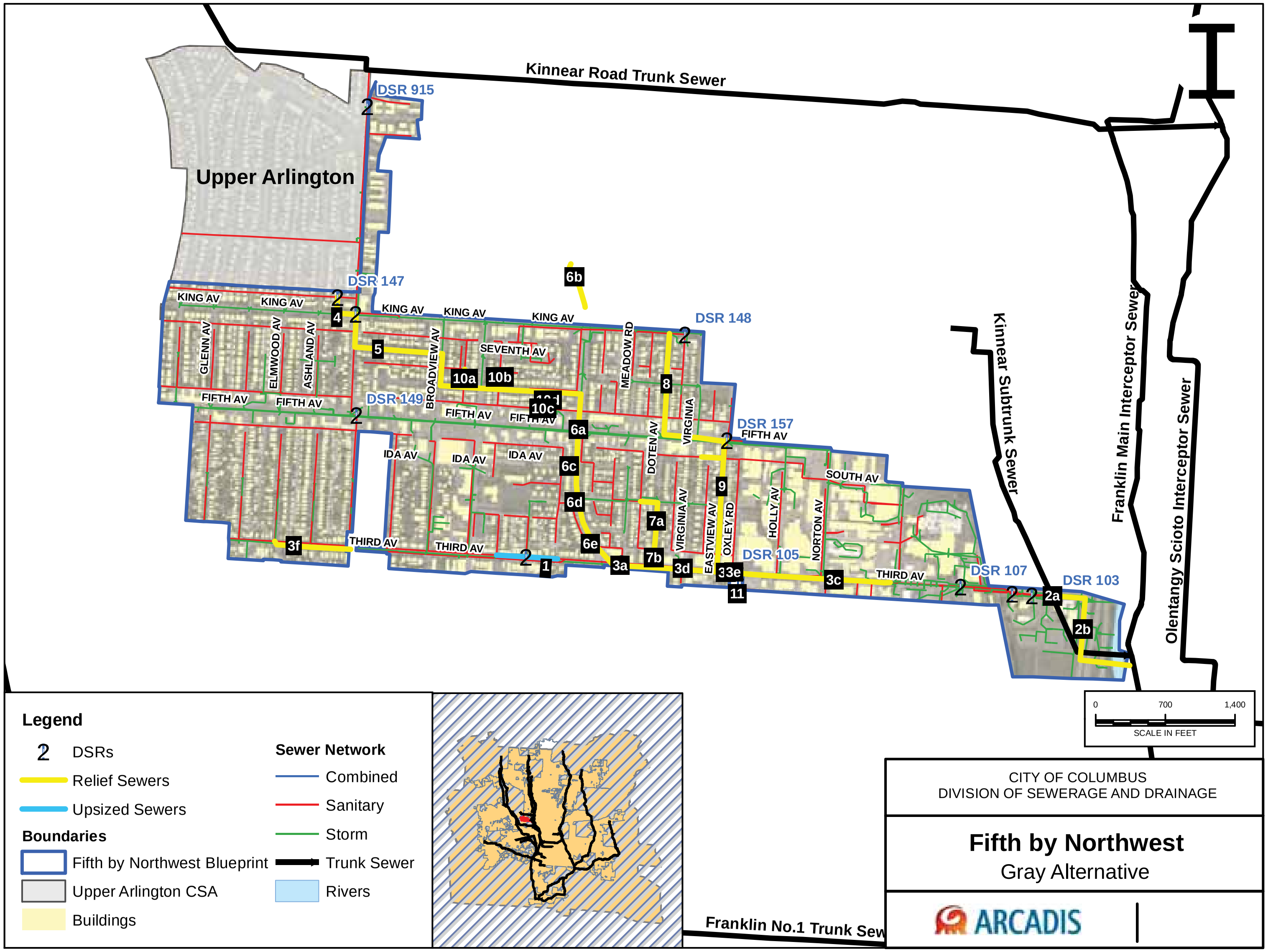


FIGURE 7.1.15 » WEST FRANKLINTON GRAY ALTERNATIVE – PROJECTS LOCATION

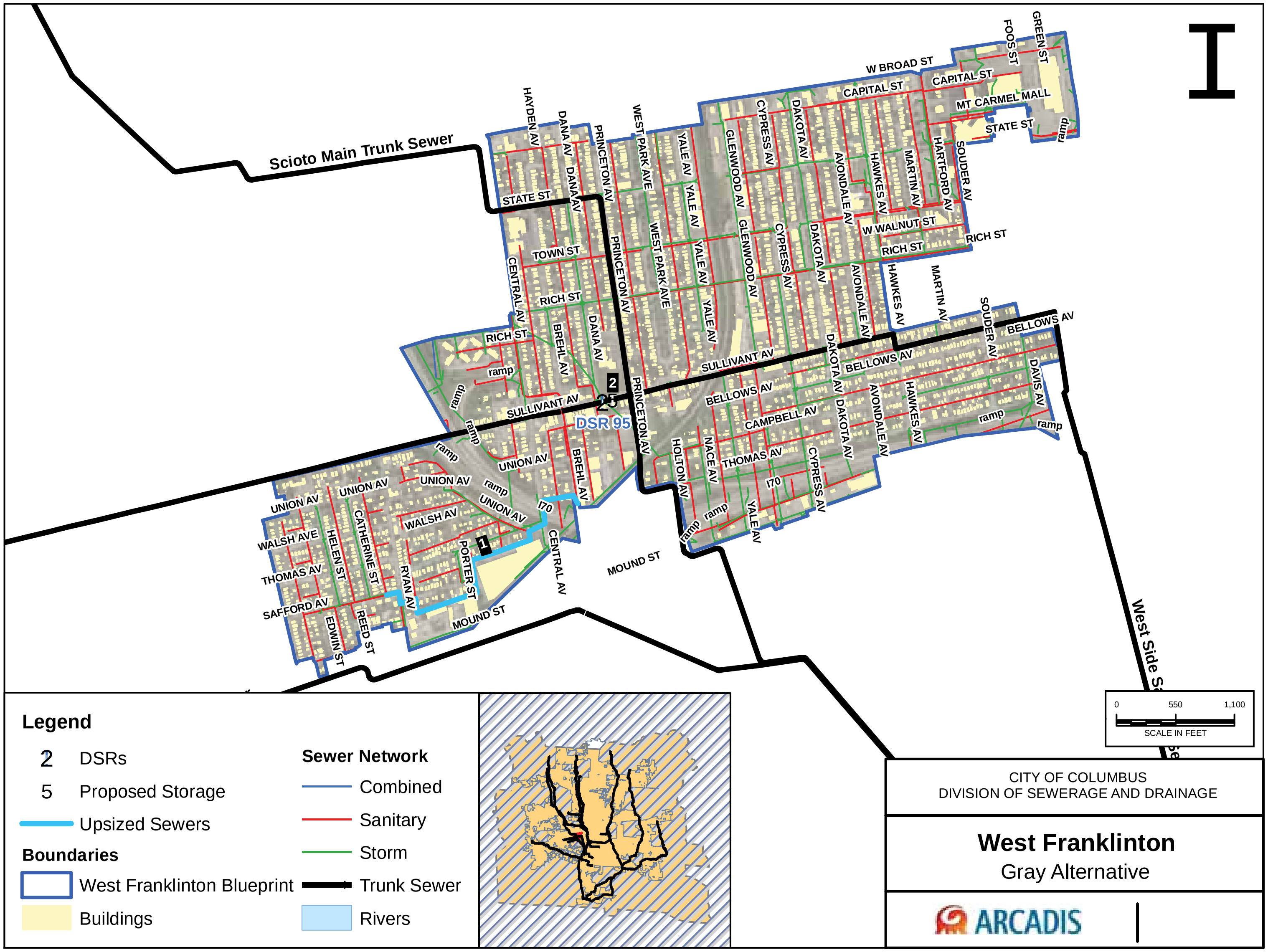


FIGURE 7.1.16 » NEAR EAST GRAY ALTERNATIVE – PROJECTS LOCATION

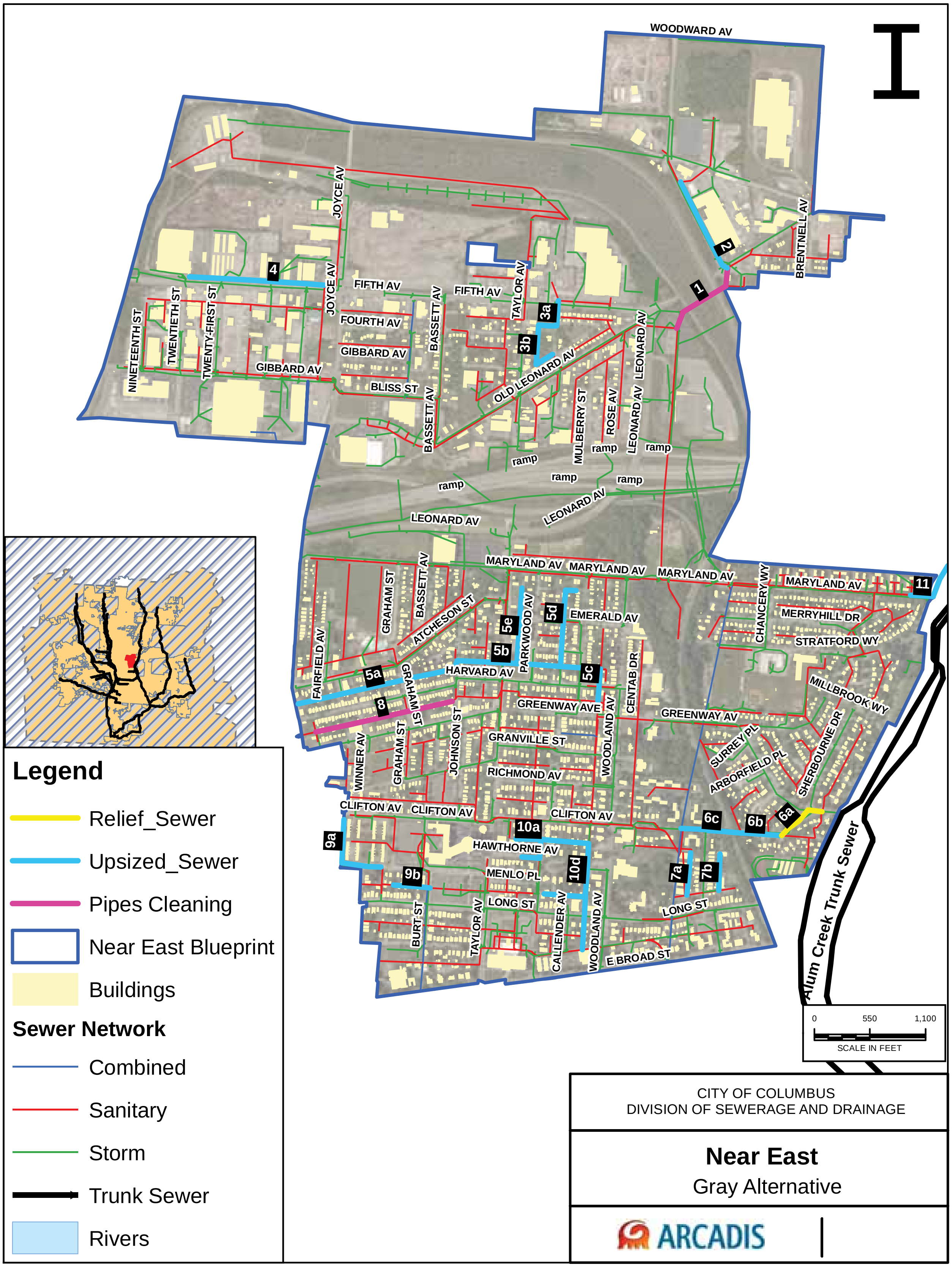


FIGURE 7.1.17 » SYSTEM-WIDE GRAY ALTERNITIVE WIBS

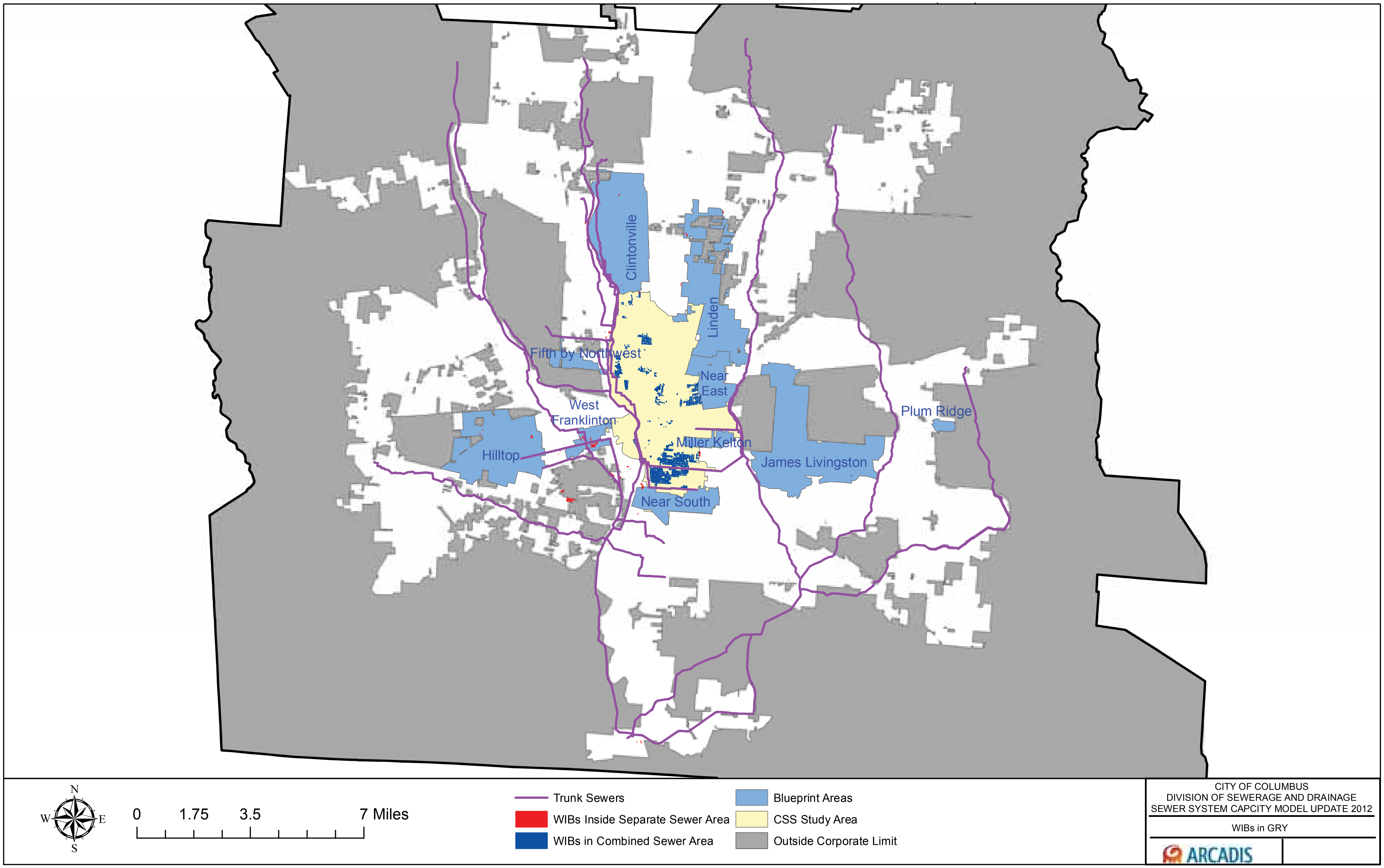


FIGURE 7.1.18 » SYSTEM-WIDE GRAY ALTERNATIVE FLOODING MANHOLES

SECTION 8

8

ANALYSIS OF ALTERNATIVES

THE CITY OF COLUMBUS
MICHAEL B. COLEMAN, MAYOR

DEPARTMENT OF PUBLIC UTILITIES

The Integrated Plan and 2015 WWMP Update Report

BLUEPRINT COLUMBUS
Clean streams.
Strong neighborhoods.

Clean streams. Strong neighborhoods.

8 ANALYSIS OF ALTERNATIVES

The city has developed two alternatives that will meet the requirements of the consent orders. The Blueprint alternative is discussed in Section 6, while the gray alternative is addressed in Section 7. For the reasons discussed below, the city is recommending the Blueprint alternative. The recommended schedule is discussed in Sections 9 and 10.

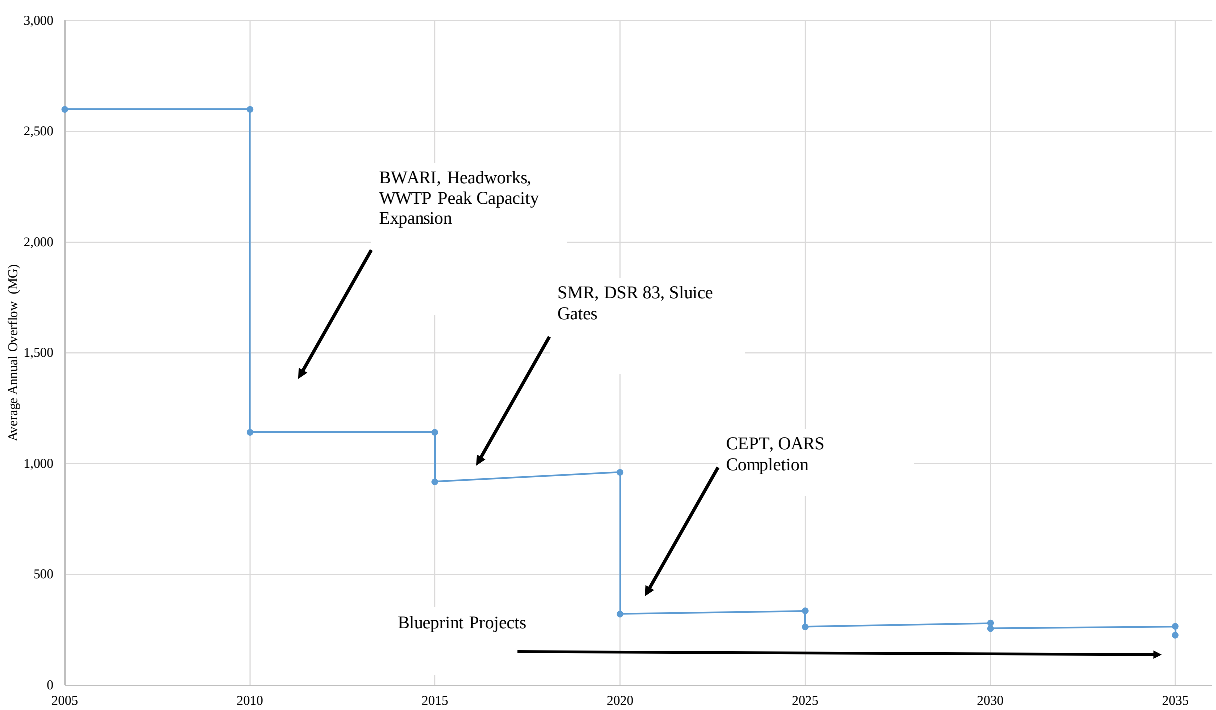
8.1 Water Quality Benefits

Comparing the Blueprint Columbus alternative and the gray 2015 Wet Weather Management Plan (WWMP) alternative reveals the Blueprint plan has two primary water quality advantages. First, the Blueprint alternative achieves a greater reduction in overall overflows from the system. Second, the Blueprint alternative has a positive impact on stormwater quality, which the gray alternative does not have.

8.1.1 Overall Overflows

Both plans meet the requirements of the consent orders for combined sewer overflows (CSOs) and sanitary sewer overflows (SSOs), and thus both plans have a positive impact on water quality. Exhibit 8.1.1 depicts the dramatic decreases in overflows from the beginning of the city's wet weather program in 2005 through 2035.

EXHIBIT 8.1.1 » AVERAGE ANNUAL OVERFLOW REDUCTION WITH BLUEPRINT



However, there are differences in the overall performance of the plans. Generally, the Blueprint alternative will reduce the amount of overflows from the system more than the gray alternative.

The only overflows that will occur in a typical year are at the Olentangy Scioto Interceptor

Sewer Augmentation and Relief Sewer (OARS) overflow. The Blueprint alternative dramatically reduces the volume at this overflow point as compared to the gray plan. The OARS overflow in the gray plan is predicted to be 11.5 million gallons (MG) in a typical year, which is reduced to 0.59 MG by the Blueprint alternative. Duration of the overflows and number of activations are also lower in the Blueprint alternative model simulations.

The Chemically Enhanced Primary Treatment (CEPT) is also used less in the Blueprint alternative. While not a water quality advantage, as the CEPT discharge is intended to meet all National Pollutant Discharge Elimination System (NPDES) discharge requirements, it is notable that the CEPT discharge in the gray plan is 98 MG, which is reduced to 18.7 MG by the Blueprint alternative.

Section 6 and Section 7 contain the model results using the full 20 years of rain data for both plans. Exhibit 8.1.2 and Exhibit 8.1.3 provide a summary of the results. In the 20-Year simulations, the largest overflow point continues to be at the OARS overflow. This overflow location accounts for 86% of the total overflow volume from the system.

EXHIBIT 8.1.2 » SUM OF OVERFLOWS FOR A 20-YEAR MODEL RUN (MG)

	Blueprint Alternative	Gray Alternative
Total SSO	3	1.2
Total CSO (includes OARS Overflow)	4,052	5,981
Total Bypass	507	627
Total Overflow (includes OARS Overflow)	4,561	6,609

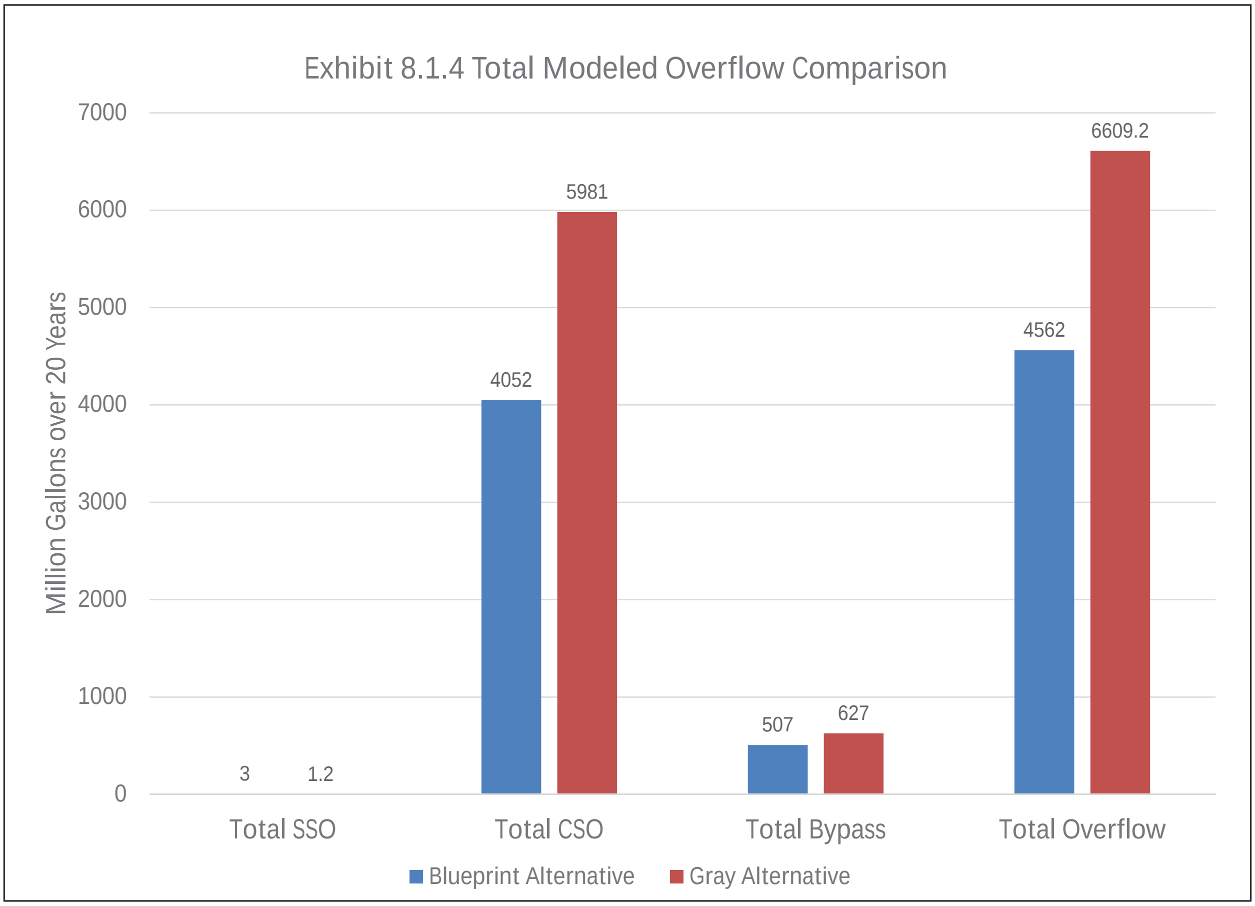
EXHIBIT 8.1.3 » SUM OF OVERFLOWS AND ACTIVATIONS FOR A 20-YEAR MODEL RUN

	Blueprint Alternative	Gray Alternative
OARS Overflow Volume (MG)	3,909	5,859
OARS Activations	37	53
CEPT Flow Volume (MG)	3,085	4,176
CEPT Activations	50	68
SWWTP Bypass Volume (MG)	507	627
SWWTP Bypass Activations	9	11

In examining the individual overflow points, the comparison between the plans is more mixed. Some individual CSO and designed sanitary relief (DSR) locations are better in the Blueprint alternative, and some in the gray alternative. However, total overflows from the system are reduced by more than two billion gallons over 20 years with the Blueprint alternative (from

6,609 MG in the gray plan to 4,561 MG in Blueprint). Thus Blueprint reduces overall sewer overflows to the environment as compared to the gray alternative. As with the typical year, the CEPT is also activated less in the Blueprint plan. Exhibit 8.1.4 below shows a comparison of all of the overflows that the model predicted in the 20-year scenario. It is important to remember that many CSOs only have a typical year level of service (LOS), and that OARS is permitted to overflow four times in a typical year.

EXHIBIT 8.1.4 » TOTAL MODELED OVERFLOW COMPARISON



8.1.2 Stormwater Benefits

The gray alternative's only water quality benefit is from reducing sewer overflows. It does not have any impact on stormwater discharges. In central Ohio, stormwater discharges have a more significant impact on water quality, as compared to sewer overflows. Through an assessment of all the watershed assessment units (WAUs) in the Columbus Facility Planning Area (FPA) based on data from the Ohio Environmental Protection Agency (Ohio EPA) 2014 integrated report, it was found that approximately 64% of the area within the Columbus FPA is impaired due to stormwater factors.

The Blueprint alternative includes a green infrastructure component, as discussed in Section 6, which will have a direct, significant and positive impact on water quality.

The green infrastructure component of Blueprint will first ensure that local flooding will not be made worse when the inflow and infiltration (I/I) removal technologies of Blueprint are applied. A second standard of at least 20 % reduction of total suspended solids (TSS) is also applied. When this “do no harm” standard and 20 % TSS reduction standard is applied in the Clintonville pilot area, the city determined that it would need approximately 4.3 acres of green infrastructure, split almost evenly between rain gardens and pervious pavement. The Clintonville pilot area drains to the Olentangy River, and TSS is a pollutant of concern, according to the Ohio EPA’s total maximum daily load (TMDL). The city calculated that the amount of green infrastructure it plans to install will reduce TSS loading from the pilot area by 22%, exceeding the minimum 20% target.

This dual standard of controlling local flooding and 20% TSS reduction should be duplicated or exceeded in future Blueprint areas. Once Blueprint Columbus implementation is complete it is estimated that 342 tons of sediment will be removed by green infrastructure each year. The city has included the same dollar-per-acre cost in future areas, but some of those areas may actually cost less. Clintonville was more expensive with regard to green infrastructure because the area had few opportunities for more regional installations. In addition, one area required a significant amount of pervious pavement to meet the “do no harm” standard. Future areas may have more opportunities for regional green infrastructure sites.

The city has calculated that if it were to add similar water quality benefits to the gray plan, such as many hydrodynamic separators into the neighborhoods, it would cost an additional $148 million. Water quality professionals generally agree that rain gardens provide a more effective and reliable removal of TSS compared to hydrodynamic separators and the separators would not mitigate the additional stormwater peak flows generated by the I/I mitigations.

Blueprint Columbus will advance the goals of the Clean Water Act (CWA) by mitigating the SSOs, CSOs and stormwater. As stated previously, the gray plan will have no benefit on stormwater. Blueprint Columbus includes an estimated $373 million in green infrastructure, putting the city that much further ahead of any future stormwater mandates.

8.2 Regional Economic Impact and Job Creation

One of the advantages of the Blueprint alternative is its relative impact on the local economy. The largest expenditure in the gray alternative is for the tunnels, at slightly over $1 billion. In the city’s experience, local construction companies do not bid on large tunnel jobs; none of the lead contractors currently building the OARS tunnel for the city are local construction companies. In fact, they are not even based in Ohio.

The Blueprint alternative, on the other hand, will have significantly fewer tunnels. The bulk of the costs in the Blueprint alternative will consist of small jobs that local construction companies can complete and perform. To confirm that Blueprint is better for the city’s economy, the city retained Regionomics to assess the two plans. The full report is found in Appendix F. Highlights include:

- The impact of Blueprint on the central Ohio economy is far greater than the gray plan.
- Over 20 years, Blueprint will create an additional $2.8 billion in regional output, $977 million in earnings and 700 additional jobs.
- The Blueprint program will provide a boost to small businesses and entrepreneurs in the region, and will thus help address a weakness of the local economy.

8.3 Neighborhood Impacts

The Blueprint alternative provides opportunities to improve neighborhoods in ways that the gray plan does not.

The creation of significant amounts of green infrastructure is a neighborhood benefit. Green infrastructure adds to the aesthetics of the neighborhood, as well as providing environmental benefits, such as greenhouse gas reductions and wildlife habitat. According to the Center for Neighborhood Technology, adding green infrastructure to a street can improve home values by up to 7%. In addition, in the Clintonville pilot area, the city is including a porous pavement street with a sidewalk, which is another neighborhood amenity.

Green infrastructure also provides the city with the opportunity to repurpose vacant and abandoned property. In the Barthman Parsons pilot program, the city is turning a one-acre empty lot into a park with significant stormwater controls (including a porous pavement basketball court), as well as amenities such as playground equipment, benches and tables. The city intends to carry this pilot forward as it moves Blueprint into other areas with significant vacant housing.

In addition, while the I/I reduction technologies are designed to reduce overflows, they also provide an incidental benefit to homeowners. Under Columbus City Code, homeowners are responsible for their sewer laterals from their home to the city main line. This can be an expensive repair if the lateral becomes damaged. The lateral rehabilitation component of Blueprint will provide homeowners with virtually new laterals, which is a $453 million benefit to homeowners. The homeowners may also benefit from the sump pump program. Without Blueprint Columbus, homeowners will incur the same utility rate increases and also incur significant costs to maintain and repair their aging laterals in the Blueprint areas.

8.4 Costs

A detailed analysis of the costs of the Blueprint plan and the gray plan are presented in Sections 6 and 7, respectively. Those costs for the plans, and for the original 2005 WWMP are summarized in Table 8.4.1. Table 8.4.1 further breaks down the costs into three categories. The top category is "Conventional Infrastructure" which includes all gray infrastructure costs included in a plan such as tunnel costs. The next category is "Blueprint Infrastructure" which includes the green infrastructure and the costs to implement the four pillars of Blueprint such as lateral lining. These two categories are summed to reflect the costs of consent order compliance for a plan. The final category is "Other City Projects" which was estimated to fully evaluate affordability discussed later in Section 9. Other city projects include non-consent order work that will be necessary to maintain and grow the system to serve the community.

As can be seen, the total consent order cost of the Blueprint plan is approximately $150 million more than the gray plan. However, when overall capital costs are considered, this difference shrinks to just over $16 million. At this level of planning, these programs are virtually identical in cost, so this factor is at best neutral. However, as discussed below, there are advantages to Blueprint that are revealed by these cost estimates.

8.5 Sustainability

The sustainability of the Blueprint plan is demonstrated with a detailed review of the costs of the gray plan vs. the Blueprint plan as presented in Table 8.4.1. Blueprint includes $373 million in green infrastructure - sustainable stormwater technologies that restore natural functions such as infiltration in the watershed. The gray plan does nothing for stormwater or restoring natural watershed functions. Furthermore, it is clear that stormwater requirements will increase at some point in the future and Blueprint will have a head start in meeting stormwater pollution reduction standards thereby saving even more money over the gray plan. No funds are provided in the gray plan to address future stormwater requirements.

Another interesting facet of the detailed cost comparison is in the "Other City Projects" category - the "sanitary renewal" line. It is the difference in this category between the two plans that brings the plans so close together in terms of overall capital costs. This difference exists because Blueprint already includes sewer lining and manhole rehabilitation as part of its plan -which is itself another advantage.

Blueprint does a better job of maintaining and extending the useful life of existing assets, both public and private, while the gray plan relies on building new assets instead of investing in existing infrastructure. The Blueprint Plan will restore many more pipes, manholes, and even private laterals. Blueprint Columbus includes $959 million in rehabilitation of infrastructure with half of that going to private laterals that otherwise would be likely to be neglected until total failure by the homeowners. The gray plan does not directly include any rehabilitation, although the overall capital program associated with the gray plan would include sanitary renewal – but only $390 million or 41% of the Blueprint plan.

Not only does Blueprint do a better job of investing in existing infrastructure, it also is more sustainable because it actually attacks the root of the problem - rainwater entering the separate sanitary sewer system instead of the stormwater system. The gray alternative does nothing to resolve this underlying problem. Over time, as private laterals continue to age and deteriorate, it is reasonable to assume the I/I entering the system will only increase and SSOs will only get worse. Continuing to address SSOs with gray infrastructure to transport and treat the I/I will just require even more tunnels and treatment capacity.

The Blueprint alternative, on the other hand, focuses on preventing the I/I in the first place. Resolving the underlying problem is a long-term plan that is sustainable.

TABLE 8.4.1 » ESTIMATED PROGRAM COSTS

	Blueprint	Gray	2005 WWMP Indexed
CONVENTIONAL INFRASTRUCTURE			
System-wide tunnels	$185,000,000	$1,080,000,000	$2,017,000,000
System-wide conveyance improvements	$8,000,000	$8,000,000	$28,000,000
Priority areas, conveyance improvements	$42,000,000	$327,000,000	$327,000,000
Chemically Enhanced Primary Treatment	$99,000,000	$99,000,000	$99,000,000
Bolt down manhole cost	$29,000,000	$27,000,000	$0
Consent order projects from capital plan	$41,000,000	$41,000,000	already included
Subtotal	$404,000,000	$1,582,000,000	$2,471,000,000
BLUEPRINT INFRASTRUCTURE			
Green infrastructure	$373,000,000	$0	$0
Sewer lining	$215,000,000	$0	$0
Manhole rehabilitation	$41,000,000	$0	$0
Lateral lining	$453,000,000	community cost	community cost
Roof disconnection & redirection	$152,000,000	$0	$0
Sump pumps	$100,000,000	$0	$0
Subtotal	$1,334,000,000	$0	$0
Consent Order Total	$1,738,000,000	$1,582,000,000	$2,471,000,000
OTHER CITY PROJECTS			
Sanitary renewal	$250,000,000	$390,000,000	$390,000,000
Sanitary system capital program	$280,000,000	$280,000,000	$280,000,000
Sanitary pump station renewal	$58,000,000	$58,000,000	$58,000,000
Sanitary biofilter renewal	$53,000,000	$53,000,000	$53,000,000
Sanitary instrumentation renewal	$6,000,000	$6,000,000	$6,000,000
Storm renewal	$360,000,000	$360,000,000	$360,000,000
Treatment plant capital program	$751,000,000	$751,000,000	$751,000,000
WIB reduction for combined areas	$114,000,000	$114,000,000	$114,000,000
Watchlist areas	$4,000,000	$4,000,000	$4,000,000
Total City Cost	$3,614,000,000	$3,598,000,000	$4,487,000,000

Notes: *All costs are in January 2015 dollars
*All costs for Other City Projects based on a 30 year planning horizon
*Column D cost are based on 2005 WWMP, updated using Engineering News Record Construction Cost Index to January 2015 dollars

9

AFFORDABILITY ANALYSIS

SECTION 9

THE CITY OF COLUMBUS
MICHAEL B. COLEMAN, MAYOR

DEPARTMENT OF PUBLIC UTILITIES

The Integrated Plan and
2015 WWMP Update Report

Clean streams. Strong neighborhoods.

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9 AFFORDABILITY ANALYSIS

9.1 Columbus' Affordability Analysis

9.1.1 Methodology

This affordability analysis has the following components. First, state law and federal guidelines on affordability are reviewed. The city then prepared an affordability assessment based on the United States Environmental Protection Agency's (USEPA's) 1997 Financial Capability Assessment (FCA). The city FCA analysis reveals that implementing the Blueprint alternative will result in burden on the city that is on the line between medium and high. This analysis also determined that the burden on the city's poorest populations would be a very high burden.

As recognized by state law and more recent guidelines from USEPA, the FCA analysis is a narrow snapshot in time with regard to affordability. To provide a more complete picture than the FCA, the city prepared a long-term financial model that includes revenue projections, year-to-year increases in debt service, operations and maintenance, and the rate increases that would be necessary to implement the program. The financial model allows trends to be analyzed and allows the full impact of rate increases over time to be observed. It must be clearly stated that the model results and the FCA analysis may look similar in some respects but they are very different financial calculations and the resulting metrics cannot be directly compared to each other.

Both financial analyses consider median household income. To obtain a more complete picture, the city also took a more in depth look at some of its demographics. In general, while the region is doing relatively well, there are persistent and significant sections of the city with high poverty rates. These vulnerable populations will have more difficulty with significant rate increases.

Finally, the city has developed measures of success. These are designed to assist the city in determining whether rates are being managed over time in a way that is affordable. Two measures focus on customer response to bill increases, in particular the vulnerable populations identified in the demographic analysis. Two additional measures focus on the overall financial health of the utility. Maintaining financial health is critical for long-term success of the program.

9.1.2 Recommended Schedule

As discussed in Section 1, Ohio Environmental Protection Agency (Ohio EPA) and Columbus agreed that the city could revise its 2005 Wet Weather Management Program (WWMP) with a new plan that would include an integrated plan and a revised WWMP. As set forth above, to meet this requirement the city has prepared two plans that will achieve the goals of the city's consent orders: the Blueprint plan, and the 2015 WWMP. For the reasons set forth in Section 8, the city's recommended plan is Blueprint Columbus.

In addition to selecting a plan, the city was also required by the Ohio EPA to recommend a schedule. The 2005 WWMP proposed a 40-year schedule, which was originally due to be completed in 2045. In its conditional approval in 2009, and confirmed in 2013, the Ohio EPA required the city to look at shortening that schedule by five, ten and 15 years.

To meet this requirement, the city developed eight schedules. First, the city developed a Blueprint schedule that was the same as the original schedule (Blueprint 2045), and a revised WWMP with the same schedule (gray 2045). Then, schedules that were shorter were evaluated, per the Ohio EPA's requirements: Blueprint 2040, Blueprint 2035, Blueprint 2030, gray 2040, gray 2035 and gray 2030.

The city's recommended schedule is Blueprint 2035, ten years shorter than the original schedule. Blueprint 2035 is the recommended schedule for several reasons.

First, the USEPA FCA methodology was evaluated for the city. The actual outcome of this analysis places Columbus just below the high burden threshold. The residential indicator (RI) for Blueprint 2035 is 1.97%, which is just barely below the frequently referenced threshold value of 2% of median household incomes. Furthermore, the RI of the lowest quintile (LQ) population in the city is 4.88%. While the FCA methodology did not indicate high burden, it is clear that the city is extremely close to the high burden threshold; therefore, an even shorter schedule is not warranted.

Next, the city used its long-term financial model to look at the full impact of all eight analyses of the Blueprint and gray alternatives. See Tables 9.4.1 through 9.4.8. The rate impacts are summarized in Exhibits 9.4.3 and 9.4.4. As could be predicted, rate increases are more pronounced with a shorter schedule, as the same work is being done more quickly. Projected rate increases are relatively similar across the schedules at the beginning of the program, but then become more escalated. While the original 40-year schedule (Blueprint 2045) is the most favorable, followed by Blueprint 2040, the differences between them and the 30-year schedule (Blueprint 2035) were not deemed to be significant enough to warrant the longer schedules. (Note, when referring to a 30-year schedule, the baseline is 2005 so it can be compared with the original schedule. Blueprint 2035, the recommended schedule, is a 20-Year plan starting in 2015). Thus, based on the model runs, the city determined it did not need either of the longest schedules for an affordable program.

The city rejected the shortest schedule (Blueprint 2030) for a number of reasons. Comparing Table 9.4.2 (Blueprint 2035) to Table 9.4.1 (Blueprint 2030) it can be seen that Blueprint 2035 provides faster relief from significant annual rate increases and has a lower overall impact on rates. Under Blueprint 2030, the city's LQ would have sewer bills that exceed 3% of their household incomes, a result that does not occur with Blueprint 2035. As discussed below, the city has selected 3% of median household income (MHI) for the LQ as a measure of success, and Blueprint 2035 meets it while Blueprint 2030 does not.

More fundamentally, however, the city selected Blueprint 2035 for practical reasons. First and foremost is the novelty and uncertainty of this approach. The Blueprint has never been attempted at this scale anywhere. While certain components of it (lateral lining and sump pumps) have been done by other cities, we are unaware of any city that has proposed the sheer number of private residences proposed in Blueprint. Each Blueprint project area will take approximately seven years to get from initial engineering to completion of construction, with a new project area being started almost every year. A few years into the program, the city will be managing four or five project areas at once.

Moreover, each project area has between 3,000 and 4,000 homes. The city will have to go door-to-door to survey the homes, redirect roof water, line laterals, and install sump pumps. Instead of one or two big tunnel projects, the city will be managing what amounts to tens of thousands of small projects every year. And the type of projects are very different from what the city typically does, raising questions about how to issue the contracts, manage the work, perform inspections, etc.

While we are confident that this can be done, the originality of this program suggests that the 2035 schedule is warranted. The 2045 schedule is the most attractive as the city would not be required to start more than one project area in any given year, and could spread the work out to allow a longer learning curve. However, the city was able to arrange the 2035 schedule so that project areas do not need to be doubled up until 2029. While this is not ideal, the city is reasonably confident that all of the complicated unknowns of today will have become much more routine by then, allowing acceleration toward the end of the schedule. The shortest schedule, 2030, would have required doubling up on Blueprint areas almost immediately. The city rejected this approach as too risky while the city is on its initial learning curve.

A second and related reason that the city is recommending Blueprint 2035 is the uncertainty of the available workforce capacity of the contracting community. Again, as Blueprint is without precedence it is difficult to predict how much capacity there is for this type of work. We have already seen shortages of companies to perform closed-circuit television (CCTV) work in our current Blueprint projects. While we are confident that this issue will resolve itself, the shortest schedule would again add significantly more work up front, before the contracting community has had time to adapt and grow. This would needlessly escalate costs or lead to program failures.

Finally, a shorter schedule is not warranted when looking at the costs and benefits. As discussed in Section 8, the sanitary sewer overflows (SSOs) that remain are a small fraction of the overflows that Columbus has historically experienced. Massive decreases in system-wide overflows (more than 2 billion gallons) have already been achieved or will soon be realized with current capital projects including OARS and Chemically Enhanced Primary Treatment (CEPT). These accomplishments have been achieved for roughly $1 per gallon or less. The remaining overflows, which must be addressed, will cost considerably more than $1 per gallon. In fact, the overflow reductions from 2020 to 2035 will cost more than $17 per gallon reduced. While this work is necessary, it is not cost effective to accelerate it any further. The relatively small environmental benefit for the remaining program comes at a greater cost and is simply not worth adding additional stress to our ratepayers.

9.2 State Law and Federal Guidelines Applicable to Affordability

In 2011, the Ohio General Assembly enacted legislation requiring that various cost and economic items be considered with respect to the regulation, permitting and enforcement of Ohio's publicly owned sewerage systems. Revised Code (RC) 6111.60 provides that "(b)efore … requiring and approving a long-term control plan for wet weather discharges from a publicly owned sewerage system, or enforcing the Federal Water Pollution Control Act as applied to publicly owned sewerage systems, the director of environmental protection, to the extent allowable under that act and regulations adopted under that act, shall consider …" specifically enumerated items. These statutory items are particularly applicable to the evaluation of this affordability analysis and the Blueprint Columbus program and include:

- *Limitations on the ability of an applicant for a permit or of a permitee to pay for or to secure money to pay for a required project.* Blueprint 2035 appropriately spreads the cost of remaining projects over the next 20 years in a way that will protect the city's bond rating from further downgrade, ensure the city can continue to borrow funds at a reasonable interest rate, and protect the long-term financial integrity of the utility. The measures of success are established to effectively protect the city's financial health.
- *An evaluation of the effectiveness and cost of specific wet weather flow control technologies.* Compared to the gray plan, Blueprint 2035 is more effective in many ways, including dramatically reducing the overflow volume at the OARS overflow and dramatically reducing the need for CEPT utilization. It utilizes inflow and infiltration (I/I) removal components, like lateral rehabilitation, lateral lining, roof redirection and sump pumps that likewise address the problem at its source and adds homeowner amenities that allow program benefits to be directly realized at the ratepayer level.

- *An evaluation of the impact of a long-term control plan on the environment as a whole and of the promotion of alternative control options that will minimize the impact on the environment.* The Blueprint 2035 alternative not only results in clean water improvements above and beyond that which could be attained by the gray plan, but it also enhances the environment in a broader way with rain gardens that will create habitat and visual enhancements, and with pervious pavement that will add neighborhood recreational amenities.
- *Allowing for reasonable flexibility in the implementation of a long-term control plan when the plan would impose a disproportionate financial hardship compared to its environmental benefits.* Any rate increases will have a disproportionate financial hardship, and shorter schedules will exaggerate this hardship on the poorest members in the community. Furthermore and as noted above, the cost/benefit of the remaining plan is 17 times greater than the work performed to date.
- *Allowing adequate time and flexibility for implementation of the schedule specified in the long-term control plan when justified by a clear environmental benefit.* Although completion of Blueprint 2035 is spread over 20 years, the schedule is justified, as the most significant annual overflow reductions will be achieved with the current capital program that is implemented by 2020. Models predict that Blueprint 2035 will also achieve greater reductions in combined sewer overflows (CSOs), bypasses and total overflows than the gray plan.

The General Assembly's enactment of RC 6111.60 was in light of the weakness of federal guidance on this topic. That guidance was first issued in 1997 and clarified in 2014.

The USEPA's 1997 guidance, *combined sewer overflows – Guidance for Financial Capability Assessment* (FCA Guidance) and *Schedule Development*, includes a methodology for examining rate-payer impacts and the utility's financial capability. The methodology is described in detail in the next section. It ultimately results in an analysis of the burden on a community, with the ratings being high, medium or low.

Many commentaries have raised issues with how narrow the FCA methodology is, and how it only presents a snapshot in time. In light of these issues, the USEPA released an updated FCA framework in November 2014. The FCA framework builds on the principles put forth in the USEPA's *Integrated Municipal Storm Water and Wastewater Planning Approach Framework* (May 2012), which encourages municipalities to balance the Clean Water Act (CWA) requirements "in a manner that addresses the most pressing health and environmental protections issues first." The FCA framework clarifies that all clean water act costs, including stormwater costs, may be included.

The results of the USEPA FCA methodology are presented in the next section.

9.3 USEPA's Financial Capability Assessment

Ohio EPA's 2009 approval of the City's WWMP required that the City conduct an updated Affordability Analysis that includes the completion of USEPA's FCA Methodology. The USEPA FCA consists of ten worksheets. The first two calculate the Residential Indicator (RI), which is a measure of the cost per household (CPH) of wastewater utility program relative to the MHI of the community. The next six worksheets calculate the inputs for the Financial Capability Indicator, which is a measure of the financial strength of the government and the community as a whole. The measures include debt indicators, socioeconomic indicators, and financial management indicators. The ninth worksheet combines the scores of the Financial Capability worksheets and develops an average score. The tenth worksheet combines the Residential Indicator score and the Financial Capability Indicator score into a matrix to determine the overall burden impact on the community.

In November 2014, the USEPA released its FCA framework for municipal CWA requirements. In this memorandum, the USEPA reaffirmed the FCA; however, in order to allow for a more comprehensive evaluation of the impact of all CWA requirements, the USEPA indicated that utilities may include the cost of stormwater management in addition to wastewater.

This section will present the detailed worksheets first for the city of Columbus, and then for the city's entire service area. While both are presented, the city believes that it is more appropriate to focus on the city's affordability. The city owns the utility and is ultimately responsible for paying all of the debt incurred for this program. In addition, as presented below, the city has consistent and significant areas of poverty; this population will be hit the hardest with the rate increases necessary to pay for this program.

9.3.1 Financial Capability Assessment for the City

The RI is intended to measure the financial impact of the current and proposed wastewater treatment (WWT) and CSO/SSO controls on residential households. The first step (Worksheet 1) is to determine the estimated CPH of the current and proposed projects. The second step (Worksheet 2) divides the CPH by the MHI of the community to determine the RI, expressed as a percentage. The RI is then scored as low, mid-range, or high impact based on the following levels (CPH as % of MHI):

- Low - Less than 1% of MHI
- Mid-Range - 1% - 2% of MHI
- High - Greater than 2% of MHI

WORKSHEET 1 – COST PER HOUSEHOLD – COLUMBUS

Worksheet 1 develops the CPH for residential households served by the city. Lines 100 and 101 show the current (FY2015) operating and debt service costs for both the wastewater and stormwater utilities, based on the city's current pro forma models for the wastewater and stormwater utilities. Lines 103 and 104 show the projected costs for future projects for both Blueprint and for on-going renewal and replacement of existing infrastructure, and are based on the Blueprint 2035 schedule. The additional operation and maintenance (O&M) expenses anticipated due to implementation of Blueprint varies based on several project categories, as follows:

- Green infrastructure (consent order) = 2% of capital cost, paid through stormwater rates
- Sealing manholes (consent order) = 1% of capital cost, paid through wastewater rates
- Water in basement (WIB) (non-consent order) = 2% of capital cost, paid through stormwater rates
- Pump stations (non-consent order) = 1% of capital cost, paid through wastewater rates
- All other capital costs in Blueprint and for remaining renewal/replacement result in no additional O&M
- Annual debt service is estimated at a 4% interest rate and 20-Year term. A small portion of the program is assumed to be cash financed, based upon the outcome of the long-term financial plan for the city's recommended plan, Blueprint 2035.

Total current and projected costs come to approximately $567,073,000, of which 65.7% or $372,526,961 of total wastewater and stormwater costs is the residential share. Residential share was calculated based upon an analysis of billed volume and the city's cost of service/rate setting policies. As shown, CPH for wastewater is calculated by dividing the residential share by 445,356, which is the total number of households served by the wastewater utility in the service area. For stormwater, residential share is calculated by dividing by 324,641, which is the total number of households served by the city of Columbus stormwater utility. The combined total CPH, as shown in line 109, is $878. This number is underestimated because it is not possible to gather the CWA costs, current and future, for all contract communities.

WORKSHEET 1 » TOTAL COST PER HOUSEHOLD FOR RECOMMENDED PLAN – COLUMBUS

Line No.	Description	Wastewater	Stormwater	Total
	Current WWT Costs			
100	Annual O&M Expense (Excluding Depreciation)	$113,776,000	$25,311,000	$139,087,000
101	Annual Debt Service	$145,821,000	$14,344,000	$160,165,000
102	Subtotal (Line 100 + Line 101)	$259,597,000	$39,655,000	$299,252,000
	Projected WWT and SSO Costs			
103	Estimated Additional O&M Expense	$304,000	$7,698,000	$8,002,000
103a	Estimated Annual Cash Financed Capital	$21,840,000	$0	$21,840,000
104	Annual Debt Service on Projected Capital Projects	$210,625,000	$27,354,000	$237,979,000
105	Subtotal (Line 103 + Line 104)	$232,769,000	$35,052,000	$267,821,000
106	Total Current and Projected WWT and SSO Costs (Line 102 + Line 105)	$492,366,000	$74,707,000	$567,073,000
107	Residential Share of Total WWT and SSO Costs (65.7%)	$323,484,462	$49,082,499	$372,566,961
108	Total Number of Residential Households	445,356	324,641	-
109	Annual Cost Per Household (Line 107 / Line 108)	$726	$151	$878

WORKSHEET 2 – RESIDENTIAL INDICATOR – COLUMBUS

The second step to determine the RI is to determine the adjusted MHI. The MHI for the city of Columbus is estimated to be $44,590 in 2015. Therefore, the city RI is calculated by dividing the CPH from Worksheet 1 ($878) by the adjusted MHI ($44,590). The calculated RI is 1.97%, which places the RI just below the threshold of 2%, which would indicate "high impact" based on the USEPA methodology.

WORKSHEET 2 » RESIDENTIAL INDICATOR – COLUMBUS

Line No.	Description	WW/SW
	Median Household Income - City	
201	Census Year MHI (2013)	$44,072
202	MHI Adjustment Factor (0.95%/2014; 0.23%/2015)	1.01175
203	Adjusted MHI (Line 201 x Line 202)	$44,590
204	Total CPH (Worksheet 1, Line 109)	$878
205	Residential Indicator (Line 204 / Line 203 x 100)	1.97%

While the calculated RI using the USEPA methodology is just under 2% based on the city's MHI, it should be noted that this does not reflect the range of burden households within the community will experience. It is important to understand the impact of the program on all customers. Based on the 2013 census data, five-year estimates, the upper limit of the LQ household income for the city of Columbus was $17,796. Adjusting to 2015, the estimated income level would be $18,005. Therefore, the CPH of $878 would represent 4.88% of the LQ, which is significantly higher than the USEPA's threshold indicating "high impact."

The second phase of the USEPA FCA is intended to assess the financial capability of the community. There are three general categories of financial capability: debt indicators, socioeconomic indicators and financial management indicators. The existing USEPA guidance for the development of these indicators is found in Worksheets 3 through 8 of the 1997 USEPA Guidance.

The source data used in determining these six indicators come from a variety of resources, including: comprehensive annual financial reports and debt rating reports for the city of Columbus and contract communities served by the city. A summary of each worksheet follows and is based on the city of Columbus.

WORKSHEET 3 – BOND RATING – COLUMBUS

The debt indicator in Worksheet 3 is a composite bond rating for the city that recognizes both the general obligation (GO) bond rating of the city and the rating on revenue bonds issued by the city.

WORKSHEET 3 » BOND RATING – COLUMBUS		
Inputs	General obligation bond	Revenue (water/sewer) bond
Most recent rating	AAA, Aaa, & AAA	AA+, Aa1 & AA
Date	3/20/2014	3/20/2014
Rating agency	S&P, Moody's & Fitch	S&P, Moody's & Fitch
Bond insurance (y/n) (Revenue bonds only)	N	N
Summary bond rating	AAA	AA
Ohio EPA Score/Rating	3	3

The bond rating is scored as weak, mid-range, or strong according to the following scale for Moody's bond ratings:

- Weak – BB, B, CCC, CC, C, D
- Mid-Range – BBB
- Strong – AAA, AA, A

Based on the bond rating summary, this indicator is scored as a 3 or "strong". It is important that the city maintain strong financial policies to help maintain its current bond rating, which will help minimize borrowing costs incurred in financing the costs of the program.

WORKSHEET 4 – OVERALL NET DEBT AS A PERCENTAGE OF FULL MARKET PROPERTY VALUE (FMPV) – COLUMBUS

Overall net debt is debt repaid by property taxes in the permitee's service area. It excludes the debt of revenue bonds issued and repaid with user fees. This indicator provides a measure of the debt burden on residents and the ability of the local government to issue additional debt. It includes the debt issued directly by the local government and the debt of overlapping entities, such as school districts. The indicator compares the level of debt owed by the service area population with the full market value of real property used to support the debt. As shown in Worksheet 2, the city has direct net debt that includes all government related debt and debt for business type activities not related to revenue bonds supported by user fees of almost $1.3 billion. The city's proportionate share of the debt from overlapping entities such as school districts, townships and park districts totals $1 billion.

WORKSHEET 4 » OVERALL NET DEBT AS A PERCENTAGE OF FMPV – COLUMBUS

Line No.	Description	Value
401	Direct Net Debt (G.O. Bonds Excluding Double-Barreled Bonds)	$ 1,295,873,000
402	Debt of Overlapping Entities (Proportionate Share of Multijurisdictional Debt)	$ 1,013,075,048
403	Overall Net Debt	$ 2,308,948,048
404	Market Value of Property	$ 14,622,135,000
405	Overall Net Debt as a Percentage of Full Market Property Value (Line 403/Line 404*100)	16%

As shown on Worksheet 4, the overall net debt divided by the FMPV ($14.6 billion) results in a score of 16%. This indicator is scored on the following scale:

- Weak – Above 5%
- Mid-Range – 2% - 5%
- Strong – Below 2%

Based on the above scale, the score for Worksheet 4 is a 1 or "weak".

It should also be noted that this indicator includes only formal debt and does not include other factors such as unfunded pension and healthcare commitments to retirees. If significant, the result could be a further weakening of this measure.

WORKSHEET 5 – UNEMPLOYMENT RATE – COLUMBUS

According to the Bureau of Labor Statistics, the most recent annual rate available (2013) for the Columbus Metropolitan Statistical Area (MSA) is 6.2%. To score this indicator, a comparison is made to the national unemployment rate. The U.S. unemployment rate for the year 2013 was 7.4%, placing the MSA rate 1.2% below the national average. This indicator is scored according to the following scale:

- Weak – More than 1% above the national average
- Mid-Range – ± 1% of the national average
- Strong – More than 1% below the national average

This indicator is scored as "strong".

WORKSHEET 6 – MEDIAN HOUSEHOLD INCOME - COLUMBUS

The MHI used in this measure of financial capability is the same as in Worksheet 2, and reflects the MHI for the city of Columbus. For this FCA measure, MHI is compared to the national MHI average, providing an overall indicator of community earning capacity. This comparison is shown in Worksheet 6.

WORKSHEET 6 » MEDIAN HOUSEHOLD INCOME – COLUMBUS

Line No.	Description	Value
601	Median Household Income (2013$)[1]	$44,072
602	Census Year National MHI (2013$)	$52,250
603	MHI Adjustment Factor[2]	1.01175
604	Adjusted MHI (2015$)[3]	$44,590
605	Adjusted National MHI (2015$)	$53,661

[1] Worksheet 2, Line 201 [2] Worksheet 2, Line 202 [3] Worksheet 2, Line 203

Scoring for the MHI indicator is based on the following scale:

- Weak – More than 25% below adjusted national MHI
- Mid-Range – ± 25% of the adjusted national MHI
- Strong – More than 25% above the adjusted national MHI

As shown, the city's MHI is 16% below the national average and is scored as 2 or "Mid-Range".

WORKSHEET 7 – PROPERTY TAX REVENUES AS A PERCENTAGE OF FULL MARKET PROPERTY VALUE – COLUMBUS

This indicator can be viewed as the "property tax burden" as it indicates the funding capacity available to support debt based on the wealth of the community. The full market value of real property is determined in Worksheet 4. Property tax revenues collected for FY2013 amounted to $44,639,826.

WORKSHEET 7 » PROPERTY TAX REVENUES AS A PERCENTAGE OF FULL MARKET PROPERTY VALUE – COLUMBUS

Line No.	Description	Value
701	Full Market Property Value (FMPV)	$ 14,622,135,000
702	Property tax revenue	$ 44,639,826
703	Property tax revenue as a percent of FMPV	0.3%

Scoring for Worksheet 7 is as follows:

- Weak – Above 4%
- Mid-Range – 2% - 4%
- Strong – Below 2%

As shown in Worksheet 7, the property tax revenues as a percent of FMPV are 0.3%, and based on the scale below places the city at a 3 or in the "strong" category. While this measure indicates a "strong" rating, it should be noted that this indicator fails to capture the impact to the community due to other forms of taxation, including earned revenue tax, sales tax, local income taxes or other revenue sources of the community, and therefore under-represents taxing burden on the community.

WORKSHEET 8 – PROPERTY TAX REVENUES COLLECTION RATE – COLUMBUS

The property tax revenue collection rate is an indicator of the efficiency of the tax collection system and the acceptability of tax levels to residents. Worksheet 8 displays the property tax revenues previously used in Worksheet 7 and compares them to the amount of property taxes actually levied.

WORKSHEET 8 » PROPERTY TAX REVENUES COLLECTION RATE – COLUMBUS

Line No.	Description	Value
801	Property tax revenue collected	$ 44,639,826
802	Property taxes levied	$ 48,295,578
803	Property tax revenue collection rate	92%

Scoring for Worksheet 8 is as follows:

- Weak – Below 94%
- Mid-Range – 94% - 98%
- Strong – Above 98%

As shown in Worksheet 8, the actual property tax revenue collection rate in FY2013 (CAFR 2013) was 92%, which places the city in the 3 or "weak" category according to the scale above.

WORKSHEET 9 – SUMMARY OF PERMITEE FINANCIAL CAPABILITY INDICATORS – COLUMBUS

Worksheet 9 summarizes the six indicators used to develop the financial capability indicator. In previous sections, each of the indicators was categorized as "weak," "mid-range," or "strong" based on the worksheet economic measures. To develop the overall financial capability indicator, each indicator is scored using the following scale and the previous category assignments:

- Weak: 1
- Mid-Range: 2
- Strong: 3

Once each indicator from Worksheets 3 through 8 is scored, an average score is calculated and assigned an overall rating of weak, mid-range or strong. As shown in Worksheet 9, Line 907 provides the overall financial capability indicators score for the city.

WORKSHEET 9 » SUMMARY OF FINANCIAL CAPABILITY INDICATORS – COLUMBUS

Line	No.	Description	Benchmark	Score
901	Bond Rating (Line 303)	Strong	3	
902	Overall Net Debt as a Percent of Full Market Property Value (Line 405)	Weak	1	
903	Unemployment Rate (Local rate minus National rate) (Line 501 – Line 503)	Strong	3	
904	Median Household Income (vs. National MHI) (Line 601 / Line 604)	Mid-Range	2	
905	Property Tax Revenues as a Percent of Full Market Property Value (Line 703)	Strong	3	
906	Property Tax Revenue Collection Rate (Line 803)	Weak	1	
907	Permittee Indicator Score (Average of Scores)	Mid-Range	2.17	

As shown, the city's financial capability indicator is a 2.17, which is considered "mid-range" based on the scoring criteria below:

- Weak – Below 1.5
- Mid-Range – 1.5 – 2.5
- Strong – Above 2.5

WORKSHEET 10 – LEVEL OF FINANCIAL BURDEN – COLUMBUS

In Worksheet 10, the results of the RI and financial capability indicator analyses are combined in the financial capability matrix to evaluate the level of financial burden the CSO/SSO controls may impose on the permitee. As shown in Worksheet 10, the RI is 1.97%, which places it just barely within the "medium" impact category. The city's financial capability indicator is a 2.17, which places it in the "mid-range" category. The combined impact of these two indicators in the matrix places the proposed program in the "medium burden" range of financial impact to the community. However, it should be noted that the RI is just barely below the threshold for "high" impact. Worksheet 10 indicates that the city is right on the edge of being at a "high burden" for the program. As indicated in the USEPA's 2014 FCA framework for municipal CWA requirements, the level of burden is a continuum for communities, and as such, this should be taken into consideration in evaluating the community impact.

WORKSHEET 10 » FINANCIAL CAPABILITY MATRIX – COLUMBUS

Financial Capability Indicator Score	Residential Indicator		
	Low (Below 1%)	Medium (1% - 2%)	High (Above 2%)
Weak (Below 1.5)	Medium Burden	High Burden	High Burden
Mid-Range (1.5 – 2.5)	Low Burden	Medium Burden	High Burden
Strong (Above 2.5)	Low Burden	Low Burden	Medium Burden

9.3.2 Financial Capability Assessment for the Service Area

As previously discussed, it is most appropriate to evaluate the USEPA FCA based on the city, and not the service area. However, the FCA has also been calculated based on the service area to understand the resulting measures based upon the service area. It should be noted that the results that follow underestimate the full impact of the CWA on the service area, as wastewater and stormwater costs for the contract communities are not included in the calculation of CPH.

WORKSHEET 1 – COST PER HOUSEHOLD – SERVICE AREA

As mentioned, it is very difficult to determine the true long-term impact of the CWA for many of the contract communities, given the small size of many of the communities, and the fact that many of the communities manage their stormwater and wastewater systems in conjunction with other public works responsibilities, making it difficult to separate CWA costs. A number of communities do not charge rates for utilities and in others the rates are known to underrepresent the full cost of providing service. Therefore, for the purpose of this analysis, the CPH of $878 from city of Columbus' Worksheet 1 has been used to calculate the RI for the service area.

WORKSHEET 2 – RESIDENTIAL INDICATOR – SERVICE AREA

The RI based on the service area is calculated using the MHI for the city's service area. The 2015 MHI for the city's service area is estimated to be $56,513, based on U.S. Census Bureau American Community Survey (ACS) 2013, 5-year estimates escalated to 2015 dollars based on an evaluation of historical income growth compared to the Consumer Price Index (CPI). The service area RI is calculated by dividing the CPH from Worksheet 1 ($878) by the adjusted MHI ($56,513). The calculated RI of 1.55% places the RI for the service area in the "mid–range impact" based on the USEPA RI rating scale.

WORKSHEET 2 » RESIDENTIAL INDICATOR – SERVICE AREA

Line No.	Description	WW/SW
	Median Household Income - Service Area	
201	Census Year MHI (2013)	$55,857
202	MHI Adjustment Factor (0.95%/2014; 0.23%/2015)	1.01175
203	Adjusted MHI (Line 201 x Line 202)	$56,513
204	Total CPH (Worksheet 1, Line 109)	$878
205	Residential Indicator (Line 204 / Line 203 x 100)	1.97%

The RI does not reflect the range of burden that households within the community will experience. Based on the 2013 ACS, 5-year estimates, the upper limit of the LQ for the service area was $26,769. Adjusting to 2015, the estimated income level would be $27,084. Therefore, the CPH of $878 would represent 3.24% of the LQ, which is significantly higher than the USEPA's threshold indicating "high impact".

SUMMARY OF WORKSHEETS 3 TO 9 – FINANCIAL CAPABILITY MATRIX – SERVICE AREA

An analysis of the financial capability indicators for each of the contract communities within the service area is summarized below. The following table summarizes each community's rating for each indicator. Blanks indicate lack of data necessary to calculate the indicator. The service area score is a weighted average of all communities, based on population. As shown, on average, most communities score within the "mid-range" for the six financial capability indicators, while four communities scored "strong," and one community scored "weak." The weighted average of all communities result in the service area average indicator of 2.21, or "mid-range."

WORKSHEETS 3 to 9 » SUMMARY OF FINANCIAL CAPABILITY INDICATORS – SERVICE AREA

City	Population	Ohio EPA Financial Capability Analysis - Worksheet:							
		#3 Bond Rating	#4 Overall Net Debt as a % of FMPV	#5 Unemployment Rate	#6 MHI	#7 Property Tax Rev. as % of FMPV	#8 Property Tax Coll. Rate	#9 Summary of Scores	
Columbus	822,553	3.00	1.00	2.00	2.00	3.00	1.00	2.00	Mid-Range
Bexley	13,252		2.00	3.00	3.00	3.00	2.00	2.60	Strong
Dublin	42,906	3.00	1.00	3.00	3.00	3.00	1.00	2.33	Mid-Range
Gahanna	33,243		2.00	3.00	3.00	3.00	1.00	2.40	Mid-Range
Grandview Heights	6,910	3.00	2.00	3.00	3.00	3.00	1.00	2.50	Mid-Range
Grove City	36,832		1.00	3.00	2.00	3.00	3.00	2.40	Mid-Range
Groveport	5,540	3.00	1.00	3.00	2.00	3.00	2.00	2.33	Mid-Range
Hilliard	30,564		1.00	3.00	3.00	3.00	1.00	2.20	Mid-Range
Marble Cliff	573			3.00	3.00			3.00	Strong
Minerva Park	1,272		3.00	3.00	2.00	3.00		2.75	Strong
New Albany	8,507		1.00	3.00	3.00	3.00	1.00	2.20	Mid-Range
Obetz	4,532		2.00	1.00	2.00	3.00	3.00	2.20	Mid-Range
Reynoldsburg	36,347		1.00	3.00	2.00	3.00	1.00	2.00	Mid-Range
Riverlea	545				3.00			3.00	Strong
Upper Arlington	34,203	3.00	1.00	3.00	3.00	3.00	2.00	2.50	Mid-Range
Valleyview	620			3.00	2.00			2.50	Mid-Range
Westerville	37,071		1.00	3.00	3.00	3.00	2.00	2.40	Mid-Range
Whitehall	18,403		1.00	1.00	1.00	3.00	1.00	1.40	Weak

As discussed previously, the results of the RI and financial capability indicator analyses are combined in the financial capability matrix to evaluate the level of financial burden the CSO/SSO controls may impose on the permitee. As shown below in Worksheet 10, the RI for the service area is 1.55%, which places it within the “medium” impact category. The financial capability indicator for the service area is a 2.21, which places it in the “mid-range” category. The combined impact of these two indicators in the matrix places the proposed program in the “medium burden” range of financial impact to the community.

WORKSHEET 10 » FINANCIAL CAPABILITY MATRIX – SERVICE AREA

Financial Capability Indicator Score	Residential Indicator		
	Low (Below 1%)	Medium (1% - 2%)	High (Above 2%)
Weak (Below 1.5)	Medium Burden	High Burden	High Burden
Mid-Range (1.5 – 2.5)	Low Burden	Medium Burden	High Burden
Strong (Above 2.5)	Low Burden	Low Burden	Medium Burden

9.4 Long Term Financial Analysis

As discussed, the USEPA 1997 Guidance provides a "snapshot view" of affordability for a utility in the form of a RI. This approach is very limited in its ability to truly account for the impact the program costs will have on the community, but more importantly it does not allow a utility to assess the impact of alternative schedules on customer bills. A much more meaningful approach is to prepare a long-term financial forecast of utility operations to determine a more realistic estimate of annual rate impact on customers based on alternative programs and schedules.

To accomplish this analysis, the city developed a comprehensive long-term financial planning model (affordability model). The affordability model builds upon the city's existing pro forma models for wastewater and stormwater that the city uses to evaluate budgets and set rates, to determine the average annual rate increases that would be necessary to finance future capital costs and provide adequate funding for all other on-going costs of both utilities. Based upon the analysis, the projected average annual residential bill for wastewater and stormwater was calculated in each year of the program, in order to evaluate both the near-term and long-term impacts of the alternative capital programs and schedules. This long-term evaluation provided the information necessary for the city to determine its recommended plan, Blueprint 2035.

The affordability model is based on the city's FY2015 second quarter pro forma models for the wastewater and stormwater utilities and data from the city's most recent rate study. It includes a forecast of future revenues under existing rates as well as future expenditures for on-going operation and maintenance of the systems, and capital spending to complete the requirements of the consent orders as well as provide adequate capital funding for on-going renewal and replacement of the existing infrastructure. Based upon projected expenditure levels, annual increases in rates are determined as necessary to provide adequate funding of all needs. The following discussion provides a summary of the methodology used in key assumptions and inputs into the model, followed by the resulting forecast for the city's recommended plan, Blueprint 2035. The full results of the model runs are presented in Tables 9.4.1 through 9.4.8.

9.4.1 Wastewater and Stormwater Revenue

The wastewater and stormwater utilities are separate enterprise funds, with revenues from wastewater service charges, wastewater volume charges and stormwater charges comprising the majority of revenue used to recover the costs of operation. Other miscellaneous revenues such as interest income and miscellaneous fees provide a small portion of the total revenue for each utility. The level of future revenue was projected based upon consultation with city fiscal staff and an analysis of historical system growth in terms of number of customers, wastewater volume and stormwater equivalent residential units (ERUs).

The projected number of customers served by the wastewater utility, and the number of ERUs for the stormwater utility, was based on a detailed evaluation of past trends in the number of accounts as well as an evaluation of current economic conditions, including an evaluation of projected population within the service area.

In addition, it is important to understand the trend in wastewater volume per customer, by customer class, in projecting future wastewater revenues. This is even more critical given the trend in declining volume per customer, particularly for residential customers, but also experienced within other customer classes. The city has experienced declining volume for several years. This is a trend that is being experienced by utilities across the U.S. and is caused by a number of factors, including the installation of more water efficient appliances and fixtures.

A detailed water forecast study conducted for the city in 2014 included the evaluation of historical water consumption trends. While it is not possible to forecast when the trend of declining volume per customer will level off and what an ultimate level may be, there will be a limit to just how little water households can be expected to use. Therefore, in this analysis, volume per customer has been projected by customer class that reflects a slowing of the rate of decline in volume per customer through FY2018, followed by a leveling off beginning in FY2019.

The assumptions used in projecting the number of wastewater customers by customer class and the change in volume per customer are summarized in Exhibit 9.4.1. As discussed, volume per customer is projected to decline through FY2018 for all customer classes except wholesale, which is being projected to increase each year of the program, reflecting anticipated growth in contract communities served on a wholesale (master meter) basis. The number of customers is projected to increase in all years for most customer classes. Stormwater ERUs are projected to increase at a rate of 0.5% per year.

EXHIBIT 9.4.1 » PROJECTION OF VOLUME PER CUSTOMER AND CUSTOMER GROWTH

Description	Customer									
	FY15	FY16	FY17	FY18	FY 19-40	FY15	FY16	FY17	FY18	FY 19-40
Inside City - Single Family	-1.7%	-1.7%	-1.8%	-1.9%	0.0%	1.0%	1.0%	1.0%	1.0%	1.0%
Inside City - Multi Family	-1.0%	-1.0%	-1.0%	-1.1%	0.0%	1.0%	1.0%	1.0%	1.0%	1.0%
Inside City - Commercial	-0.2%	-0.2%	-0.1%	-0.1%	0.0%	0.5%	0.5%	0.5%	0.5%	0.5%
Inside City - Industrial	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%	0.5%	0.5%	0.5%	0.5%
Inside City - Exception	-0.5%	-0.5%	-0.5%	-0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Anheuser Busch	-4.5%	-4.5%	-4.5%	-4.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Ohio State University	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Outside City - Single Family	-2.2%	-2.2%	-2.4%	-2.5%	0.0%	1.0%	1.0%	1.0%	1.0%	1.0%
Outside City - Multi Family	-0.1%	-0.1%	-0.1%	-0.1%	0.0%	1.0%	1.0%	1.0%	1.0%	1.0%
Outside City - Commercial	-0.7%	-0.6%	-0.6%	-0.5%	0.0%	1.0%	1.0%	1.0%	1.0%	1.0%
Outside City - Industrial	-0.2%	-0.2%	-0.2%	-0.2%	0.0%	0.5%	0.5%	0.5%	0.5%	0.5%
Outside City - Exception	-1.7%	-1.5%	-1.4%	-1.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Wholesale	0.5%	0.5%	0.5%	0.5%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%

Revenue under existing rates was projected based upon the projected number of wastewater customers and total volume, and projected stormwater ERUs. Miscellaneous revenue was evaluated and projected in a manner consistent with the city's current projections outlined in the wastewater and stormwater pro forma models.

9.4.2 Wastewater and Stormwater Revenue Requirements

The revenue required to adequately provide for the continued operation of the wastewater and stormwater utilities must be sufficient to meet the cash requirements of O&M: principal, interest and reserve payments on general obligation and revenue bond indebtedness, principal and interest on low interest loans and other indebtedness and any capital expenditures funded with cash.

O&M expenses have been projected based upon the city's current pro forma models for fiscal years (FYs) 2015-2024. In FY2025 and beyond, the following cost escalation factors are used:

- Personnel Services – 3%
- Health Insurance – 7%
- Supplies & Materials – 2%
- Contractual Services – 3%
- Other – 2%
- Equipment – 2%
- Department of Public Utilities Allocation – 2%

In addition, it is important to forecast the impact of the program on future O&M. Such "incremental O&M" is projected in future years based on a percentage of capital costs for select projects, ranging from zero to 2% and begin one year after projects are completed. These costs are escalated at 3% per year thereafter. Green Infrastructure projects/assets within Blueprint Columbus are assumed to be maintained by the stormwater utility in the future, and as such, the incremental O&M of these projects, estimated at 2% of capital costs, is reflected in future stormwater O&M.

Annual expenditures for the capital programs evaluated are anticipated to be met primarily from the issuance of long-term debt. The city plans to utilize the state revolving loan program administered through the Ohio Water Development Authority (OWDA) to the maximum extent possible. However, in order to reflect the likelihood that the city will not be able to fund all eligible projects through OWDA, the financial forecasts assume that 50% of the capital costs of eligible projects will be funded through this source. Remaining capital costs are assumed to be financed through issuance of general obligation bonds. In addition, some of the capital costs, particularly in the later years of the program, are projected to be cash financed when revenues in excess of that necessary to maintain minimum reserve levels are available.

PROJECTED DEBT SERVICE FOR BOTH UTILITIES IS BASED ON THE PRO FORMA MODELS FOR FY2015. IN FY2016 AND BEYOND, DEBT SERVICE IS CALCULATED AS FOLLOWS:

STATE LOANS

- Interest Rate – 3% through FY2020, 3.25% for FY2021 through FY2025, and 3.5% thereafter.
- Term – 20 Years
- Principal & Interest – equal annual payments, beginning three years after issuance of loan to simulate the average project, will take three years to complete. Typically, the payment begins six months after project is complete.

GENERAL OBLIGATION (GO) BONDS

- Interest Rate – 4% through FY2020, 4.25% from FY2021 through FY2025, and 4.5% thereafter.
- Term – 20 Years
- Principal & Interest – interest payment begins next FY and principal payment begins two FYs after issuance (e.g., if GO bonds are issued in FY2016, interest would begin in FY2017 and principal would begin in FY2018).

The city is required to evaluate the impact of both Blueprint Columbus and an updated WWMP program, based on the current schedule (completion by 2045) as well as schedules that are five, ten and 15 years shorter. Therefore, the long-term financial analysis has been completed and evaluated for eight alternative program schedules to determine the impact on customers. Exhibit 9.4.2 summarizes total capital spending under each scenario. Capital spending includes both consent order and non-consent order capital projects projected through FY2045.

EXHIBIT 9.4.2 » SUMMARY OF ALTERNATIVE CAPITAL PROGRAM SCHEDULES (2015 $MILLION)

DESCRIPTION	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Blueprint 2030	$ 264	$ 206	$ 217	$ 167	$ 129	$ 151	$ 141	$ 208	$ 246	$ 222
Blueprint 2035	$ 264	$ 206	$ 206	$ 175	$ 128	$ 134	$ 125	$ 164	$ 180	$ 142
Blueprint 2040	$ 264	$ 206	$ 206	$ 175	$ 122	$ 130	$ 128	$ 143	$ 169	$ 128
Blueprint 2045	$ 264	$ 206	$ 195	$ 167	$ 132	$ 110	$ 71	$ 118	$ 140	$ 138
Gray 2030	$ 264	$ 198	$ 209	$ 164	$ 106	$ 127	$ 135	$ 146	$ 178	$ 155
Gray 2035	$ 264	$ 163	$ 173	$ 164	$ 141	$ 110	$ 83	$ 129	$ 152	$ 117
Gray 2040	$ 264	$ 163	$ 173	$ 164	$ 141	$ 110	$ 83	$ 129	$ 152	$ 117
Gray 2045	$ 264	$ 163	$ 173	$ 128	$ 106	$ 110	$ 114	$ 133	$ 111	$ 76
	2025	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**
Blueprint 2030	$ 217	$ 160	$ 158	$ 121	$ 94	$ 65	$ 44	$ 44	$ 44	$ 46
Blueprint 2035	$ 146	$ 115	$ 107	$ 105	$ 103	$ 129	$ 113	$ 122	$ 124	$ 112
Blueprint 2040	$ 120	$ 104	$ 95	$ 75	$ 75	$ 106	$ 106	$ 94	$ 100	$ 110
Blueprint 2045	$ 146	$ 67	$ 69	$ 70	$ 68	$ 112	$ 98	$ 80	$ 85	$ 110
Gray 2030	$ 155	$ 144	$ 139	$ 196	$ 182	$ 167	$ 50	$ 50	$ 50	$ 52
Gray 2035	$ 152	$ 112	$ 111	$ 108	$ 100	$ 152	$ 164	$ 171	$ 134	$ 130
Gray 2040	$ 135	$ 95	$ 111	$ 117	$ 118	$ 141	$ 117	$ 133	$ 127	$ 132
Gray 2045	$ 74	$ 65	$ 127	$ 124	$ 109	$ 137	$ 75	$ 67	$ 162	$ 144
	2036	**2037**	**2038**	**2039**	**2040**	**2041**	**2042**	**2043**	**2044**	**2045**
Blueprint 2030	$ 46	$ 46	$ 46	$ 60	$ 60	$ 60	$ 60	$ 60	$ 60	$ 60
Blueprint 2035	$ 46	$ 46	$ 46	$ 60	$ 60	$ 60	$ 60	$ 60	$ 60	$ 60
Blueprint 2040	$ 104	$ 78	$ 99	$ 104	$ 95	$ 60	$ 60	$ 60	$ 60	$ 60
Blueprint 2045	$ 97	$ 96	$ 116	$ 136	$ 113	$ 97	$ 102	$ 87	$ 82	$ 70
Gray 2030	$ 52	$ 52	$ 52	$ 65	$ 65	$ 65	$ 65	$ 65	$ 65	$ 65
Gray 2035	$ 52	$ 52	$ 52	$ 65	$ 65	$ 65	$ 65	$ 65	$ 65	$ 65
Gray 2040	$ 99	$ 57	$ 60	$ 74	$ 69	$ 65	$ 65	$ 65	$ 65	$ 65
Gray 2045	$ 133	$ 88	$ 102	$ 123	$ 116	$ 74	$ 74	$ 71	$ 71	$ 69

The city has established a policy to maintain reserve funds at a level that provides significant liquidity for the utilities. Current policy is to maintain $100 million (2015 $) in the general reserve, and a minimum of $11 million (2015 $) for the reserve, replacement and revenue bond debt service funds plus approximately $50 million (2015 $) for the operating fund annually.

The city's current policy is to maintain minimum adjusted debt service coverage of 1.5 times current year debt service. Adjusted debt service coverage is calculated by dividing all unrestricted revenue (including unrestricted cash reserves) less current year operating expenses (excluding debt service or depreciation) by current year debt service (principal and interest). The adjusted debt service coverage is one of the city's measures of success, discussed below.

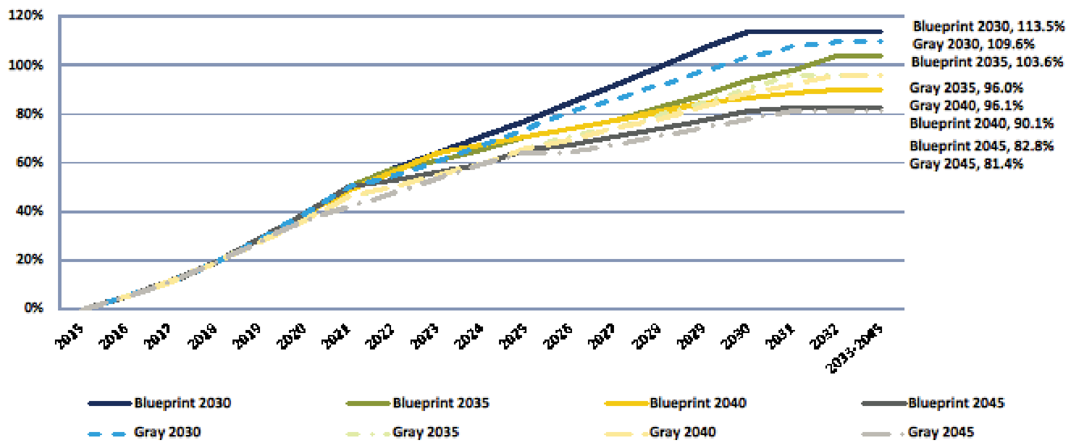
9.4.3 Affordability Model Results

Once all the inputs to the model (discussed above) were completed, the city used the model to generate a long range analysis of the various schedules. The full results are presented in Tables 9.4.1 through 9.4.8 and summarized below.

The model runs demonstrate that the city is meeting its goal with regard to maintaining a minimum adjusted debt service coverage of 1.5 times current year debt service. On Table 9.4.2 (Blueprint 2035 run), adjusted debt service coverage ranges from 1.58% in 2016 at the beginning of the program to 4.79% in 2045, ten years after the program is complete.

The city was able to look at the rate increases that each of the eight schedules would require. A projected cash flow analysis for each utility was developed to provide a basis for evaluation of the adequacy of revenues under existing rates to meet the projected revenue requirements of each utility in each year of the program. Based upon this evaluation, required system-wide revenue increases for each utility were determined in each year. This information is in the first line of each of the eight tables (rate increases [WW]). Exhibit 9.4.3 presents a summary of the projected annual and cumulative wastewater rate increases required under each alternative.

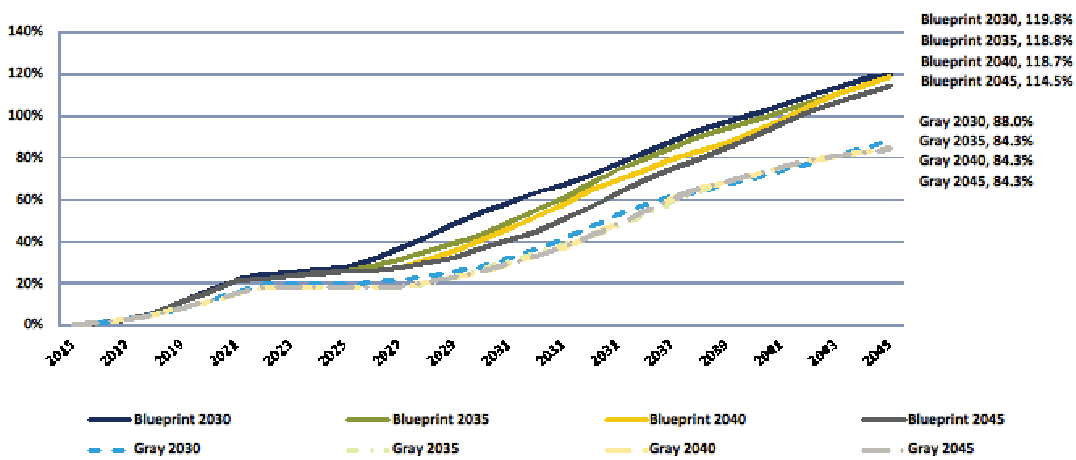
EXHIBIT 9.4.3 » PROJECTED ANNUAL AND CUMULATIVE WASTEWATER RATE INCREASES UNDER EACH PROGRAM/SCHEDULE



As can be seen, rate impacts are similar across the eight scenarios through about FY 2020, and then vary based on the schedule. While the longest schedule is the most favorable in terms of cumulative impacts, the city believes that Blueprint 2035 is the optimal schedule. It provides much quicker relief on the annual rate increase as compared to Blueprint 2030 while completing the work more expeditious than Blueprint 2040 or 2045.

The impact on stormwater rates is more varied. This information is presented on the third line of the eight tables (rate increases [SW]) and summarized in Exhibit 9.4.4.

EXHIBIT 9.4.4 » PROJECTED ANNUAL AND CUMULATIVE STORMWATER RATE INCREASES UNDER EACH PROGRAM/SCHEDULE



As can be seen, all of the Blueprint schedules will impact stormwater rates more significantly than any of the gray plans. This is because of the green infrastructure contained in the Blueprint plan, which will require more maintenance than any of the elements in the gray plan. In fact, over 20 years, we estimate that O&M for Blueprint will be approximately $60 million, compared to just over $1 million for gray. However, while these rate increases look significantly different, they do not actually impact affordability that much. The stormwater fees are so modest compared to wastewater and water rates that the stormwater fee has very little impact on a customer's overall bill.

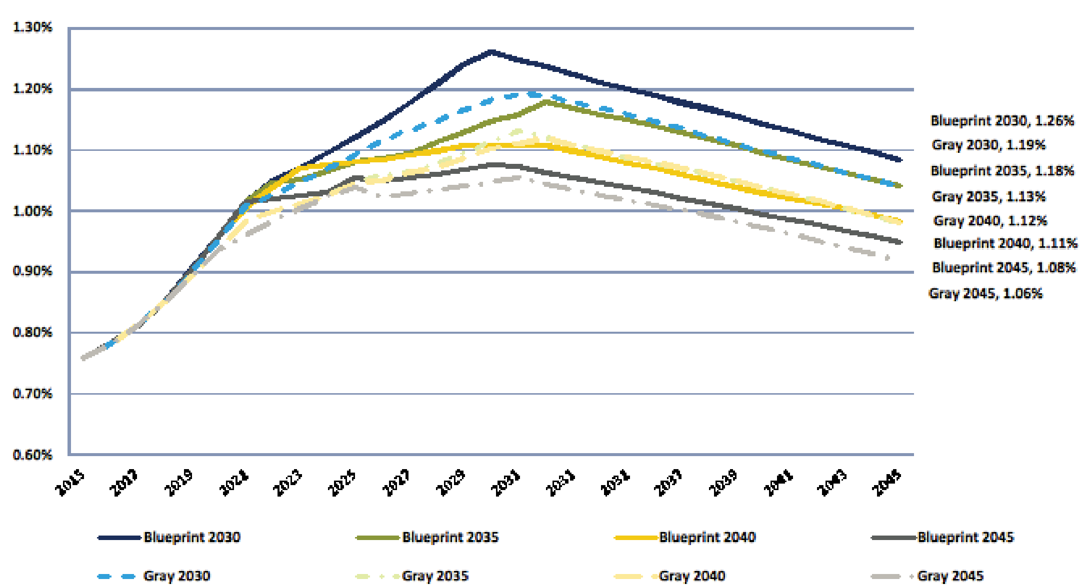
In addition to looking at rate increases, the city also used the capital model to analyze the total wastewater and stormwater bill as a percentage of various populations' MHI.

While the MHI analysis may sound similar to the USEPA's RI analysis, it is not, and the two should not be confused or compared. The RI is a blunt tool. It does not take into account any of the many factors that actually impact revenue and expenditures of the utility, such as how capital projects are financed. It also does not take into consideration many of the other decisions that go into setting rates, such as defining rate classes, establishing fees, actual consumer use, etc. It does have the advantage, in theory, of allowing comparisons of the impact of programs across different cities. In short, the 2% MHI standard is only applicable when discussing the RI. As noted above, the city's RI of 1.97% of MHI is on the threshold of high burden and compares favorably with other Ohio cities.

The MHI predictions from the financial model are based on a completely different approach to determining consumer burden. The model is much more sophisticated and takes into account many factors unique to Columbus. It is therefore not surprising that the MHI percentages are different than the RI. The two things are apples and oranges and cannot be compared.

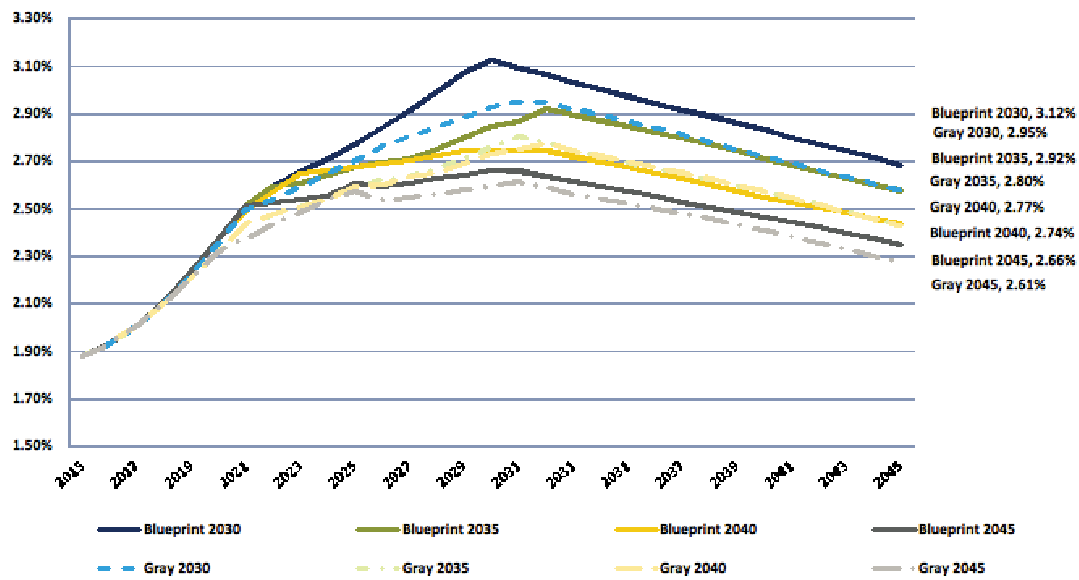
Exhibit 9.4.5 shows the impact of rate increases over time in terms of the city's MHI.

EXHIBIT 9.4.5 » PROJECTED ANNUAL WASTEWATER AND STORMWATER BILL AS A PERCENTAGE OF COLUMBUS' MHI



Again, the impacts are similar in the beginning and then vary more sharply after FY 2020. We also analyzed this same information for our LQ. This information is presented in Exhibit 9.4.6.

EXHIBIT 9.4.6 » PROJECTED ANNUAL WASTEWATER AND STORMWATER BILL AS A PERCENTAGE OF COLUMBUS' LOWEST QUINTILE



As discussed below, the city has selected the upper limit of the LQ as one of its measures of success. According to the model, this measure of success is met though the Blueprint 2035 program. The model will allow the city to track this measure.

The affordability model has allowed the city to conduct a robust and thorough examination of how Blueprint 2035 will impact its rates and its financial capabilities. Based on this analysis, the city is confident that Blueprint 2035 is the appropriate plan.

9.4.4 Sensitivity Analysis

In conducting the Long Term Financial Analysis, numerous assumptions regarding future conditions are necessary. As previously discussed, such assumptions including customer growth, volume per customer, cost of debt, O&M and capital cost escalation are based upon historical data and analysis of past and current conditions. While we believe these assumptions are reasonable, it is possible that future conditions may differ from those projected. Of the assumptions, customer growth and volume per customer have significant impact on revenues, and therefore projected rate increases are particularly sensitive to changes in such assumptions. A sensitivity analysis was performed to evaluate the impacts of specific assumptions. Exhibit 9.4.7 summarizes the impact of less optimistic conditions, as follows:

- Line 1 – Base model includes the actual assumptions used in the financial model discussed above
- Line 2 – Customer growth (new accounts) increases at half the rate assumed in the base model
- Line 3 – Volume per customer declines at twice the rate assumed in the base model for FYs 2016 through 2018
- Line 4 – Combined impact of slower customer growth and steeper decline in customer consumption

EXHIBIT 9.4.7 » SENSITIVITY ANALYSIS - IMPACT OF LOWER CUSTOMER GROWTH AND VOLUME PER CUSTOMER ON FUTURE RATES (BLUEPRINT 2035)

Line No.	Projected Annual Rate Increase for Varying Model Input Assumptions - Blueprint 2035							
	Description	2016	2017	2018	2019	2020	2021	2022
	Wastewater Rate Increases							
1	Base	5.0%	6.0%	7.0%	8.0%	8.0%	8.0%	7.0%
2	Customers - Growth Half Base for SF, MF (IC/OC), & Commercial (OC)	5.0%	6.0%	8.0%	8.0%	8.0%	8.0%	7.0%
3	Use Per Customer - Decline Twice Base for Most Customer Classes	6.0%	7.0%	8.0%	8.0%	8.0%	8.0%	7.0%
4	Combined Effect	7.0%	7.0%	8.0%	8.0%	8.0%	8.0%	7.0%

SF = single-family, MF = multi-family, IC = inside city, OC = outside city

If future conditions differ from the base model, the sensitivity analysis clearly demonstrates that rate increases will be impacted significantly. As shown in line 3, changes in volume per customer have a more significant impact on revenues than customer growth, shown on line 2. The largest impact is in the first three years of the program. As in all scenarios, we are assuming that the decline in volume per customer will stop beginning in FY2019. If conditions are such that the decline continues beyond FY2018, it is expected that greater increases in rates, beyond those shown in this report, would be required. The city will continue to monitor the actual financial performance to determine if future adjustments are needed to rates and the recommended schedule.

9.5 Demographic/Socioeconomic Factors

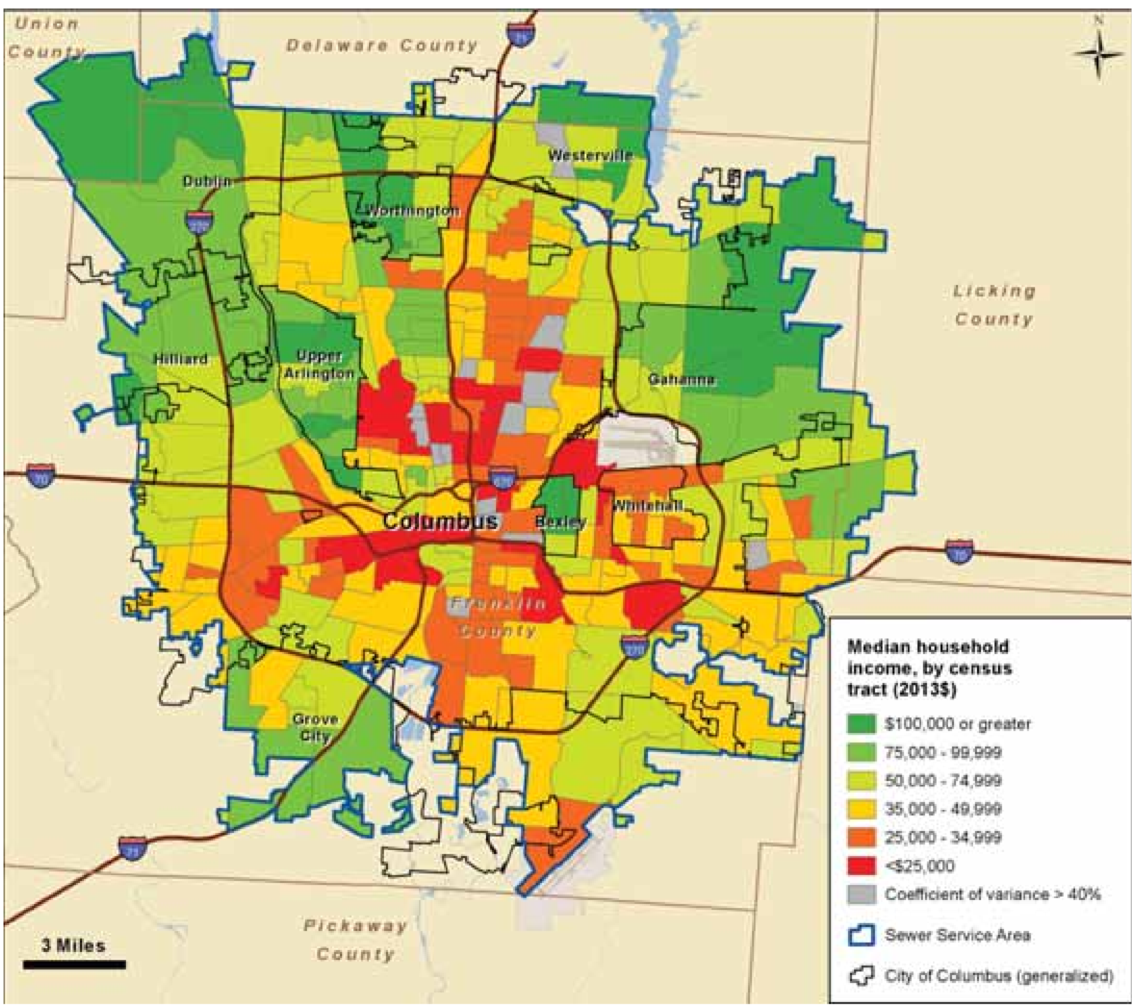
The USEPA's 2014 FCA framework recognized that the financial capability matrix, as developed in the 1997 guidance, does not provide a complete picture of the burden that CWA-related programs have on local communities. To better characterize the potential impact of Blueprint Columbus on residential customers, this section provides demographic and socioeconomic information specific to the city's service area.

9.5.1 Income Levels and Distribution

While the USEPA's FCA analysis focuses solely on the MHI of the entire service area, a more complete picture emerges when income levels are examined by neighborhood and type of household.

Exhibit 9.5.1 shows that income levels vary considerably across neighborhoods within the service area, and that there are several areas in the city with high concentrations of low-income households. Approximately 17.6% of inside-city households are located within "at-risk" census tracts, or census tracts with an MHI of less than 50% of the MHI for the service area as a whole (i.e., less than about $28,000)[1].

EXHIBIT 9.5.1 » MHI BY CENSUS TRACT, COLUMBUS SEWER SERVICE AREA



Source: U.S. Census Bureau American Community Survey 2009–2013 5-year average estimates

Income levels also vary across different types of households. For example, there are significant differences between income levels for renter- and owner-occupied households, as well as between multi-family and single-family households. Exhibit 9.5.2 shows MHI for different household types across the service area and for the state of Ohio and the United States as a whole. As shown, elderly, multi-family and renter-occupied households inside the city have lower income levels compared to any other group. Approximately 53% of households within the city are renter-occupied and 46% of households are in multi-family buildings. Elderly residents make up about 17.1% of total inside-city households, and the elderly population is growing. From 2005 to 2013, the number of inside-city residents who were 60 years and older increased by approximately 33.3%. This compares to an increase in the general population of 18.6%. While a larger percentage of elderly households own their homes free and clear (almost 40% compared to 8.5% of non-elderly households in the service area), this demographic group most often is living on fixed incomes, and therefore is of concern as wastewater and stormwater rates increase.

EXHIBIT 9.5.2 » MHI BY HOUSEHOLD TYPE

Household Type	Service Area	Inside City	Outside City	State of Ohio	United States
All households	$55,857	$44,072	$73,534	$48,308	$53,046
Elderly households	$39,363	$32,339	$48,066	34,270	$37,000
Renter-occupied	$36,380	$30,643	$42,878	26,404	$32,466
Owner-occupied	$72,978	$64,578	$88,973	62,005	$67,298
Multi-family	$36,036	$32,797	$41,031	28,211	N/A
Single-family	$73,001	$64,704	$85,798	59,244	N/A

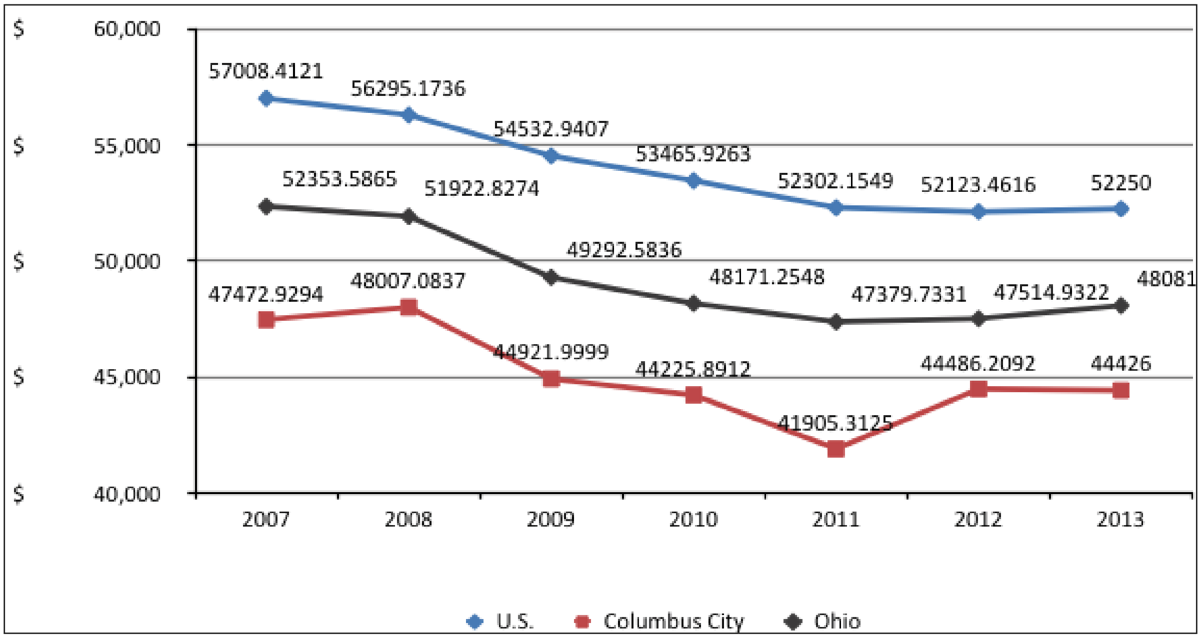
Source: U.S. Census Bureau American Community Survey 2009–2013, 5-year average estimates, PUMS 2013 (multi-family and single-family MHI).

Based on the data presented above, a greater percentage of inside-city households will likely face affordability challenges.

In recent years the MHI within the city of Columbus has been declining. As shown in Exhibit 9.5.3, when adjusted to 2013 values, MHI decreased from $47,473 in 2007 to $44,426 in 2013. This has important affordability implications because it means that increases in wastewater and stormwater rates are not being offset by similar increases in incomes. Exhibit 9.5.3 also shows that MHI within the city has consistently been 15 to 20% lower than the MHI for the United States as a whole, and has been 8% to 12% lower than the MHI for the state of Ohio.

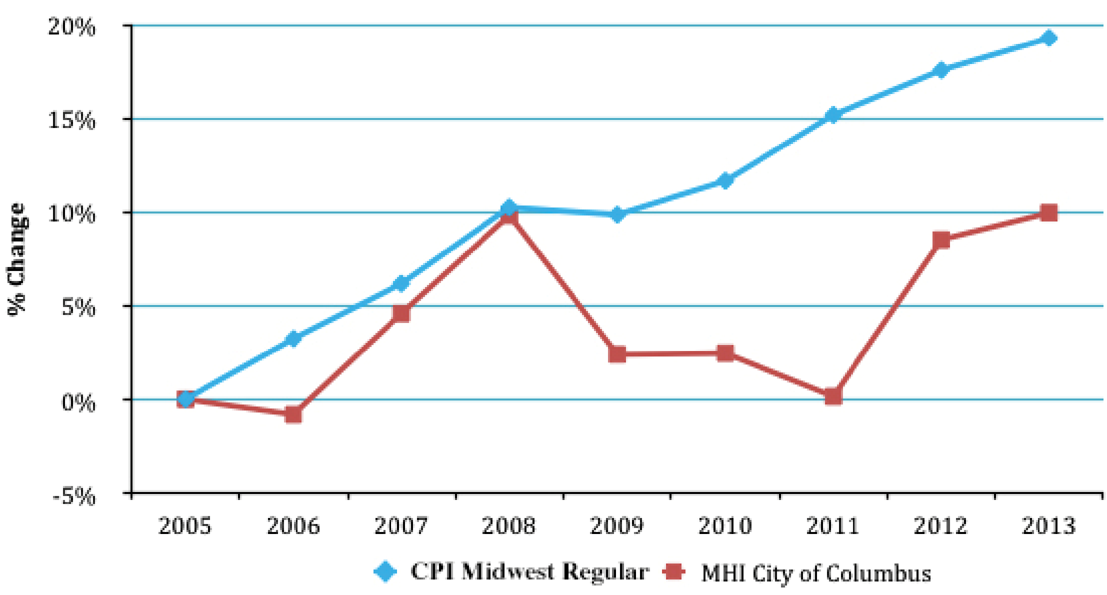
In addition, as shown in Exhibit 9.5.4, real household income within the service area has increased at a much slower rate than general inflation. For example, from 2005 to 2013, the CPI for the Midwest region of the United States increased by approximately 19%. Over this same time period, real MHI within the city of Columbus increased by only approximately 10%.

EXHIBIT 9.5.3 » COLUMBUS MHI, 2007–2013 (ADJUSTED TO 2013 DOLLARS USING CPI)



Source: U.S. Census Bureau American Community Survey, 2007–2013 single-year estimates.

EXHIBIT 9.5.4 » COMPARISON OF ACTUAL GROWTH IN MHI VERSUS CPI



9.5.2 Poverty Rates

In 2013, 22.7% of the city's residents – more than 186,000 people – were living below the federal poverty level. This compares to a national poverty rate of 15.8%, and 16% for the state of Ohio. Exhibit 9.5.5 shows that poverty rates have generally been on the rise within the city of Columbus since 2005. In addition, the poverty rate within the city has been growing more rapidly than poverty levels at the national and state levels.

EXHIBIT 9.5.5 » 2005–2013 POVERTY RATES, COLUMBUS, OHIO AND THE UNITED STATES

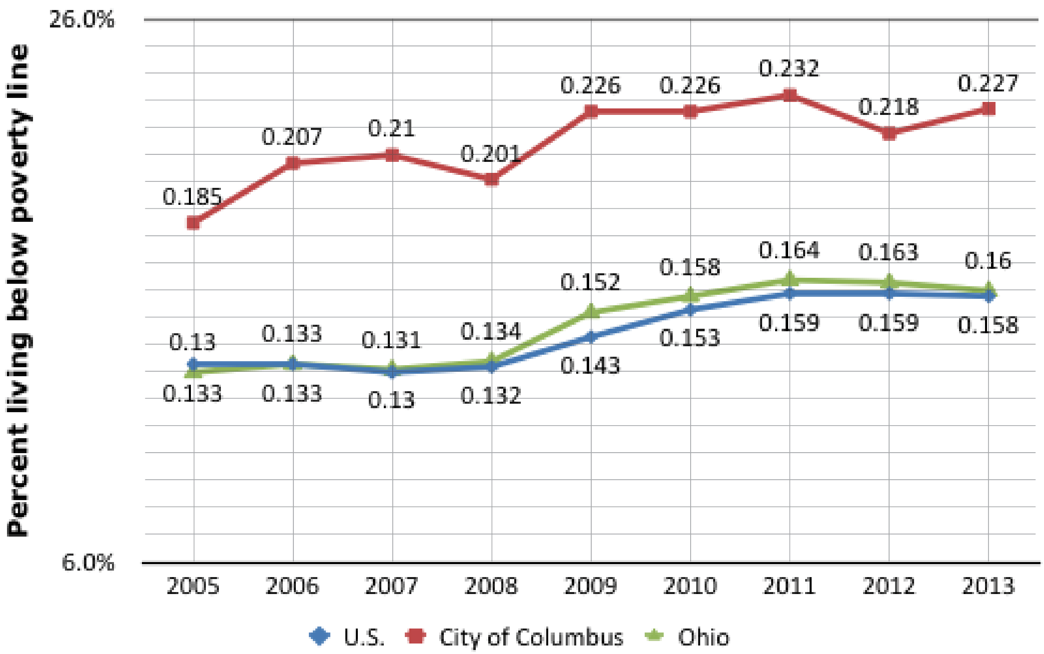
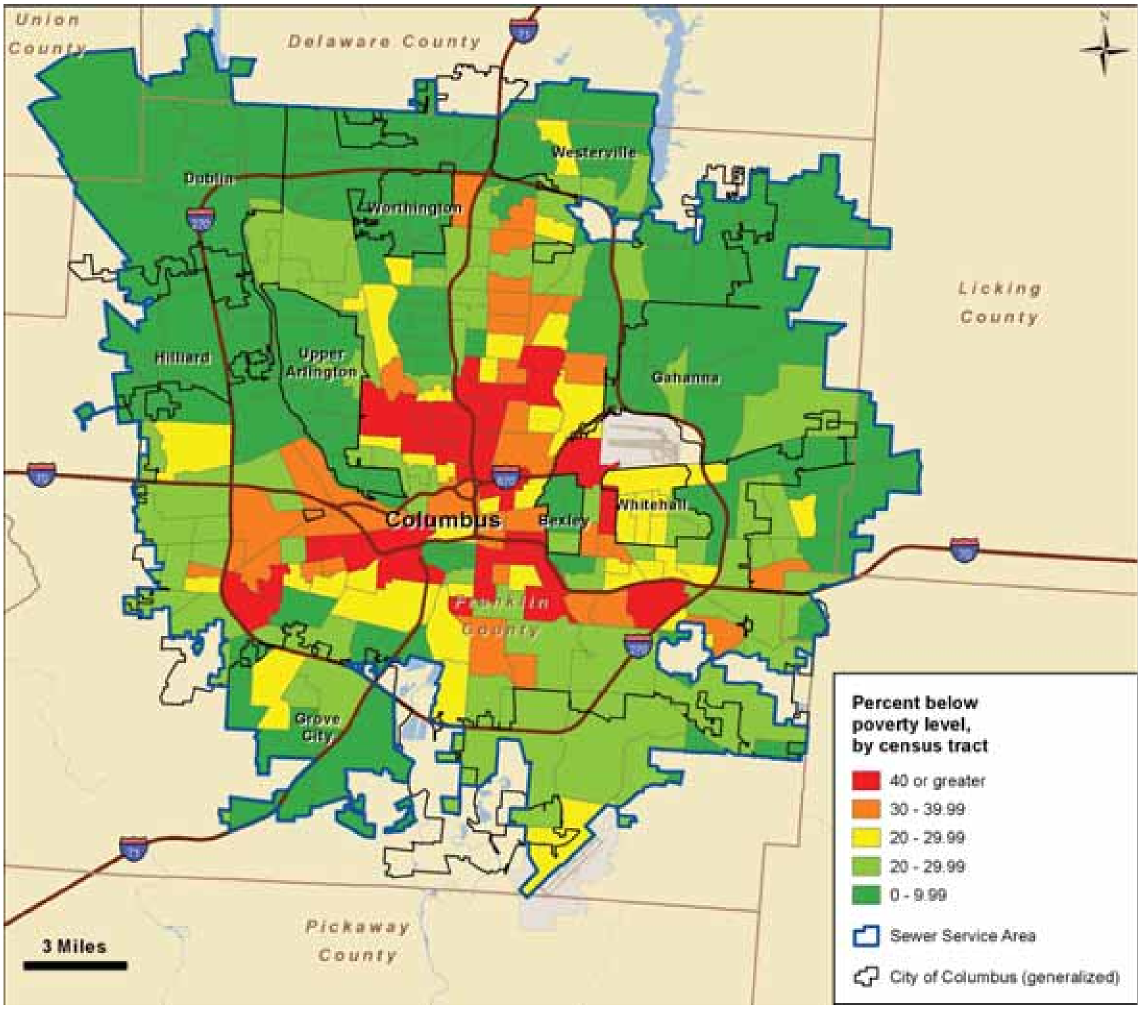


Exhibit 9.5.6 shows that poverty rates also vary across neighborhoods, with several areas in the city having a relatively high concentration of people living below the federal poverty level. In 2013, 46% of the city's population was living within a "poverty area" census tract, meaning that 20% or more of the households in that census tract had incomes below the federal poverty level. The city's contract communities had fewer poverty areas and in general had much lower poverty rates compared to the city of Columbus.

In addition to overall poverty rates, it is important to evaluate populations that may be especially vulnerable, including the city's elderly residents and children. Exhibit 9.5.7 shows the percentage of elderly residents and children (under 18 years) living below the federal poverty level in the United States, in the state of Ohio, in the service area and in the city of Columbus. As shown, the percentage of elderly residents living in poverty is lower than the overall average both inside the city and within contract communities, while the percentage of children under the age of 18 is much higher. Although elderly households tend to have lower incomes compared to households city-wide, the percentage of elderly residents living below the federal poverty level is likely lower than the average for all residents because they typically have fewer people per household, and thus, the poverty income threshold is quite low for these households.

EXHIBIT 9.5.6 » PERCENTAGE OF RESIDENTS LIVING BELOW THE FEDERAL POVERTY LEVEL, BY CENSUS TRACT



Source: U.S. Census Bureau American Community Survey, 2013 (2009–2013 data)

EXHIBIT 9.5.7 » PERCENTAGE OF RESIDENTS LIVING BELOW THE FEDERAL POVERTY LEVEL, UNITED STATES, SERVICE AREA AND COLUMBUS

Location	Percentage living below the federal poverty level		
	Residents	Elderly Residents	Children Under 18 Years
United States	15.4%	9.4%	21.6%
Ohio	15.8%	8.0%	22.8%
Service area	22.0%	11.8%	28.9%
Inside City	22.4%	11.1%	32.4%
Outside City	11.8%	7.3%	16.6%

Source: U.S. Census Bureau, American Community Survey, 2013, 5-year average estimates.

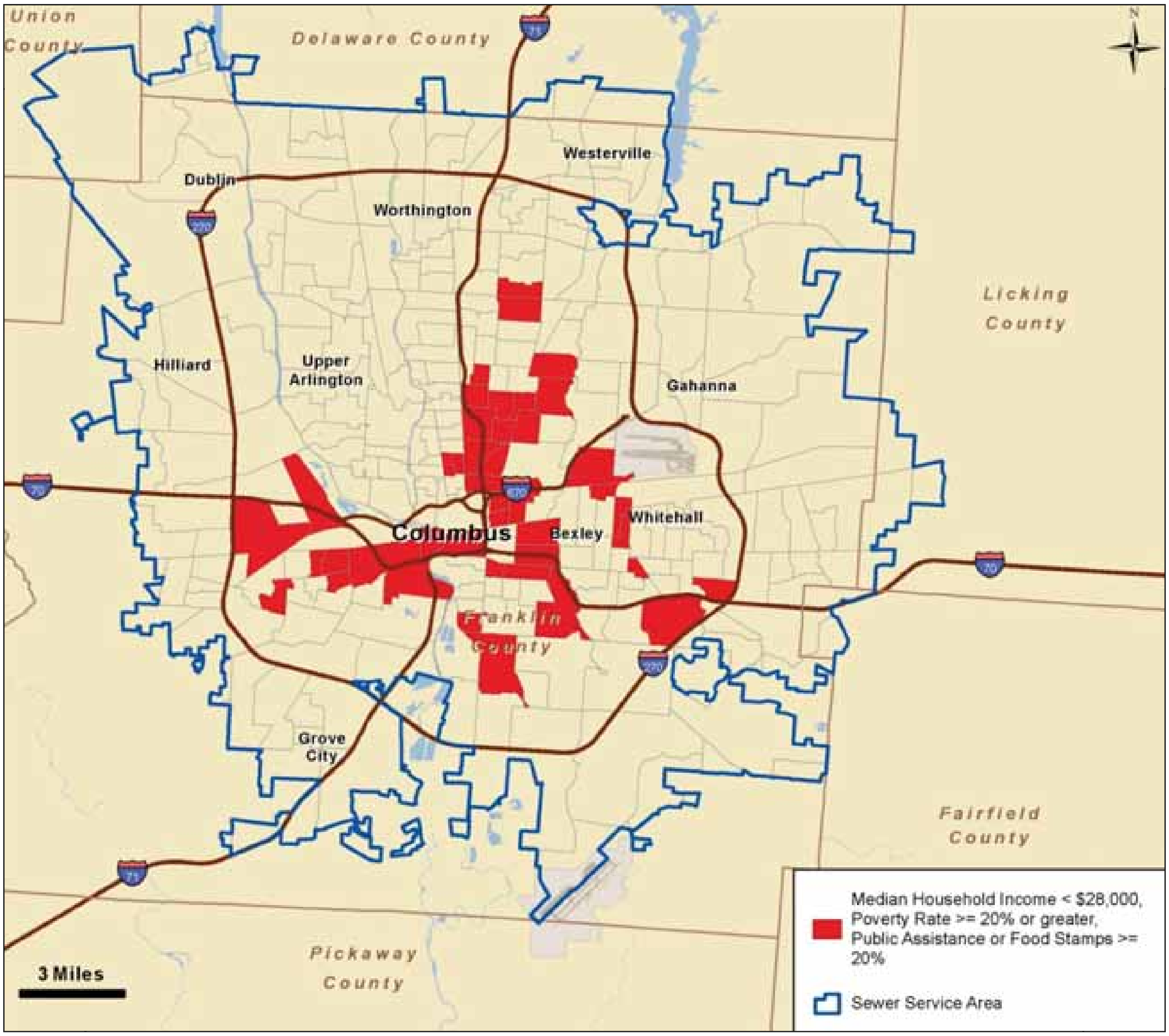
Socioeconomic characteristics vary considerably across the different communities and neighborhoods within the service area served by the city, and between the city and the service area. Based on current data, economic hardship associated with increasing wastewater and stormwater rates will concentrate in several lower-income neighborhoods, mostly located within the city of Columbus. This will compound the affordability issue and may also raise environmental justice issues.

USEPA defines environmental justice as *"…the fair and meaningful involvement of all people regardless of race, color, national origin or income with respect to the development, implementation and enforcement of environmental laws, regulations and policies."* Fair treatment means that no group of people should bear a disproportionate burden, including burden from governmental policies. This involves consideration of how burdens are distributed across populations.

In developing an appropriate compliance schedule, it is therefore critical to evaluate and manage the impact on these vulnerable populations. The Blueprint Columbus program accomplishes environmental goals in ten years less time than required by the current, approved WWMP and does so by carefully ensuring that the economic burden on at-risk populations is limited.

Exhibit 9.5.8 shows census tracts within the service area where affordability issues may be concentrated. These tracts have an MHI of lower than 50% of the MHI for the service area as a whole (i.e., an MHI of lower than $28,000), and a poverty rate of 20% or higher – therefore, the U.S. Census Bureau considers these tracts "poverty areas". In addition, 20% or more of households in these tracts receive food stamps, and/or are in the Supplemental Nutrition Assistance Program (SNAP) and/or receive public assistance income. As shown, almost all of these census tracts are located within the city of Columbus. There are approximately 47,250 households located within these tracts, which account for about 17% of inside-city households. As noted above, households within these tracts are not necessarily paying less for wastewater and stormwater even though they may live in multi-family units or may be facing affordability challenges. Based on city billing data, households located in low-income census tracts inside the city use a relatively large amount of water compared to other income groups.

EXHIBIT 9.5.8 » "AT-RISK" CENSUS TRACTS WITHIN COLUMBUS SERVICE AREA



9.6 Measures of Success

9.6.1 Objectives of Measures

The purpose of defining and tracking measures of success is three-fold. Initially, the selection of the measures of success helps define current economic conditions, define utility financial conditions, and evaluate the program and alternative schedules. The data becomes the "narrative" used to convey the overall picture of current conditions as well as any trends that can be identified. The second purpose of the measures of success is to track conditions over time and provide a mechanism by which the city could either automatically make adjustments to the program schedule or rate of spending, or at least enter into discussions with the Ohio EPA about concerns related to affordability. The third purpose of the measures of success is to provide a means of communicating, tracking and demonstrating a commitment to affordability concepts with community stakeholders.

It is difficult to establish set metrics, and no single metric alone can adequately define "affordability". It is important to evaluate several measures together in order to understand what is causing the metrics to change. The city can then manage the program in a way that is consistent with the principles set forth in the USEPA's integrated planning framework, which at its core is designed to take traditionally segregated regulatory costs of compliance (e.g., wastewater, stormwater, drinking water) and collectively prioritize them based on evaluations of the investment that would be required and the environmental benefit that would be attained.

The city has selected four measures of success. The first two measures focus on customer impact, and the second two focus on the financial health of the utility. All four are measures that the city can track itself, allowing these measures of success to be implemented easily.

9.6.2 Annual Residential Bill as a Percent of Income

This metric is often confused with the USEPA RI, as it is a "percent of income". However, the USEPA RI is calculated as CPH of wastewater utility projects divided by the MHI of the community based on a snapshot in time. As the RI is a snapshot, it doesn't capture the affordability of varying schedules and cannot be compared directly with the annual residential bill as a percent of income. The estimated annual bill as a percent of income is a much more appropriate measure of impact on customers, as it looks at the average annual bill customers will be paying. Because the income growth rate of lower-income households has in recent years been substantially lower than the median, a more appropriate measure is to set a cap based on the upper limit of the LQ. While it is recognized that lower income households will necessarily be more burdened than those at the median, establishing a measure of success based upon the LQ will help protect lower income households from being even more heavily burdened in the event the current trend regarding income divergence continues in the future.

In addition, this measure of success is based on the city's income levels, as opposed to the service area as a whole. A thorough analysis of the demographics for the service area reveals that the most vulnerable populations are concentrated in the city of Columbus. It is therefore appropriate to focus this measure of success on those populations.

Exhibit 9.6.1 presents a summary of FY2015 estimated annual bills by community, compared to various income levels within each community. The average annual volume is based on 2013 billing data, and includes both sanitary sewer and stormwater bills. As shown on the first line of Exhibit 9.6.1, this measure of success is currently calculated at 1.88%.

EXHIBIT 9.6.1 » FY2015 AVERAGE ANNUAL RESIDENTIAL BILL AS PERCENT OF INCOME (COLUMBUS)

Current Average Annual Residential Bill (2015)						
Community	MHI	Average Annual Resid. Volume (CCf/Yr)	Estimated Annual Bill (WW/SW)	(WW/SW) Annual Bill as % of MHI	Lowest Quintile	(WW/SW) Annual Bill as % of LQ
Columbus	$44,590	50.9	$338.10	0.76%	$18,005	1.88%
Bexley	$94,576	53.7	$414.91	0.44%	$37,536	1.11%
Dublin	$114,512	81.3	$506.36	0.44%	$60,515	0.84%
Gahanna	$72,038	53.73	$330.61	0.46%	$35,430	0.93%
Grandview Heights	$86,089	61.7	$363.62	0.42%	$43,669	0.83%
Grove City	$67,078	58.8	$340.59	0.51%	$33,346	1.02%
Groveport	$58,747	55.6	$353.61	0.60%	$27,155	1.30%
Hilliard	$86,051	70.7	$431.22	0.50%	$40,721	1.06%
Marble Cliff	$82,837	56.7	$347.36	0.42%	$32,652	1.06%
Minerva Park	$69,980	56.7	$315.89	0.45%	$35,968	0.88%
New Albany	$187,251	123.3	$595.39	0.32%	$67,679	0.88%
Obetz	$50,364	36.4	$223.90	0.44%	$23,017	0.97%
Reynoldsburg	$58,942	53.73	$367.25	0.62%	$25,962	1.41%
Riverlea	$120,145	64.9	$345.85	0.29%	$53,223	0.65%
Upper Arlington	$98,979	67.3	$452.84	0.46%	$42,652	1.06%
Valleyview	$47,426	45.8	$264.38	0.56%	$27,317	0.97%
Westerville	$83,111	53.73	$421.17	0.51%	$38,947	1.08%
Whitehall	$33,702	38.6	$233.63	0.69%	$16,017	1.46%
Worthington	$87,876	60.9	$333.51	0.38%	$40,551	0.82%

To help offset affordability challenges, the city has established a low-income assistance program for both single-family and multi-family customers. Single-family customers in need of assistance can receive a 20% discount on water and sewer usage (the discount does not apply to fixed charges, including meter reading, late charges, interest or other associated fees). To qualify for the program, households must have an income of lower than 150% of the U.S. Census federal poverty level, or be currently enrolled in a qualifying low-income program (e.g., food stamp benefits, Ohio Medicaid, Low Income Energy Assistance). For households with three and four residents, an income of 150% of the poverty level in 2015 amounts to $28,609 and $36,136 respectively. These levels surpass the upper limit of the LQ in many of the service area communities.

The city also has a low-income assistance program targeted to multi-family and master-meter property owners. Similar to the single-family assistance program, building owners/managers can receive a 20% discount on water/wastewater usage. A property is eligible for the low income discount program if the property owner or manager bills tenants for water/wastewater services (i.e., lease states tenant pays for water/wastewater services) and at least 80% of the units have income levels of 150% (or lower) of the federal poverty level or participate in a qualifying low income program.

Although the city has been proactive in providing meaningful assistance to customers in need, participation in the low-income assistance programs outlined above has been limited. This is partly because many low-income customers are renters and/or live in multi-family units and do not directly receive a water/wastewater bill. Based on 2013 ACS Public Use Microdata data, 47% of service area customers in the lowest income quintile do not receive their water/wastewater bill directly; rather it is included in their monthly rent or condo fee. Thus, affordability challenges remain and will become more pronounced as wastewater and stormwater rates continue to increase.

Based upon the analysis of demographic, socioeconomic and financial data, the city has determined that a cap of 3% of the upper limit of the LQ for the city of Columbus is an appropriate measure of success.

9.6.3 Delinquency Rate

Well-managed utilities regularly monitor delinquency rates and establish policies and procedures for managing delinquent revenues and bad debt. Because the city's program is expected to require significant increases in rates and ultimately customer bills over the completion of the program, a measure of success has been established to monitor delinquencies. While the first measure of success is focused on the most vulnerable populations, tracking delinquency rates will allow the city to make sure the program stays affordable for all customers.

The city evaluated alternative approaches for monitoring delinquencies, and has established a measure of success based upon the number of accounts in past due status (60 and 90+ days past due). By tracking the number of accounts in delinquency status, the city can monitor whether more customers, both residential and non-residential, begin to have difficulty paying increased costs associated with completion of the program.

The city will track the percent of sewer accounts that are more than 60 and 90 days delinquent. Sudden and prolonged increases in the delinquency rate may indicate that rates are becoming unaffordable. In such an event, the city will closely analyze the increased delinquent accounts to determine if an adjustment in future rate increases is warranted.

9.6.4 Adjusted Debt Service Coverage

Debt service coverage is the ratio of cash available for paying principal and interest (debt service) on outstanding debt. This is one of the most important and widely analyzed factors that rating agencies evaluate when rating a utility. As stated by Moody's Investor Service in its Rating Methodology for US Municipal Utility Revenue Debt, issued December 15, 2014:

> *Debt service coverage is a core statistic assessing the financial health of a utility revenue system. The magnitude by which net revenues are sufficient to cover debt service shows a utility's margin to tolerate business risks or declines in demand while still assuring repayment of debt. Higher coverage levels indicate greater flexibility to withstand volatile revenues, unexpected outflows, or customer resistance to higher rates.*

The city primarily issues GO debt for both the wastewater and stormwater utilities, although it has issued revenue bonds for the wastewater utility in the past. In both cases, utility revenues are pledged for repayment of the outstanding debt; however, for the GO debt, bondholders also have the additional security of the bonds being backed by the city's tax revenues.

The city's current policy is to maintain an adjusted debt service coverage of 1.5 times or greater. The city calculates adjusted debt service coverage by dividing all unrestricted revenue (including unrestricted cash reserves), less current year operating expenses (excluding debt service or depreciation), by current year debt service (principal and interest). The city has set a minimum of 1.5 times as the minimum level for this measure of success.

9.6.5 Overall Level of Indebtedness

Capital programs associated with consent orders necessarily require significant investment, with a substantial portion of the program being debt financed. While issuance of debt helps spread the costs of the program over a longer period of time, allowing those benefiting from the improvements to help pay for them, the issuance of substantial debt is a cause of concern for rating agencies, and therefore, the total level of debt outstanding for each utility needs to be managed. As stated by Moody's Investor Service in its Rating Methodology for US Municipal Utility Revenue Debt, issued December 15, 2014:

> *A utility's debt profile determines its leverage and fixed costs. Systems that carry a lot of debt have less ability to reduce costs if demand shrinks, and are generally more challenged to achieve higher debt service coverage. A greater debt burden may also prohibit a utility from funding necessary capital upgrades, if a covenant prevents the issuer from incurring the debt necessary to fund those upgrades.*

Debt service for the wastewater utility currently comprises just over 56% of the utility's total operating budget. The issuance of debt has allowed the city to complete the substantial amount of the work undertaken over the past ten years in a way that has allowed the city to manage the rate shock of previous rate increases, and to allow rates to remain as low as possible. Rating agencies have acknowledged that utilities under consent decrees will require issuance of debt that will be beyond that which is required by most utilities that are not under consent decrees. However, as stated by Moody's in its June 30, 2014 Special Comment "Most US Sewer Utilities Can Weather Costs of Federal EPA Consent Decrees:"

> *Consent decrees usually require additional debt, which can weaken credit in the form of higher debt ratios…, changes in debt structures, or weakened legal provisions protecting bondholders. The combination of higher debt and political resistance to higher rates can sometimes weaken debt service coverage.*

The importance of strong financial policies cannot be understated. In 2014, the city's wastewater debt was down-graded by Fitch due to concerns about debt service coverage levels.

The city's current debt is already very high, contributing well more than half of the wastewater utility's annual budget. The city recognizes that additional debt will need to be incurred in order to continue moving forward with the program; however, in order to help maintain the city's current debt ratings, it is critical for the city to place a cap on how high its debt burden can climb. As such, the city has determined that a cap of 64%, or approximately 8% higher than the current level of indebtedness, is needed to help ensure that the utilities remain in sound financial condition. Even with this measure of success, it will be important for the city to also maintain additional strong financial indicators, including liquidity, debt service coverage and annual rate increases, to demonstrate a strong commitment to maintaining financial strength.

TABLE 9.4.1 » LONG RANGE ANALYSIS OF THE 2030 BLUEPRINT ALTERNATIVE

Blueprint Columbus 2030 - GO Debt, OWDA 50% on Eligible Projects, & Cash Reserves (August 18, 2015)

Description	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Rate Increase (WW)	0.0%	5.0%	6.0%	7.0%	8.0%	8.0%	8.0%	5.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	3.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Cumulative Rate Increase (WW)	0.0%	5.0%	11.3%	19.1%	28.6%	38.9%	50.0%	57.5%	63.8%	70.4%	77.2%	84.3%	91.6%	99.3%	107.3%	113.5%	113.5%	113.5%	113.5%	113.5%	113.5%	113.5%	113.5%	113.5%	113.5%	113.5%	113.5%	113.5%	113.5%	113.5%	113.5%
Rate Increase (SW)	0.0%	1.0%	2.0%	3.0%	5.0%	5.0%	4.0%	2.0%	1.0%	1.0%	1.0%	3.0%	4.0%	4.0%	4.0%	4.0%	3.0%	3.0%	2.0%	3.0%	3.0%	3.0%	3.0%	3.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	1.0%
Cumulative Rate Increase (SW)	0.0%	1.0%	3.0%	6.1%	11.4%	17.0%	21.7%	24.1%	25.3%	26.6%	27.9%	31.7%	37.0%	42.4%	48.1%	54.1%	58.7%	63.4%	66.7%	71.7%	76.9%	82.2%	87.6%	93.3%	97.1%	101.1%	105.1%	109.2%	113.4%	117.7%	119.8%
Total Annual Sewer CIP ($million)	$264	$212	$297	$113	$161	$184	$167	$363	$258	$250	$236	$219	$231	$167	$113	$102	$71	$73	$75	$81	$84	$86	$89	$92	$121	$125	$129	$132	$136	$141	$145
Total Annual Sewer CIP ($million) (2015$)	$264	$206	$280	$104	$143	$159	$140	$295	$204	$191	$176	$158	$162	$114	$75	$65	$44	$44	$44	$46	$46	$46	$46	$46	$60	$60	$60	$60	$60	$60	$60
Cumulative Sewer CIP ($million)	$264	$476	$772	$886	$1,047	$1,231	$1,399	$1,761	$2,019	$2,269	$2,505	$2,724	$2,955	$3,123	$3,236	$3,338	$3,409	$3,482	$3,557	$3,639	$3,722	$3,809	$3,897	$3,989	$4,110	$4,235	$4,364	$4,496	$4,633	$4,773	$4,918
Cumul. Sewer CIP ($million) (2015 $)	$264	$470	$750	$854	$997	$1,156	$1,296	$1,591	$1,795	$1,986	$2,162	$2,320	$2,482	$2,596	$2,671	$2,736	$2,780	$2,824	$2,868	$2,914	$2,960	$3,006	$3,052	$3,098	$3,158	$3,218	$3,278	$3,338	$3,398	$3,458	$3,518
Capital Financing																															
OWDA ($million)	$175	$96	$137	$49	$74	$81	$77	$176	$107	$112	$110	$100	$85	$49	$22	$18	$35	$36	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
GO Bonds ($million)	$0	$205	$160	$65	$87	$103	$90	$187	$151	$138	$126	$119	$141	$113	$91	$84	$36	$37	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Cash ($million)	$89	($89)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$5	$5	$0	$0	$0	$0	$75	$81	$84	$86	$89	$92	$121	$125	$129	$133	$137	$141	$145
Debt Service Coverage (Adjusted)	2.32	1.58	2.05	1.88	1.73	1.64	1.64	1.70	1.70	1.69	1.57	1.58	1.61	1.59	1.53	1.53	1.56	1.57	2.05	2.12	2.39	2.64	2.88	3.32	4.00	4.64	5.31	6.19	7.26	8.94	11.67
Debt Service Coverage (Annual)	0.93	0.91	0.95	0.93	0.94	0.97	1.03	1.08	1.06	1.03	0.97	1.01	1.04	1.04	1.00	1.02	1.02	1.02	1.31	1.33	1.47	1.54	1.57	1.70	1.90	2.06	2.20	2.38	2.58	2.95	3.54
Reserve (Days) All Funds	360	584	539	486	436	403	403	442	461	467	429	424	427	429	416	414	418	415	424	426	466	515	561	623	666	719	773	829	885	948	1,017
Operating Fund ($million)	$3	$75	$63	$47	$31	$21	$24	$39	$48	$53	$38	$37	$40	$42	$38	$38	$42	$42	$49	$52	$78	$112	$146	$193	$230	$276	$326	$381	$440	$507	$585
Reserve, Replacement, and Rev. Bond DS Funds ($million)	$111	$114	$118	$121	$125	$129	$133	$137	$141	$145	$149	$154	$158	$163	$168	$173	$178	$183	$189	$195	$200	$206	$213	$219	$226	$232	$239	$247	$254	$262	$269
Debt Service as % of Total Budget	56.2%	56.9%	57.1%	58.7%	60.4%	61.4%	61.4%	61.6%	62.7%	63.7%	65.7%	65.1%	64.9%	65.4%	66.7%	66.5%	65.6%	65.0%	58.0%	56.8%	53.2%	51.1%	49.6%	46.5%	42.8%	39.6%	37.1%	34.2%	31.3%	27.5%	23.1%
Annual WW & SW Resid. Bill as % of MHI (Service Area)	0.60%	0.62%	0.64%	0.67%	0.71%	0.76%	0.80%	0.83%	0.85%	0.86%	0.88%	0.91%	0.93%	0.95%	0.98%	1.00%	0.99%	0.98%	0.97%	0.96%	0.95%	0.94%	0.93%	0.92%	0.91%	0.90%	0.89%	0.88%	0.87%	0.87%	0.86%
Annual WW & SW Resid. Bill as % of LQ Household Income (Service Area)	1.25%	1.29%	1.34%	1.40%	1.49%	1.58%	1.67%	1.73%	1.77%	1.80%	1.84%	1.89%	1.94%	1.99%	2.04%	2.08%	2.06%	2.04%	2.01%	2.00%	1.98%	1.96%	1.94%	1.92%	1.90%	1.88%	1.86%	1.84%	1.82%	1.81%	1.78%
Annual WW & SW Resid. Bill as % of MHI (City)	0.76%	0.78%	0.81%	0.85%	0.90%	0.96%	1.02%	1.05%	1.07%	1.10%	1.12%	1.15%	1.18%	1.21%	1.24%	1.26%	1.25%	1.24%	1.22%	1.21%	1.20%	1.19%	1.18%	1.17%	1.16%	1.14%	1.13%	1.12%	1.11%	1.10%	1.08%
Annual WW & SW Resid. Bill as % of LQ Household Income (City)	1.88%	1.93%	2.01%	2.11%	2.24%	2.37%	2.52%	2.60%	2.65%	2.71%	2.77%	2.84%	2.92%	2.99%	3.07%	3.12%	3.09%	3.06%	3.03%	3.00%	2.97%	2.95%	2.92%	2.89%	2.86%	2.83%	2.80%	2.77%	2.74%	2.72%	2.68%

TABLE 9.4.2 » LONG RANGE ANALYSIS OF THE 2035 BLUEPRINT ALTERNATIVE

Blueprint Columbus 2035 - GO Debt, OWDA 50% on Eligible Projects, & Cash Reserves (August 18, 2015)

Description	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Rate Increase (WW)	0.0%	5.0%	6.0%	7.0%	8.0%	8.0%	8.0%	5.0%	2.0%	3.0%	3.0%	2.0%	2.0%	3.0%	3.0%	3.0%	2.0%	3.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Cumulative Rate Increase (WW)	0.0%	5.0%	11.3%	19.1%	28.6%	38.9%	50.0%	57.5%	60.7%	65.5%	70.5%	73.9%	77.3%	82.7%	88.1%	93.8%	97.7%	103.6%	103.6%	103.6%	103.6%	103.6%	103.6%	103.6%	103.6%	103.6%	103.6%	103.6%	103.6%	103.6%	103.6%
Rate Increase (SW)	0.0%	1.0%	2.0%	3.0%	4.5%	4.5%	4.5%	1.0%	1.0%	1.0%	1.0%	2.0%	2.0%	3.0%	3.0%	3.0%	4.0%	4.0%	4.0%	4.0%	4.0%	3.0%	3.0%	3.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Cumulative Rate Increase (SW)	0.0%	1.0%	3.0%	6.1%	10.9%	15.9%	21.1%	22.3%	23.5%	24.8%	26.0%	28.5%	31.1%	35.0%	39.1%	43.3%	49.0%	54.9%	61.1%	67.6%	74.3%	79.5%	84.9%	90.5%	94.3%	98.1%	102.1%	106.2%	110.3%	114.5%	118.8%
Total Annual Sewer CIP ($million)	$264	$212	$285	$123	$160	$165	$148	$302	$172	$137	$147	$156	$153	$150	$153	$208	$182	$201	$222	$161	$166	$86	$89	$92	$121	$125	$129	$132	$136	$141	$145
Total Annual Sewer CIP ($million) (2015$)	$264	$206	$269	$112	$142	$143	$124	$246	$136	$105	$110	$113	$107	$102	$101	$134	$114	$122	$130	$92	$92	$46	$46	$46	$60	$60	$60	$60	$60	$60	$60
Cumulative Sewer CIP ($million)	$264	$476	$761	$884	$1,044	$1,209	$1,357	$1,659	$1,831	$1,967	$2,115	$2,271	$2,424	$2,574	$2,726	$2,935	$3,117	$3,318	$3,540	$3,701	$3,867	$3,953	$4,042	$4,134	$4,255	$4,380	$4,508	$4,641	$4,777	$4,918	$5,063
Cumul. Sewer CIP ($million) (2015 $)	$264	$470	$739	$851	$993	$1,136	$1,260	$1,506	$1,642	$1,747	$1,857	$1,970	$2,077	$2,179	$2,280	$2,414	$2,528	$2,650	$2,780	$2,872	$2,964	$3,010	$3,056	$3,102	$3,162	$3,222	$3,282	$3,342	$3,402	$3,462	$3,522
Capital Financing																															
OWDA ($million)	$175	$96	$131	$54	$73	$71	$67	$146	$71	$63	$66	$72	$71	$67	$61	$65	$86	$95	$80	$47	$49	$6	$24	$7	$16	$10	$4	$3	$2	$0	$0
GO Bonds ($million)	$0	$205	$154	$69	$87	$94	$81	$156	$101	$74	$81	$84	$82	$83	$92	$143	$96	$106	$62	$49	$37	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Cash ($million)	$89	($89)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$80	$65	$80	$80	$75	$85	$105	$115	$125	$130	$135	$141	$145
Debt Service Coverage (Adjusted)	2.32	1.58	2.05	1.88	1.74	1.65	1.65	1.72	1.72	1.70	1.60	1.62	1.66	1.68	1.62	1.61	1.63	1.63	2.13	2.07	2.24	2.27	2.29	2.46	2.75	2.99	3.21	3.45	3.73	4.18	4.79
Debt Service Coverage (Annual)	0.93	0.91	0.95	0.93	0.94	0.97	1.03	1.09	1.05	1.02	0.97	1.01	1.04	1.04	1.00	1.01	1.03	1.03	1.32	1.27	1.36	1.35	1.34	1.41	1.55	1.65	1.73	1.83	1.93	2.11	2.34
Reserve (Days) All Funds	360	584	539	486	437	407	407	450	464	463	427	421	431	440	424	416	420	423	413	414	414	410	410	412	412	412	408	407	407	411	422
Operating Fund ($million)	$3	$75	$63	$47	$32	$22	$25	$42	$49	$51	$37	$36	$42	$48	$41	$39	$43	$46	$43	$45	$47	$48	$50	$54	$56	$59	$59	$61	$65	$72	$85
Reserve, Replacement, and Rev. Bond DS Funds ($million)	$111	$114	$118	$121	$125	$129	$133	$137	$141	$145	$149	$154	$158	$163	$168	$173	$178	$183	$189	$195	$200	$206	$213	$219	$226	$232	$239	$247	$254	$262	$269
Debt Service as % of Total Budget	56.2%	56.9%	57.1%	58.7%	60.3%	61.4%	61.3%	61.4%	62.3%	62.9%	64.4%	63.2%	62.4%	62.5%	63.6%	63.5%	62.9%	63.0%	56.2%	56.0%	53.4%	52.5%	51.6%	49.1%	45.7%	43.0%	40.6%	38.1%	35.6%	32.5%	29.1%
Annual WW & SW Resid. Bill as % of MHI (Service Area)	0.60%	0.62%	0.64%	0.67%	0.71%	0.76%	0.80%	0.83%	0.83%	0.84%	0.85%	0.86%	0.86%	0.88%	0.89%	0.91%	0.91%	0.93%	0.92%	0.91%	0.91%	0.90%	0.89%	0.88%	0.87%	0.86%	0.86%	0.85%	0.84%	0.83%	0.82%
Annual WW & SW Resid. Bill as % of LQ Household Income (Service Area)	1.25%	1.29%	1.34%	1.40%	1.49%	1.58%	1.67%	1.72%	1.73%	1.76%	1.78%	1.79%	1.80%	1.83%	1.86%	1.89%	1.91%	1.94%	1.92%	1.91%	1.89%	1.88%	1.86%	1.84%	1.82%	1.80%	1.79%	1.77%	1.75%	1.73%	1.71%
Annual WW & SW Resid. Bill as % of MHI (City)	0.76%	0.78%	0.81%	0.85%	0.90%	0.96%	1.02%	1.05%	1.05%	1.07%	1.08%	1.09%	1.09%	1.11%	1.13%	1.15%	1.16%	1.18%	1.17%	1.16%	1.15%	1.14%	1.13%	1.12%	1.11%	1.10%	1.08%	1.07%	1.06%	1.05%	1.04%
Annual WW & SW Resid. Bill as % of LQ Household Income (City)	1.88%	1.93%	2.01%	2.11%	2.24%	2.37%	2.52%	2.59%	2.61%	2.64%	2.68%	2.69%	2.71%	2.75%	2.80%	2.84%	2.87%	2.92%	2.89%	2.87%	2.85%	2.82%	2.80%	2.77%	2.74%	2.71%	2.69%	2.66%	2.63%	2.60%	2.58%

TABLE 9.4.3 » LONG RANGE ANALYSIS OF THE 2040 BLUEPRINT ALTERNATIVE

Blueprint Columbus 2040 - GO Debt, OWDA 50% on Eligible Projects, & Cash Reserves (August 18, 2015)

Description	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Rate Increase (WW)	0.0%	5.0%	6.0%	7.0%	8.0%	8.0%	7.0%	5.0%	5.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	1.0%	1.0%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Cumulative Rate Increase (WW)	0.0%	5.0%	11.3%	19.1%	28.6%	38.9%	48.6%	56.1%	63.9%	67.1%	70.5%	73.9%	77.4%	80.9%	84.5%	86.4%	88.2%	90.1%	90.1%	90.1%	90.1%	90.1%	90.1%	90.1%	90.1%	90.1%	90.1%	90.1%	90.1%	90.1%	90.1%
Rate Increase (SW)	0.0%	1.0%	2.0%	3.0%	4.5%	4.5%	4.5%	1.0%	1.0%	1.0%	1.0%	0.0%	1.0%	3.0%	3.0%	4.0%	4.0%	4.0%	4.0%	4.0%	3.0%	3.0%	3.0%	2.0%	2.0%	3.0%	3.0%	3.0%	3.0%	2.0%	2.0%
Cumulative Rate Increase (SW)	0.0%	1.0%	3.0%	6.1%	10.9%	15.9%	21.1%	22.3%	23.5%	24.8%	26.0%	26.0%	27.3%	31.1%	35.0%	40.4%	46.0%	51.9%	58.0%	64.3%	69.2%	74.3%	79.5%	83.1%	86.8%	92.4%	98.1%	104.1%	110.2%	114.4%	118.7%
Total Annual Sewer CIP ($million)	$264	$212	$285	$123	$153	$161	$151	$277	$147	$122	$118	$146	$133	$91	$114	$186	$167	$152	$177	$193	$201	$186	$149	$186	$206	$198	$129	$132	$136	$141	$145
Total Annual Sewer CIP ($million) (2015$)	$264	$206	$269	$112	$136	$139	$127	$225	$116	$94	$88	$105	$93	$62	$75	$120	$104	$92	$104	$110	$111	$100	$78	$94	$101	$95	$60	$60	$60	$60	$60
Cumulative Sewer CIP ($million)	$264	$476	$761	$884	$1,036	$1,197	$1,349	$1,625	$1,773	$1,895	$2,013	$2,159	$2,291	$2,382	$2,496	$2,683	$2,849	$3,001	$3,179	$3,372	$3,573	$3,759	$3,908	$4,094	$4,300	$4,498	$4,627	$4,759	$4,896	$5,036	$5,181
Cumul. Sewer CIP ($million) (2015 $)	$264	$470	$739	$851	$987	$1,126	$1,253	$1,478	$1,594	$1,688	$1,776	$1,881	$1,974	$2,036	$2,111	$2,231	$2,335	$2,427	$2,531	$2,641	$2,752	$2,852	$2,930	$3,024	$3,125	$3,220	$3,280	$3,340	$3,400	$3,460	$3,520
Capital Financing																															
OWDA ($million)	$175	$96	$131	$54	$70	$69	$69	$133	$59	$56	$52	$67	$61	$38	$50	$64	$83	$76	$88	$85	$87	$86	$67	$55	$63	$59	$49	$58	$65	$51	$60
GO Bonds ($million)	$0	$205	$154	$69	$83	$92	$82	$144	$78	$61	$61	$74	$62	$38	$64	$122	$84	$76	$20	$48	$34	$25	$12	$61	$63	$59	$0	$0	$0	$0	$0
Cash ($million)	$89	($89)	$0	$0	$0	$0	$0	$0	$10	$5	$5	$5	$10	$15	$0	$0	$0	$0	$70	$60	$80	$75	$70	$70	$80	$80	$80	$75	$72	$90	$85
Debt Service Coverage (Adjusted)	2.32	1.58	2.05	1.88	1.74	1.65	1.65	1.71	1.73	1.71	1.62	1.66	1.72	1.73	1.65	1.66	1.69	1.67	2.21	2.19	2.42	2.44	2.41	2.52	2.70	2.79	2.83	2.90	3.04	3.31	3.50
Debt Service Coverage (Annual)	0.93	0.91	0.95	0.93	0.94	0.97	1.02	1.08	1.08	1.05	0.99	1.04	1.08	1.07	1.02	1.02	1.03	1.01	1.32	1.29	1.40	1.39	1.34	1.39	1.45	1.46	1.45	1.46	1.49	1.56	1.62
Reserve (Days) All Funds	360	584	539	486	437	407	402	438	445	451	417	419	428	424	422	419	424	415	411	413	411	411	406	409	407	406	400	400	406	395	396
Operating Fund ($million)	$3	$75	$63	$47	$32	$22	$23	$37	$42	$46	$33	$35	$40	$40	$41	$41	$45	$42	$42	$45	$45	$48	$47	$51	$53	$55	$53	$56	$64	$59	$63
Reserve, Replacement, and Rev. Bond DS Funds ($million)	$111	$114	$118	$121	$125	$129	$133	$137	$141	$145	$149	$154	$158	$163	$168	$173	$178	$183	$189	$195	$200	$206	$213	$219	$226	$232	$239	$247	$254	$262	$269
Debt Service as % of Total Budget	56.2%	56.9%	57.1%	58.7%	60.3%	61.3%	61.3%	61.3%	62.2%	62.7%	64.0%	62.5%	61.6%	61.5%	62.5%	62.0%	61.1%	61.1%	53.5%	53.0%	49.9%	49.1%	48.7%	46.8%	44.5%	43.0%	41.9%	40.5%	38.6%	36.2%	34.0%
Annual WW & SW Resid. Bill as % of MHI (Service Area)	0.60%	0.62%	0.64%	0.67%	0.71%	0.76%	0.80%	0.82%	0.84%	0.85%	0.85%	0.86%	0.86%	0.87%	0.87%	0.87%	0.87%	0.87%	0.87%	0.86%	0.85%	0.84%	0.84%	0.83%	0.82%	0.81%	0.81%	0.80%	0.79%	0.78%	0.78%
Annual WW & SW Resid. Bill as % of LQ Household Income (Service Area)	1.25%	1.29%	1.34%	1.40%	1.49%	1.58%	1.66%	1.71%	1.76%	1.77%	1.78%	1.79%	1.80%	1.81%	1.82%	1.82%	1.82%	1.82%	1.81%	1.79%	1.78%	1.76%	1.75%	1.73%	1.71%	1.70%	1.68%	1.67%	1.65%	1.64%	1.62%
Annual WW & SW Resid. Bill as % of MHI (City)	0.76%	0.78%	0.81%	0.85%	0.90%	0.96%	1.01%	1.04%	1.07%	1.08%	1.08%	1.09%	1.09%	1.10%	1.11%	1.11%	1.11%	1.11%	1.10%	1.09%	1.08%	1.07%	1.06%	1.05%	1.04%	1.03%	1.02%	1.01%	1.00%	0.99%	0.98%
Annual WW & SW Resid. Bill as % of LQ Household Income (City)	1.88%	1.93%	2.01%	2.11%	2.24%	2.37%	2.50%	2.57%	2.65%	2.66%	2.68%	2.69%	2.70%	2.72%	2.74%	2.74%	2.74%	2.74%	2.72%	2.70%	2.67%	2.65%	2.63%	2.60%	2.57%	2.55%	2.53%	2.51%	2.49%	2.46%	2.44%

TABLE 9.4.4 » LONG RANGE ANALYSIS OF THE 2045 BLUEPRINT ALTERNATIVE

Blueprint Columbus 2045 - GO Debt, OWDA 50% on Eligible Projects, & Cash Reserves (August 18, 2015)

Description	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Rate Increase (WW)	0.0%	5.0%	6.0%	7.0%	8.0%	8.0%	8.0%	2.0%	2.0%	2.0%	4.0%	1.0%	2.0%	2.0%	2.0%	2.0%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Cumulative Rate Increase (WW)	0.0%	5.0%	11.3%	19.1%	28.6%	38.9%	50.0%	53.0%	56.1%	59.2%	65.6%	67.2%	70.6%	74.0%	77.5%	81.0%	82.8%	82.8%	82.8%	82.8%	82.8%	82.8%	82.8%	82.8%	82.8%	82.8%	82.8%	82.8%	82.8%	82.8%	82.8%
Rate Increase (SW)	0.0%	1.0%	2.0%	3.0%	4.5%	4.5%	4.5%	1.0%	1.0%	1.0%	1.0%	0.0%	1.0%	2.0%	2.0%	3.0%	3.0%	3.0%	4.0%	4.0%	4.0%	4.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	2.0%	2.0%	2.0%
Cumulative Rate Increase (SW)	0.0%	1.0%	3.0%	6.1%	10.9%	15.9%	21.1%	22.3%	23.5%	24.8%	26.0%	26.0%	27.3%	29.8%	32.4%	36.4%	40.5%	44.7%	50.5%	56.5%	62.8%	69.3%	74.3%	79.6%	85.0%	90.5%	96.2%	102.1%	106.2%	110.3%	114.5%
Total Annual Sewer CIP ($million)	$264	$212	$274	$113	$165	$137	$58	$247	$164	$122	$118	$104	$87	$122	$83	$198	$133	$153	$123	$217	$184	$177	$193	$229	$250	$264	$182	$245	$204	$168	$169
Total Annual Sewer CIP ($million) (2015$)	$264	$206	$259	$104	$146	$118	$49	$201	$130	$94	$88	$75	$61	$83	$55	$127	$83	$92	$72	$124	$102	$95	$101	$116	$123	$126	$84	$110	$89	$71	$70
Cumulative Sewer CIP ($million)	$264	$476	$750	$864	$1,028	$1,165	$1,223	$1,470	$1,634	$1,757	$1,875	$1,979	$2,067	$2,189	$2,272	$2,470	$2,603	$2,756	$2,879	$3,095	$3,279	$3,457	$3,650	$3,878	$4,128	$4,392	$4,574	$4,819	$5,023	$5,191	$5,360
Cumul. Sewer CIP ($million) (2015 $)	$264	$470	$729	$833	$979	$1,097	$1,146	$1,347	$1,477	$1,571	$1,659	$1,734	$1,795	$1,878	$1,933	$2,060	$2,143	$2,235	$2,307	$2,431	$2,533	$2,628	$2,729	$2,845	$2,968	$3,094	$3,178	$3,288	$3,377	$3,448	$3,518
Capital Financing																															
OWDA ($million)	$175	$96	$126	$49	$75	$57	$22	$119	$67	$56	$52	$47	$39	$53	$34	$69	$66	$76	$58	$97	$80	$87	$95	$82	$91	$96	$81	$113	$92	$74	$75
GO Bonds ($million)	$0	$205	$148	$65	$90	$80	$36	$128	$97	$67	$66	$57	$48	$69	$49	$129	$67	$77	$0	$60	$29	$20	$33	$77	$84	$98	$41	$82	$72	$59	$64
Cash ($million)	$89	($89)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$65	$60	$75	$70	$65	$70	$75	$70	$60	$50	$40	$35	$30
Debt Service Coverage (Adjusted)	2.32	1.58	2.05	1.89	1.74	1.66	1.68	1.74	1.74	1.73	1.64	1.68	1.74	1.77	1.71	1.72	1.74	1.71	2.27	2.26	2.50	2.54	2.51	2.63	2.78	2.79	2.74	2.72	2.69	2.69	2.70
Debt Service Coverage (Annual)	0.93	0.91	0.95	0.93	0.94	0.98	1.04	1.07	1.04	1.02	0.98	1.02	1.05	1.05	1.00	1.01	1.03	0.99	1.32	1.29	1.41	1.41	1.36	1.40	1.44	1.42	1.36	1.32	1.26	1.22	1.19
Reserve (Days) All Funds	360	584	539	487	440	412	418	449	458	458	431	429	445	460	446	439	439	420	415	410	410	414	412	408	405	401	399	401	401	398	393
Operating Fund ($million)	$3	$75	$63	$48	$33	$24	$30	$42	$47	$49	$39	$39	$48	$57	$52	$51	$53	$45	$44	$43	$45	$50	$50	$51	$51	$51	$52	$56	$60	$61	$60
Reserve, Replacement, and Rev. Bond DS Funds ($million)	$111	$114	$118	$121	$125	$129	$133	$137	$141	$145	$149	$154	$158	$163	$168	$173	$178	$183	$189	$195	$200	$206	$213	$219	$226	$232	$239	$247	$254	$262	$269
Debt Service as % of Total Budget	56.2%	56.9%	57.1%	58.6%	60.2%	61.2%	61.1%	61.0%	61.4%	61.6%	63.1%	61.7%	60.7%	60.5%	61.5%	61.0%	60.2%	60.1%	52.1%	51.4%	48.1%	47.0%	46.8%	44.9%	42.9%	42.0%	41.7%	41.0%	40.7%	40.0%	39.2%
Annual WW & SW Resid. Bill as % of MHI (Service Area)	0.60%	0.62%	0.64%	0.67%	0.71%	0.76%	0.80%	0.81%	0.81%	0.81%	0.83%	0.83%	0.83%	0.84%	0.84%	0.85%	0.85%	0.84%	0.83%	0.83%	0.82%	0.81%	0.81%	0.80%	0.79%	0.78%	0.78%	0.77%	0.76%	0.76%	0.75%
Annual WW & SW Resid. Bill as % of LQ Household Income (Service Area)	1.25%	1.29%	1.34%	1.40%	1.49%	1.58%	1.67%	1.68%	1.69%	1.70%	1.74%	1.73%	1.74%	1.75%	1.76%	1.77%	1.77%	1.75%	1.74%	1.72%	1.71%	1.70%	1.68%	1.67%	1.65%	1.64%	1.62%	1.61%	1.59%	1.58%	1.56%
Annual WW & SW Resid. Bill as % of MHI (City)	0.76%	0.78%	0.81%	0.85%	0.90%	0.96%	1.02%	1.02%	1.03%	1.03%	1.05%	1.05%	1.05%	1.06%	1.07%	1.08%	1.07%	1.06%	1.06%	1.05%	1.04%	1.03%	1.02%	1.01%	1.00%	0.99%	0.99%	0.98%	0.97%	0.96%	0.95%
Annual WW & SW Resid. Bill as % of LQ Household Income (City)	1.88%	1.93%	2.01%	2.11%	2.24%	2.37%	2.52%	2.53%	2.54%	2.55%	2.61%	2.60%	2.61%	2.63%	2.64%	2.66%	2.66%	2.63%	2.61%	2.59%	2.57%	2.55%	2.53%	2.51%	2.49%	2.46%	2.44%	2.42%	2.40%	2.37%	2.35%

TABLE 9.4.5 » LONG RANGE ANALYSIS OF THE 2030 GRAY ALTERNATIVE

Gray Alternative 2030 - GO Debt, OWDA 50% on Eligible Projects, & Cash Reserves (August 18, 2015)

Description	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Rate Increase (WW)	0.0%	5.0%	6.0%	7.0%	8.0%	8.0%	8.0%	3.0%	4.0%	4.0%	4.0%	4.0%	3.0%	3.0%	3.0%	3.0%	2.0%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Cumulative Rate Increase (WW)	0.0%	5.0%	11.3%	19.1%	28.6%	38.9%	50.0%	54.5%	60.7%	67.1%	73.8%	80.8%	86.2%	91.8%	97.5%	103.5%	107.5%	109.6%	109.6%	109.6%	109.6%	109.6%	109.6%	109.6%	109.6%	109.6%	109.6%	109.6%	109.6%	109.6%	109.6%
Rate Increase (SW)	0.0%	1.0%	2.0%	2.0%	3.0%	3.0%	4.0%	3.0%	0.0%	0.0%	0.0%	1.0%	1.0%	1.0%	2.0%	2.0%	3.0%	3.0%	4.0%	4.0%	4.0%	3.0%	3.0%	1.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Cumulative Rate Increase (SW)	0.0%	1.0%	3.0%	5.1%	8.2%	11.5%	15.9%	19.4%	19.4%	19.4%	19.4%	20.6%	21.8%	23.0%	25.5%	28.0%	31.8%	35.8%	41.2%	46.9%	52.8%	57.3%	62.1%	63.7%	67.0%	70.3%	73.7%	77.2%	80.7%	84.3%	88.0%
Total Annual Sewer CIP ($million)	$264	$204	$277	$122	$163	$136	$187	$260	$399	$55	$63	$262	$434	$174	$96	$141	$80	$82	$85	$91	$94	$97	$100	$103	$133	$137	$141	$145	$149	$154	$158
Total Annual Sewer CIP ($million) (2015$)	$264	$198	$261	$111	$145	$118	$156	$211	$315	$42	$47	$189	$305	$119	$63	$91	$50	$50	$50	$52	$52	$52	$52	$52	$65	$65	$65	$65	$65	$65	$65
Cumulative Sewer CIP ($million)	$264	$468	$745	$866	$1,029	$1,165	$1,352	$1,612	$2,011	$2,066	$2,129	$2,391	$2,825	$2,999	$3,095	$3,236	$3,316	$3,399	$3,483	$3,575	$3,668	$3,765	$3,865	$3,967	$4,100	$4,237	$4,377	$4,522	$4,671	$4,825	$4,984
Cumul. Sewer CIP ($million) (2015 $)	$264	$462	$723	$834	$979	$1,097	$1,253	$1,464	$1,779	$1,821	$1,868	$2,057	$2,362	$2,481	$2,544	$2,635	$2,685	$2,735	$2,785	$2,837	$2,889	$2,941	$2,993	$3,045	$3,110	$3,175	$3,240	$3,305	$3,370	$3,435	$3,500
Capital Financing																															
OWDA ($million)	$175	$92	$127	$53	$75	$57	$86	$125	$185	$15	$16	$122	$208	$53	$14	$14	$40	$41	$15	$16	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
GO Bonds ($million)	$0	$201	$150	$69	$88	$79	$101	$135	$214	$40	$47	$140	$226	$121	$82	$127	$40	$41	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Cash ($million)	$89	($89)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$70	$75	$94	$97	$100	$103	$133	$137	$141	$145	$149	$154	$158
Debt Service Coverage (Adjusted)	2.32	1.58	2.06	1.89	1.75	1.67	1.68	1.73	1.74	1.71	1.61	1.63	1.72	1.75	1.66	1.58	1.58	1.57	2.03	2.09	2.35	2.51	2.64	2.94	3.44	3.87	4.31	4.87	5.56	6.57	8.40
Debt Service Coverage (Annual)	0.93	0.91	0.95	0.93	0.94	0.98	1.04	1.07	1.05	1.03	0.97	1.03	1.08	1.07	0.99	0.97	0.99	1.00	1.29	1.30	1.44	1.50	1.52	1.64	1.82	1.98	2.10	2.25	2.43	2.70	3.23
Reserve (Days) All Funds	360	584	540	488	442	415	420	452	470	471	439	442	479	506	482	444	426	410	417	417	427	444	458	489	502	526	552	580	610	644	687
Operating Fund ($million)	$3	$75	$63	$48	$34	$25	$30	$43	$52	$54	$42	$45	$64	$79	$70	$54	$46	$39	$45	$47	$55	$68	$80	$105	$118	$139	$164	$193	$224	$261	$308
Reserve, Replacement, and Rev. Bond DS Funds ($million)	$111	$114	$118	$121	$125	$129	$133	$137	$141	$145	$149	$154	$158	$163	$168	$173	$178	$183	$189	$195	$200	$206	$213	$219	$226	$232	$239	$247	$254	$262	$269
Debt Service as % of Total Budget	56.2%	56.9%	57.0%	58.6%	60.2%	61.2%	61.1%	61.2%	62.1%	63.2%	64.9%	64.1%	63.1%	63.5%	65.5%	66.0%	65.3%	64.7%	57.7%	56.5%	53.0%	51.0%	49.6%	46.6%	43.0%	39.9%	37.3%	34.6%	31.8%	28.5%	24.0%
Annual WW & SW Resid. Bill as % of MHI (Service Area)	0.60%	0.62%	0.64%	0.67%	0.71%	0.75%	0.80%	0.81%	0.83%	0.84%	0.86%	0.88%	0.89%	0.91%	0.92%	0.93%	0.94%	0.94%	0.93%	0.92%	0.91%	0.91%	0.90%	0.89%	0.88%	0.87%	0.86%	0.85%	0.84%	0.83%	0.82%
Annual WW & SW Resid. Bill as % of LQ Household Income (Service Area)	1.25%	1.29%	1.34%	1.40%	1.48%	1.57%	1.66%	1.69%	1.72%	1.76%	1.80%	1.84%	1.86%	1.89%	1.92%	1.95%	1.96%	1.96%	1.94%	1.92%	1.91%	1.89%	1.87%	1.85%	1.83%	1.81%	1.79%	1.77%	1.75%	1.73%	1.71%
Annual WW & SW Resid. Bill as % of MHI (City)	0.76%	0.78%	0.81%	0.85%	0.90%	0.95%	1.01%	1.03%	1.05%	1.07%	1.09%	1.12%	1.13%	1.15%	1.17%	1.18%	1.19%	1.19%	1.18%	1.17%	1.16%	1.15%	1.14%	1.12%	1.11%	1.10%	1.09%	1.08%	1.06%	1.05%	1.04%
Annual WW & SW Resid. Bill as % of LQ Household Income (City)	1.88%	1.93%	2.01%	2.11%	2.23%	2.36%	2.50%	2.54%	2.59%	2.65%	2.71%	2.77%	2.81%	2.84%	2.89%	2.93%	2.95%	2.95%	2.92%	2.90%	2.87%	2.84%	2.81%	2.78%	2.75%	2.72%	2.69%	2.66%	2.63%	2.61%	2.58%

TABLE 9.4.6 » LONG RANGE ANALYSIS OF THE 2035 GRAY ALTERNATIVE

Gray Alternative 2035 - GO Debt, OWDA 50% on Eligible Projects, & Cash Reserves (August 18, 2015)

Description	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Rate Increase (WW)	0.0%	5.0%	6.0%	7.0%	7.0%	7.0%	7.0%	3.0%	3.0%	3.0%	4.0%	3.0%	2.0%	3.0%	3.0%	3.0%	3.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Cumulative Rate Increase (WW)	0.0%	5.0%	11.3%	19.1%	27.4%	36.3%	45.9%	50.3%	54.8%	59.4%	65.8%	70.8%	74.2%	79.4%	84.8%	90.3%	96.0%	96.0%	96.0%	96.0%	96.0%	96.0%	96.0%	96.0%	96.0%	96.0%	96.0%	96.0%	96.0%	96.0%	96.0%
Rate Increase (SW)	0.0%	1.0%	2.0%	2.0%	3.0%	3.0%	3.0%	3.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	4.0%	4.0%	3.0%	3.0%	2.0%	2.0%	2.0%	1.0%	1.0%	1.0%
Cumulative Rate Increase (SW)	0.0%	1.0%	3.0%	5.1%	8.2%	11.5%	14.8%	18.3%	18.3%	18.3%	18.3%	18.3%	18.3%	19.5%	23.0%	26.7%	30.5%	34.4%	38.5%	42.6%	46.9%	52.8%	58.9%	63.7%	68.6%	71.9%	75.4%	78.9%	80.7%	82.5%	84.3%
Total Annual Sewer CIP ($million)	$264	$168	$240	$122	$202	$116	$124	$239	$132	$86	$391	$92	$59	$56	$431	$186	$286	$139	$166	$154	$156	$97	$100	$103	$133	$137	$141	$145	$149	$154	$158
Total Annual Sewer CIP ($million) (2015$)	$264	$163	$226	$111	$180	$100	$104	$194	$104	$66	$291	$67	$41	$38	$285	$120	$178	$84	$98	$88	$87	$52	$52	$52	$65	$65	$65	$65	$65	$65	$65
Cumulative Sewer CIP ($million)	$264	$432	$671	$793	$995	$1,112	$1,236	$1,474	$1,606	$1,692	$2,083	$2,175	$2,234	$2,290	$2,721	$2,907	$3,193	$3,333	$3,499	$3,653	$3,809	$3,906	$4,005	$4,108	$4,241	$4,377	$4,518	$4,663	$4,812	$4,966	$5,124
Cumul. Sewer CIP ($million) (2015 $)	$264	$427	$653	$764	$944	$1,044	$1,148	$1,342	$1,446	$1,512	$1,803	$1,870	$1,911	$1,949	$2,234	$2,354	$2,532	$2,616	$2,714	$2,802	$2,889	$2,941	$2,993	$3,045	$3,110	$3,175	$3,240	$3,305	$3,370	$3,435	$3,500
Capital Financing																															
OWDA ($million)	$175	$74	$108	$53	$94	$47	$55	$114	$51	$38	$188	$41	$24	$20	$200	$54	$138	$65	$52	$44	$45	$47	$48	$43	$58	$52	$56	$55	$59	$59	$58
GO Bonds ($million)	$0	$183	$132	$69	$108	$69	$69	$125	$81	$48	$203	$51	$35	$36	$231	$132	$148	$74	$64	$65	$57	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Cash ($million)	$89	($89)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$50	$45	$55	$50	$52	$60	$75	$85	$85	$90	$90	$95	$100
Debt Service Coverage (Adjusted)	2.32	1.58	2.07	1.92	1.80	1.71	1.70	1.73	1.72	1.70	1.63	1.68	1.72	1.71	1.68	1.68	1.71	1.62	2.01	1.96	2.10	2.14	2.17	2.31	2.51	2.66	2.79	2.95	3.07	3.26	3.48
Debt Service Coverage (Annual)	0.93	0.91	0.95	0.95	0.96	0.98	1.02	1.05	1.03	1.02	0.99	1.04	1.06	1.03	1.01	1.02	1.04	0.96	1.22	1.17	1.25	1.25	1.23	1.29	1.37	1.43	1.48	1.53	1.55	1.61	1.67
Reserve (Days) All Funds	360	584	542	497	458	430	423	441	444	442	420	430	449	454	446	445	457	420	422	410	410	415	411	411	407	400	401	399	399	396	392
Operating Fund ($million)	$3	$75	$64	$51	$39	$31	$31	$38	$41	$42	$34	$40	$50	$54	$52	$54	$62	$45	$48	$43	$45	$50	$50	$53	$53	$51	$54	$56	$58	$60	$60
Reserve, Replacement, and Rev. Bond DS Funds ($million)	$111	$114	$118	$121	$125	$129	$133	$137	$141	$145	$149	$154	$158	$163	$168	$173	$178	$183	$189	$195	$200	$206	$213	$219	$226	$232	$239	$247	$254	$262	$269
Debt Service as % of Total Budget	56.2%	56.9%	56.9%	58.3%	59.6%	60.6%	60.6%	60.7%	61.3%	61.7%	62.9%	61.9%	61.4%	62.1%	62.7%	62.5%	62.2%	63.3%	56.6%	56.7%	54.0%	53.0%	52.1%	49.8%	47.1%	44.8%	42.7%	40.8%	39.1%	37.0%	34.8%
Annual WW & SW Resid. Bill as % of MHI (Service Area)	0.60%	0.62%	0.64%	0.67%	0.70%	0.74%	0.78%	0.79%	0.80%	0.81%	0.83%	0.84%	0.84%	0.85%	0.87%	0.88%	0.89%	0.88%	0.88%	0.87%	0.86%	0.85%	0.84%	0.84%	0.83%	0.82%	0.81%	0.80%	0.79%	0.78%	0.77%
Annual WW & SW Resid. Bill as % of LQ Household Income (Service Area)	1.25%	1.29%	1.34%	1.40%	1.47%	1.54%	1.62%	1.65%	1.67%	1.69%	1.72%	1.75%	1.75%	1.78%	1.80%	1.83%	1.86%	1.84%	1.83%	1.81%	1.79%	1.78%	1.76%	1.74%	1.73%	1.71%	1.69%	1.67%	1.65%	1.63%	1.61%
Annual WW & SW Resid. Bill as % of MHI (City)	0.76%	0.78%	0.81%	0.85%	0.89%	0.94%	0.98%	1.00%	1.01%	1.03%	1.05%	1.06%	1.06%	1.08%	1.10%	1.11%	1.13%	1.12%	1.11%	1.10%	1.09%	1.08%	1.07%	1.06%	1.05%	1.04%	1.03%	1.02%	1.00%	0.99%	0.98%
Annual WW & SW Resid. Bill as % of LQ Household Income (City)	1.88%	1.93%	2.01%	2.11%	2.21%	2.32%	2.44%	2.48%	2.51%	2.54%	2.59%	2.62%	2.64%	2.67%	2.72%	2.76%	2.80%	2.78%	2.75%	2.72%	2.69%	2.67%	2.65%	2.62%	2.60%	2.57%	2.54%	2.52%	2.49%	2.46%	2.43%

TABLE 9.4.7 » LONG RANGE ANALYSIS OF THE 2040 GRAY ALTERNATIVE

Gray Alternative 2040 - GO Debt, OWDA 50% on Eligible Projects, & Cash Reserves (August 18, 2015)

Description	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Rate Increase (WW)	0.0%	5.0%	6.0%	7.0%	7.0%	7.0%	7.0%	3.0%	3.0%	3.0%	4.0%	2.0%	3.0%	2.0%
Cumulative Rate Increase (WW)	0.0%	5.0%	11.3%	19.1%	27.4%	36.3%	45.9%	50.3%	54.8%	59.4%	65.8%	69.1%	74.2%	77.7%
Rate Increase (SW)	0.0%	1.0%	2.0%	2.0%	3.0%	3.0%	3.0%	3.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%
Cumulative Rate Increase (SW)	0.0%	1.0%	3.0%	5.1%	8.2%	11.5%	14.8%	18.3%	18.3%	18.3%	18.3%	18.3%	18.3%	20.6%
Total Annual Sewer CIP ($million)	$264	$168	$240	$122	$202	$116	$124	$239	$132	$86	$368	$69	$59	$70
Total Annual Sewer CIP ($million) (2015$)	$264	$163	$226	$111	$180	$100	$104	$194	$104	$66	$274	$50	$41	$48
Cumulative Sewer CIP ($million)	$264	$432	$671	$793	$995	$1,112	$1,236	$1,474	$1,606	$1,692	$2,059	$2,128	$2,187	$2,257
Cumul. Sewer CIP ($million) (2015 $)	$264	$427	$653	$764	$944	$1,044	$1,148	$1,342	$1,446	$1,512	$1,786	$1,836	$1,877	$1,925
Capital Financing														
OWDA ($million)	$175	$74	$108	$53	$94	$47	$55	$114	$51	$38	$177	$29	$24	$27
GO Bonds ($million)	$0	$183	$132	$69	$108	$69	$69	$125	$81	$48	$191	$40	$35	$43
Cash ($million)	$89	($89)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Debt Service Coverage (Adjusted)	2.32	1.58	2.07	1.92	1.80	1.71	1.70	1.73	1.72	1.70	1.63	1.67	1.72	1.71
Debt Service Coverage (Annual)	0.93	0.91	0.95	0.95	0.96	0.98	1.02	1.05	1.03	1.02	0.99	1.03	1.06	1.03
Reserve (Days) All Funds	360	584	542	497	458	430	423	441	444	442	420	424	445	449
Operating Fund ($million)	$3	$75	$64	$51	$39	$31	$31	$38	$41	$42	$34	$37	$48	$52
Reserve, Replacement, and Rev. Bond DS Funds ($million)	$111	$114	$118	$121	$125	$129	$133	$137	$141	$145	$149	$154	$158	$163
Debt Service as % of Total Budget	56.2%	56.9%	56.9%	58.3%	59.6%	60.6%	60.6%	60.7%	61.3%	61.7%	62.9%	61.8%	61.2%	61.8%
Annual WW & SW Resid. Bill as % of MHI (Service Area)	0.60%	0.62%	0.64%	0.67%	0.70%	0.74%	0.78%	0.79%	0.80%	0.81%	0.83%	0.83%	0.84%	0.84%
Annual WW & SW Resid. Bill as % of LQ Household Income (Service Area)	1.25%	1.29%	1.34%	1.40%	1.47%	1.54%	1.62%	1.65%	1.67%	1.69%	1.72%	1.73%	1.75%	1.76%
Annual WW & SW Resid. Bill as % of MHI (City)	0.76%	0.78%	0.81%	0.85%	0.89%	0.94%	0.98%	1.00%	1.01%	1.03%	1.05%	1.05%	1.06%	1.07%
Annual WW & SW Resid. Bill as % of LQ Household Income (City)	1.88%	1.93%	2.01%	2.11%	2.21%	2.32%	2.44%	2.48%	2.51%	2.54%	2.59%	2.60%	2.64%	2.65%

Description	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Rate Increase (WW)	3.0%	3.0%	2.0%	2.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Cumulative Rate Increase (WW)	83.0%	88.5%	92.3%	96.1%	96.1%	96.1%	96.1%	96.1%	96.1%	96.1%	96.1%	96.1%	96.1%	96.1%	96.1%	96.1%	96.1%
Rate Increase (SW)	2.0%	2.0%	3.0%	3.0%	3.0%	4.0%	4.0%	4.0%	4.0%	3.0%	2.0%	2.0%	2.0%	2.0%	1.0%	1.0%	1.0%
Cumulative Rate Increase (SW)	23.0%	25.5%	29.3%	33.2%	37.1%	42.6%	48.3%	54.3%	60.4%	65.3%	68.6%	71.9%	75.4%	78.9%	80.7%	82.5%	84.3%
Total Annual Sewer CIP ($million)	$457	$137	$82	$146	$352	$195	$151	$109	$110	$125	$143	$146	$141	$145	$149	$154	$158
Total Annual Sewer CIP ($million) (2015$)	$302	$88	$51	$88	$207	$111	$83	$59	$57	$63	$71	$69	$65	$65	$65	$65	$65
Cumulative Sewer CIP ($million)	$2,714	$2,851	$2,933	$3,079	$3,431	$3,626	$3,777	$3,886	$3,996	$4,121	$4,264	$4,410	$4,550	$4,695	$4,845	$4,998	$5,157
Cumul. Sewer CIP ($million) (2015 $)	$2,227	$2,315	$2,366	$2,454	$2,661	$2,772	$2,855	$2,914	$2,971	$3,034	$3,105	$3,174	$3,239	$3,304	$3,369	$3,434	$3,499
Capital Financing																	
OWDA ($million)	$213	$30	$41	$72	$150	$69	$45	$44	$48	$55	$63	$61	$51	$55	$54	$59	$58
GO Bonds ($million)	$244	$107	$41	$74	$137	$72	$36	$0	$7	$5	$0	$0	$0	$0	$0	$0	$0
Cash ($million)	$0	$0	$0	$0	$65	$55	$70	$65	$55	$65	$80	$85	$90	$90	$95	$95	$100
Debt Service Coverage (Adjusted)	1.68	1.67	1.68	1.62	2.11	2.09	2.25	2.21	2.20	2.35	2.55	2.71	2.85	2.98	3.11	3.29	3.51
Debt Service Coverage (Annual)	1.01	1.02	1.02	0.98	1.29	1.26	1.33	1.28	1.26	1.32	1.40	1.46	1.50	1.54	1.56	1.62	1.68
Reserve (Days) All Funds	439	436	436	411	413	419	418	410	410	410	406	404	401	403	397	397	394
Operating Fund ($million)	$49	$49	$51	$40	$42	$48	$50	$47	$50	$52	$52	$54	$54	$58	$57	$60	$62
Reserve, Replacement, and Rev. Bond DS Funds ($million)	$168	$173	$178	$183	$189	$195	$200	$206	$213	$219	$226	$232	$239	$247	$254	$262	$269
Debt Service as % of Total Budget	62.4%	62.3%	62.0%	62.7%	55.2%	54.9%	52.6%	52.4%	51.6%	49.3%	46.6%	44.4%	42.4%	40.5%	38.9%	36.8%	34.6%
Annual WW & SW Resid. Bill as % of MHI (Service Area)	0.86%	0.87%	0.88%	0.88%	0.87%	0.87%	0.86%	0.85%	0.85%	0.84%	0.83%	0.82%	0.81%	0.80%	0.79%	0.78%	0.77%
Annual WW & SW Resid. Bill as % of LQ Household Income (Service Area)	1.79%	1.82%	1.83%	1.84%	1.82%	1.81%	1.79%	1.78%	1.76%	1.75%	1.73%	1.71%	1.69%	1.67%	1.65%	1.63%	1.61%
Annual WW & SW Resid. Bill as % of MHI (City)	1.09%	1.10%	1.11%	1.12%	1.11%	1.10%	1.09%	1.08%	1.07%	1.06%	1.05%	1.04%	1.03%	1.02%	1.00%	0.99%	0.98%
Annual WW & SW Resid. Bill as % of LQ Household Income (City)	2.69%	2.73%	2.75%	2.77%	2.75%	2.72%	2.70%	2.68%	2.65%	2.63%	2.60%	2.57%	2.55%	2.52%	2.49%	2.46%	2.43%

TABLE 9.4.8 » LONG RANGE ANALYSIS OF THE 2045 GRAY ALTERNATIVE

Gray Alternative 2045 - GO Debt, OWDA 50% on Eligible Projects, & Cash Reserves (August 18, 2015)

Description	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Rate Increase (WW)	0.0%	5.0%	6.0%	7.0%	7.0%	7.0%	4.0%	4.0%	4.0%	4.0%	3.0%	0.0%	2.0%	2.0%
Cumulative Rate Increase (WW)	0.0%	5.0%	11.3%	19.1%	27.4%	36.3%	41.8%	47.5%	53.4%	59.5%	64.3%	64.3%	67.6%	70.9%
Rate Increase (SW)	0.0%	1.0%	2.0%	2.0%	3.0%	3.0%	3.0%	3.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%
Cumulative Rate Increase (SW)	0.0%	1.0%	3.0%	5.1%	8.2%	11.5%	14.8%	18.3%	18.3%	18.3%	18.3%	18.3%	18.3%	20.6%
Total Annual Sewer CIP ($million)	$264	$168	$240	$83	$163	$116	$161	$244	$67	$53	$37	$83	$444	$92
Total Annual Sewer CIP ($million) (2015$)	$264	$163	$226	$76	$145	$100	$135	$198	$53	$40	$27	$60	$312	$62
Cumulative Sewer CIP ($million)	$264	$432	$671	$754	$917	$1,033	$1,195	$1,438	$1,505	$1,558	$1,595	$1,677	$2,122	$2,213
Cumul. Sewer CIP ($million) (2015 $)	$264	$427	$653	$729	$874	$974	$1,109	$1,307	$1,360	$1,400	$1,427	$1,487	$1,799	$1,861
Capital Financing														
OWDA ($million)	$175	$74	$108	$34	$75	$47	$74	$117	$19	$21	$11	$36	$217	$38
GO Bonds ($million)	$0	$183	$132	$49	$88	$69	$87	$127	$48	$32	$21	$42	$227	$54
Cash ($million)	$89	($89)	$0	$0	$0	$0	$0	$0	$0	$0	$5	$5	$0	$0
Debt Service Coverage (Adjusted)	2.32	1.58	2.07	1.92	1.80	1.74	1.72	1.74	1.73	1.73	1.67	1.75	1.86	1.91
Debt Service Coverage (Annual)	0.93	0.91	0.95	0.95	0.96	0.99	1.01	1.04	1.03	1.04	1.00	1.06	1.11	1.09
Reserve (Days) All Funds	360	584	542	497	460	439	424	439	444	451	424	431	476	509
Operating Fund ($million)	$3	$75	$64	$51	$40	$34	$32	$37	$41	$46	$36	$40	$63	$80
Reserve, Replacement, and Rev. Bond DS Funds ($million)	$111	$114	$118	$121	$125	$129	$133	$137	$141	$145	$149	$154	$158	$163
Debt Service as % of Total Budget	56.2%	56.9%	56.9%	58.3%	59.5%	60.3%	60.0%	60.1%	60.9%	61.3%	62.4%	60.3%	58.7%	59.0%
Annual WW & SW Resid. Bill as % of MHI (Service Area)	0.60%	0.62%	0.64%	0.67%	0.70%	0.74%	0.76%	0.78%	0.79%	0.81%	0.82%	0.81%	0.81%	0.82%
Annual WW & SW Resid. Bill as % of LQ Household Income (Service Area)	1.25%	1.29%	1.34%	1.40%	1.47%	1.54%	1.58%	1.62%	1.65%	1.69%	1.71%	1.69%	1.69%	1.70%
Annual WW & SW Resid. Bill as % of MHI (City)	0.76%	0.78%	0.81%	0.85%	0.89%	0.94%	0.96%	0.98%	1.00%	1.03%	1.04%	1.02%	1.03%	1.03%
Annual WW & SW Resid. Bill as % of LQ Household Income (City)	1.88%	1.93%	2.01%	2.11%	2.21%	2.32%	2.38%	2.44%	2.49%	2.54%	2.57%	2.54%	2.55%	2.56%

Description	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Rate Increase (WW)	2.0%	2.0%	2.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Cumulative Rate Increase (WW)	74.3%	77.8%	81.4%	81.4%	81.4%	81.4%	81.4%	81.4%	81.4%	81.4%	81.4%	81.4%	81.4%	81.4%	81.4%	81.4%	81.4%
Rate Increase (SW)	2.0%	2.0%	3.0%	3.0%	3.0%	4.0%	4.0%	4.0%	4.0%	3.0%	2.0%	2.0%	2.0%	2.0%	1.0%	1.0%	1.0%
Cumulative Rate Increase (SW)	23.0%	25.5%	29.3%	33.2%	37.1%	42.6%	48.3%	54.3%	60.4%	65.3%	68.6%	71.9%	75.4%	78.9%	80.7%	82.5%	84.3%
Total Annual Sewer CIP ($million)	$97	$105	$108	$111	$591	$144	$172	$125	$333	$221	$148	$139	$165	$157	$161	$166	$169
Total Annual Sewer CIP ($million) (2015$)	$64	$67	$67	$67	$347	$82	$95	$67	$174	$112	$73	$66	$76	$71	$71	$71	$69
Cumulative Sewer CIP ($million)	$2,310	$2,415	$2,522	$2,633	$3,224	$3,368	$3,540	$3,665	$3,998	$4,219	$4,367	$4,506	$4,671	$4,827	$4,989	$5,155	$5,324
Cumul. Sewer CIP ($million) (2015 $)	$1,925	$1,992	$2,059	$2,126	$2,473	$2,555	$2,650	$2,717	$2,891	$3,003	$3,076	$3,142	$3,218	$3,289	$3,360	$3,431	$3,500
Capital Financing																	
OWDA ($million)	$33	$14	$53	$55	$269	$44	$57	$61	$165	$109	$71	$65	$74	$69	$71	$74	$76
GO Bonds ($million)	$64	$91	$55	$56	$262	$51	$60	$29	$138	$82	$47	$54	$81	$88	$90	$92	$93
Cash ($million)	$0	$0	$0	$0	$60	$50	$55	$35	$30	$30	$30	$20	$10	$0	$0	$0	$0
Debt Service Coverage (Adjusted)	1.82	1.73	1.74	1.69	2.28	2.20	2.31	2.16	2.15	2.21	2.27	2.23	2.22	2.26	2.29	2.33	2.32
Debt Service Coverage (Annual)	1.00	0.96	0.99	0.97	1.33	1.25	1.29	1.18	1.16	1.17	1.17	1.12	1.09	1.07	1.05	1.03	1.00
Reserve (Days) All Funds	495	458	441	412	418	414	414	413	410	408	407	405	407	416	415	409	393
Operating Fund ($million)	$76	$60	$54	$40	$45	$45	$47	$49	$49	$50	$52	$54	$58	$68	$71	$70	$61
Reserve, Replacement, and Rev. Bond DS Funds ($million)	$168	$173	$178	$183	$189	$195	$200	$206	$213	$219	$226	$232	$239	$247	$254	$262	$269
Debt Service as % of Total Budget	60.8%	61.5%	60.5%	60.2%	51.5%	52.0%	50.0%	51.1%	50.4%	49.0%	47.7%	47.4%	46.7%	45.8%	45.0%	43.9%	43.1%
Annual WW & SW Resid. Bill as % of MHI (Service Area)	0.82%	0.83%	0.83%	0.82%	0.82%	0.81%	0.80%	0.80%	0.79%	0.78%	0.78%	0.77%	0.76%	0.75%	0.74%	0.73%	0.72%
Annual WW & SW Resid. Bill as % of LQ Household Income (Service Area)	1.71%	1.73%	1.74%	1.72%	1.70%	1.69%	1.68%	1.66%	1.65%	1.63%	1.62%	1.60%	1.58%	1.57%	1.55%	1.53%	1.51%
Annual WW & SW Resid. Bill as % of MHI (City)	1.04%	1.05%	1.06%	1.05%	1.04%	1.03%	1.02%	1.01%	1.00%	0.99%	0.98%	0.97%	0.96%	0.95%	0.94%	0.93%	0.92%
Annual WW & SW Resid. Bill as % of LQ Household Income (City)	2.58%	2.60%	2.61%	2.59%	2.56%	2.54%	2.52%	2.50%	2.48%	2.46%	2.43%	2.41%	2.38%	2.36%	2.33%	2.30%	2.28%

10

RECOMMENDED ALTERNATIVE AND SCHEDULE

THE CITY OF COLUMBUS
MICHAEL B. COLEMAN, MAYOR

DEPARTMENT OF PUBLIC UTILITIES

The Integrated Plan and 2015 WWMP Update Report

BLUEPRINT COLUMBUS
Clean streams.
Strong neighborhoods.

Clean streams. Strong neighborhoods.

SECTION 10

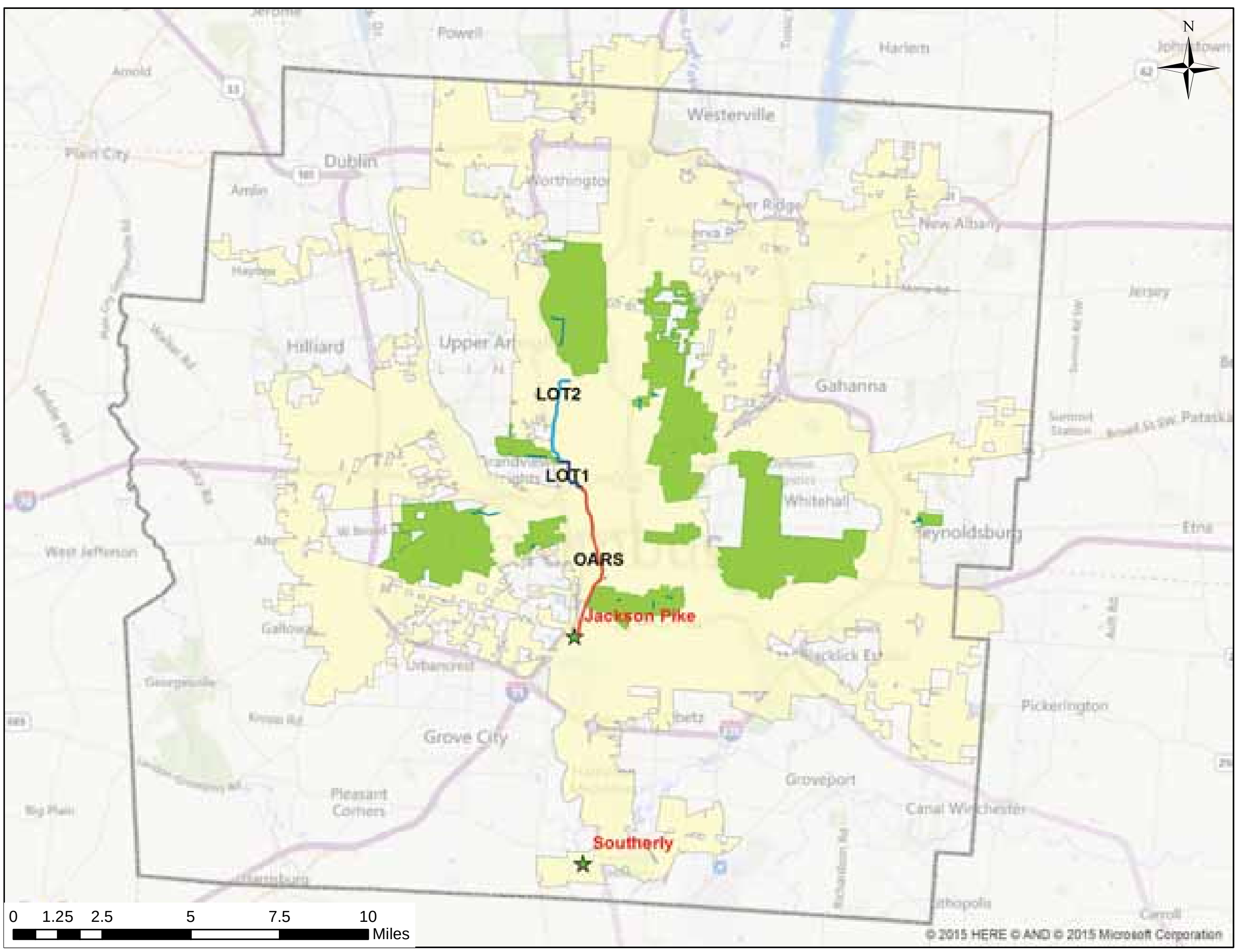
10 RECOMMENDED ALTERNATIVE AND SCHEDULE

10.1 Recommended Alternative

The recommended alternative is the Blueprint alternative with the 2035 schedule. Both the gray plan and the Blueprint plan provide similar levels of service. However, the Blueprint plan was chosen over the gray plan based on the additional social and environmental benefits it provides, as outlined in Section 8 of this report.

The scope and cost of the Blueprint alternative is detailed in Section 6. The total capital cost for the Blueprint plan is about $1.7 billion. About $185 million is associated with the Lower Olentangy Tunnel (LOT). Another $219 million is associated with other conventional infrastructure-like relief sewers. The rest of the cost of the project, $1.33 billion, is associated with Blueprint infrastructure such as sewer lining, green infrastructure, lateral lining, roof redirection and sump pumps. These technologies attack the source of overflows, instead of just dealing with the symptoms. Exhibit 10.1.1 shows all of the projects associated with the Blueprint plan. The green areas are the areas in the city where the Blueprint infrastructure will be installed, and additional gray infrastructure, including new tunnels and sewers are also shown.

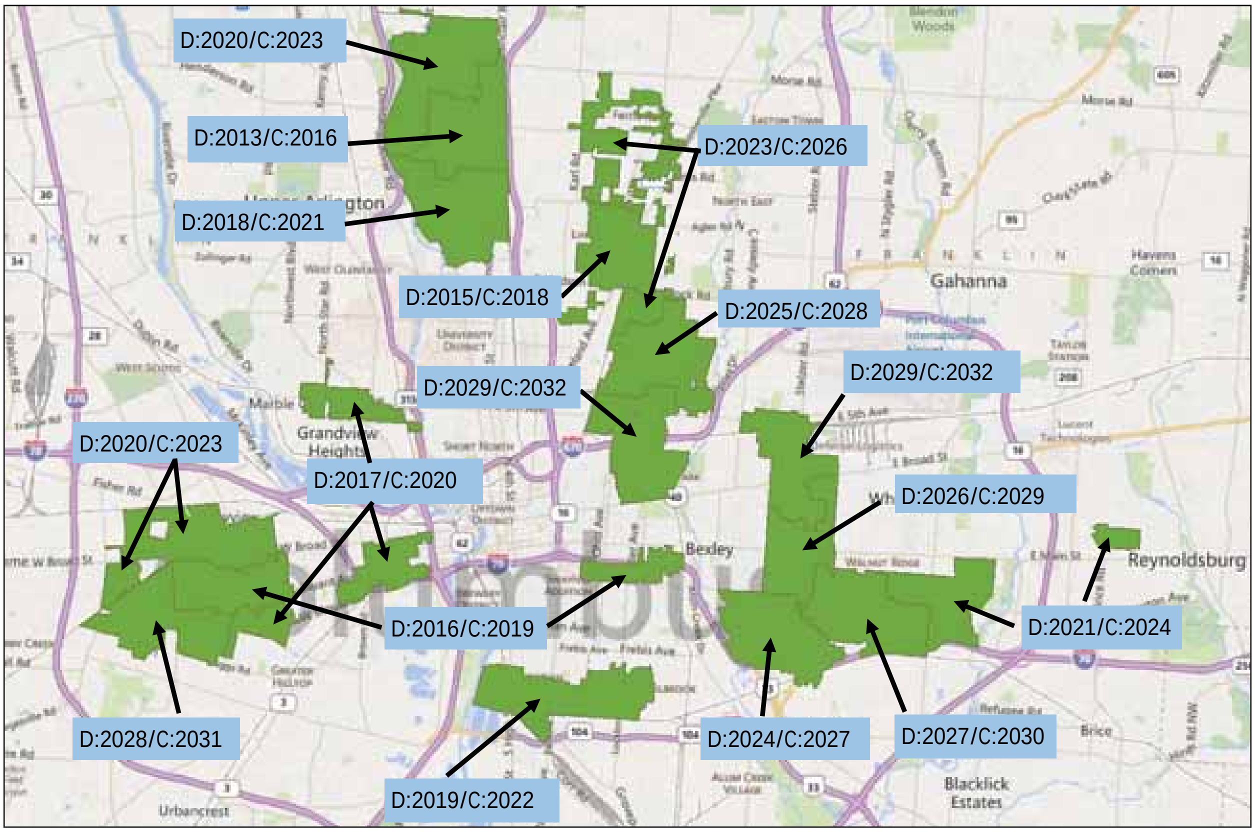
EXHIBIT 10.1.1 » BLUEPRINT PROJECTS



10.2 Schedule

The schedule for the recommended alternative can be seen in Figure 10.2.1. The 2035 schedule was chosen as it allows for one Blueprint area per year, with doubling up on areas only occurring at the end of the schedule. The prioritization of the Blueprint areas is discussed in Section 6. The staggering of the Blueprint areas will allow the local contractor base to build up its capacity to handle the Blueprint jobs. Exhibit 10.2.1 geographically shows the start construction and start design dates of each Blueprint area.

EXHIBIT 10.2.1 » DESIGN START AND CONSTRUCTION START DATES FOR EACH BLUEPRINT AREA

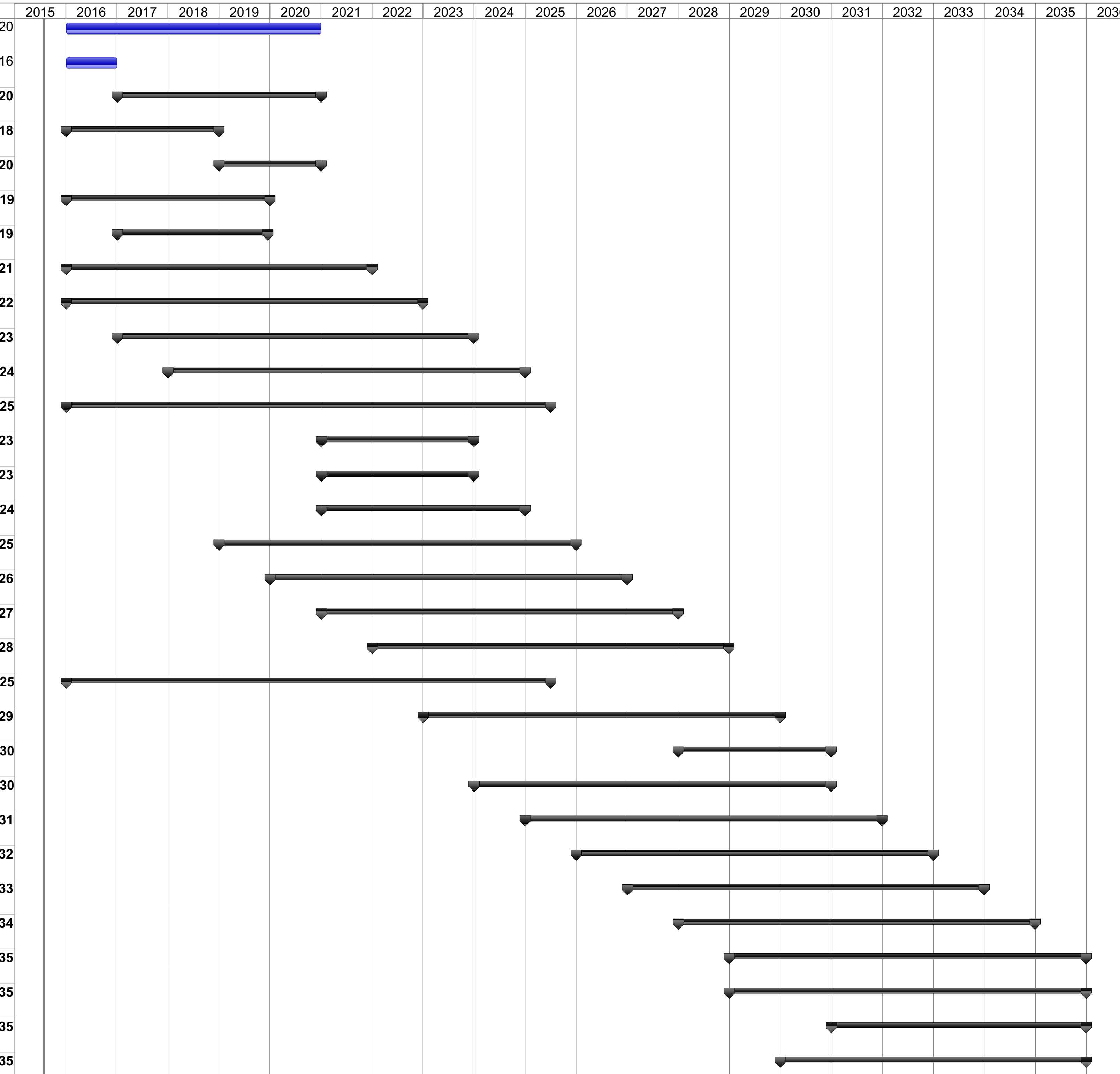


Several projects have deadlines that are already prescribed. The Chemically Enhanced Primary Treatment (CEPT) project must be operational by December 16, 2019, as per a January 24, 2013 letter from the Ohio Environmental Protection Agency (Ohio EPA). In addition, there are several projects that are part of the combined sewer overflow (CSO) consent order that must be operational by July 1, 2025. These projects include Lower Olentangy Tunnel Phase 1 (LOT1), Dodge Park inflow redirection, weir at 18th & Long, Noble & Fourth sewer shed improvement, Kerr & Russell sewer shed improvement and Markison inflow redirection.

The 2035 schedule will also accommodate affordability for the city of Columbus rate-payers, as outlined in Section 9.

FIGURE 10.2.1 » SCHEDULE FOR THE RECOMMENDED ALTERNATIVE

ID	Task Name	Start	Finish
1	Public Information Outreach	Mon 1/4/16	Thu 12/31/20
2	OSIS Augment Releif Sewer, Henry St.-JPWWTP OARS	Mon 1/4/16	Fri 12/30/16
3	**Moler Street Overflow Intercepting Sewer**	**Tue 1/3/17**	**Thu 12/31/20**
6	**Dodge Park Inflow Redirection**	**Mon 1/4/16**	**Mon 12/31/18**
9	**Weir at 18th and Long**	**Wed 1/2/19**	**Thu 12/31/20**
12	**Clintonville 1**	**Mon 1/4/16**	**Tue 12/31/19**
17	**CEPT**	**Tue 1/3/17**	**Mon 12/16/19**
19	**North Linden 1**	**Mon 1/4/16**	**Fri 12/31/21**
25	**Hilltop 1 + Miller Kelton**	**Mon 1/4/16**	**Fri 12/30/22**
33	**Fifth by Northwest + West Franklinton + Hilltop 4**	**Tue 1/3/17**	**Fri 12/29/23**
41	**Clintonville 3**	**Tue 1/2/18**	**Tue 12/31/24**
49	**LOT1**	**Mon 1/4/16**	**Tue 7/1/25**
52	**Noble & 4th**	**Mon 1/4/21**	**Fri 12/29/23**
55	**Kerr & Russell**	**Mon 1/4/21**	**Fri 12/29/23**
58	**Markison Inflow Redirection**	**Mon 1/4/21**	**Tue 12/31/24**
61	**Near South**	**Wed 1/2/19**	**Wed 12/31/25**
69	**Clintonville 2**	**Thu 1/2/20**	**Thu 12/31/26**
77	**James Livingston 5 + Plum Ridge**	**Mon 1/4/21**	**Fri 12/31/27**
85	**Hilltop 2**	**Mon 1/3/22**	**Fri 12/29/28**
93	**LOT2**	**Mon 1/4/16**	**Tue 7/1/25**
96	**North Linden 2**	**Tue 1/3/23**	**Mon 12/31/29**
104	**DSR 873 to OMI**	**Mon 1/3/28**	**Tue 12/31/30**
107	**James Livingston 3**	**Tue 1/2/24**	**Tue 12/31/30**
114	**South Linden**	**Thu 1/2/25**	**Wed 12/31/31**
121	**James Livingston 2**	**Fri 1/2/26**	**Fri 12/31/32**
128	**James Livingston 4**	**Mon 1/4/27**	**Fri 12/30/33**
135	**Hilltop 3**	**Mon 1/3/28**	**Fri 12/29/34**
143	**James Livingston 1**	**Tue 1/2/29**	**Mon 12/31/35**
150	**Near East**	**Tue 1/2/29**	**Mon 12/31/35**
157	**2nd barrel interconnector**	**Thu 1/2/31**	**Mon 12/31/35**
160	**Sealing manholes**	**Wed 1/2/30**	**Mon 12/31/35**



11

POST-CONSTRUCTION MONITORING

THE CITY OF COLUMBUS
MICHAEL B. COLEMAN, MAYOR

DEPARTMENT OF PUBLIC UTILITIES

The Integrated Plan and
2015 WWMP Update Report

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SECTION 11

11 POST-CONSTRUCTION MONITORING

The integrated plan and 2015 Wet Weather Management Plan (WWMP) Update Report modernizes the scope and schedule for the city of Columbus' 2005 WWMP. The 2005 WWMP addressed the city's consent orders for both sanitary sewer overflows (SSOs) and combined sewer overflows (CSOs). The integrated plan and 2015 WWMP Update Report expands that scope to include stormwater considerations with the addition of green infrastructure as a component of the recommended Blueprint Columbus plan.

11.1 Metering and Collection System Model

One of the most powerful tools for evaluating post-construction performance is the city's extensive network of flow meters, rain gauges and the detailed model of the collection system. As discussed in Section 5, the collection system model has been calibrated to historical rainfall and flow meter data that represents pre-Blueprint implementation. We intend to continue monitoring the rainfall and sewer system flows both continuously at select locations and temporarily as needed in specific areas. Temporary metering may be installed in a specific Blueprint area after implementation.

The post implementation data will be used to recalibrate the collection system model and evaluate actual results. The recalibrated model can simulate the typical year rainfall pattern and the same 20-Year historical rainfall used for the development of this plan. The results of this post construction analysis can then be compared with the assumptions used to develop Blueprint Columbus and the already approved levels of service (LOSs). If the results are comparable and LOSs are verified and met, then work in that area can be considered complete. If the results are not achieved, then the plan will need to be modified to reach the LOSs.

This approach is the only practical way to account for variations in rainfall events, antecedent conditions and other variables that can impact the collection system response to any particular event. This is particularly important when the LOS is ten years. An exceptionally long post-construction monitoring period, ten to 20 years, would be necessary to prove levels are achieved using chalk and block methods.

The city recommends commencing the first major evaluation of system performance using the model after completion of the CSO consent order in 2025. The process will take between two and three years to complete given the need to acquire at least a year of post-construction data. This evaluation will be able to prove that the CSO LOSs are met and also evaluate some of the early Blueprint area implementations.

11.2 Sanitary Sewer Overflows

Since SSOs are required to be eliminated to a 10-year LOS, post construction monitoring will primarily rely upon the collection system model evaluation described above. Continued chalk and block monitoring of the designed sanitary relief (DSR) locations and reporting the frequency of overflows will be necessary until system performance can be verified with the post-construction collection system model analysis. Once verified, the city will recommend a reduced frequency of actual overflow monitoring or eliminate the monitoring altogether.

11.3 Water In Basement Events

Like SSOs, water in basement events (WIBs) are required to be stopped, and by the end of the Blueprint Columbus plan wet weather basement backups will have a 10-year LOS. Unlike SSOs, the city does not monitor residential basements, so information on these events will continue to be gathered by the city's voluntary call-in system. The post construction collection system model will be used to verify the prediction of WIBs and ensure the LOS is achieved.

11.4 Combined Sewer Overflows

The CSO consent order requires construction on the improvements to be completed by July 1, 2025. Both the Blueprint plan and the gray plan will meet this deadline, and the improvements made by the city over the past ten years have accelerated the overall build-out of the CSO plan. However, unlike the SSOs and WIBs, CSOs do not have to be eliminated, they need to be controlled to a specific level of overflows per typical year. The specific levels vary on the CSO location and are summarized in Section 2.

The United States Environmental Protection Agency (USEPA) CSO guidance documents require post construction monitoring in order to verify that CSO controls implemented are achieving the predicted levels of control. The guidance suggests several post construction monitoring activities including using the collection system model, rainfall and flow metering, and water quality sampling.

All CSOs in the collection system have flow meters installed. This is required in the city's current National Pollutant Discharge Elimination System (NPDES) permits. Furthermore, the other rainfall and flow meters will be used to develop a post-construction collection system model and test the LOS for the CSOs as described above.

The city has monitored and reported the major discharges including plant bypasses, CSOs and the largest SSOs for many years. Exhibit 2.4.1 is one example of how this data is evaluated and tracked to ensure progress is ongoing in the implementation of the 2005 WWMP. This type of evaluation along with the annual reporting per the consent orders will also continue annually and be tracked to measure progress. The challenge with this raw data is that precipitation varies substantially from year to year. For example, 2010 was close to the typical year used for development of the CSO program whereas 2011 was the single wettest year in the history of Columbus. The model is the only reasonable way to compare future system performance against the baseline used to develop the CSO and SSO programs.

The CSO guidance for post construction compliance monitoring also recommends performing water quality monitoring and comparison to baseline data which was established in the 2005 WWMP. The city intends to perform water quality monitoring at a limited number of locations such as upstream boundary locations and downstream of the major CSO discharges.

Human health criteria are the primary water quality standard (WQS) that is impacted by CSO discharges. Therefore, the primary focus of the water quality sampling program will be to evaluate the attainment of fecal coliform and E. Coli concentrations post-construction by collecting discrete samples. The water quality data will be used along with post-construction typical-year CSO discharges to evaluate compliance. A similar spreadsheet-based model was developed in the 2005 WWMP to conclude that the CSO plan met the water quality goals of the CSO policy.

The city may also collect other water quality data during the same sampling period for human health/bacteria including:

- Dissolved oxygen – continuous metering
- Total Suspended Solids (TSS) – discrete sampling and sample analysis
- Total Dissolved Solids – discrete sampling and sample analysis
- Carbonaceous Biochemical Oxygen Demand (CBOD5) and Carbonaceous Biochemical Oxygen Demand (CBOD20)– discrete sampling and sample analysis
- Ammonia (NH3N) – discrete sampling and sample analysis
- Nitrate (NO3)+ Nitrite (NO2) – Discrete sampling and sample analysis
- Total Kjehldahl Nitrogen (TKN) – discrete sampling and sample analysis
- Total Phosphorus (TP) – discrete sampling and sample analysis

11.5 Stormwater/Green Infrastructure

The city proposes that green infrastructure installed under the Blueprint plan be handled in the same way it currently handles its existing green infrastructure. This includes inventory, inspection and maintenance.

11.5.1 Inventory

The city's Municipal Separate Storm Sewer System (MS4) permit requires an inventory of post-construction stormwater control measures. As part of the inventory, a short description of the maintenance and inspection information is required. Inspection information includes dates inspected, findings, follow-up activities, and prioritization of follow-up activities. The inventory will also include information such as location and size of the green infrastructure feature.

11.5.2 Inspection

The two primary components of the city's plan are to inspect the green infrastructure and provide general maintenance. The inspection is for the purpose of determining if the green infrastructure components are functioning properly and to repair or replace them as necessary. Certain repairs or replacements may require special equipment or contractor involvement and would be scheduled as needed. Here are tasks for the inspection of a rain garden or bioswale:

- Evaluate the general health of plants, basins, swales, filter strips, wetlands, pipe and structures, and any other component or type of green infrastructure for each site (each site will be built by an approved plan and will be maintained per requirement of that plan).
- Complete an inspection form for each site and provide photo documentation. Check for deficiencies listed in the inspection form, photograph the deficiencies, and report any problems. If no deficiencies are observed crews will photograph the control structure and some of the green features for each site for proof of inspection.
- Inspections will not occur during large rain events or within 48 hours after a one-half inch (1/2") measurable rain event unless directed by the city. The city wants to ensure the basins are able to drain down to the required/engineered elevations, not to hide any problems during the inspection.
- Inspection reports and photographs shall be maintained by the city.

The city will determine the best frequency of inspections upon the final design of the green infrastructure and may change the frequency as needed.

11.5.3 Maintenance

In addition to inventory and inspection, the city of Columbus is committed to keeping their green infrastructure sites in a way that enhances the city's image by having clean, well-kept areas that exhibit civic pride. To achieve this, continual maintenance will be required. General maintenance for rain gardens and bioswales includes:

- Removal of weeds (remove weeds in bloom before going to seed) and woody vegetation (including the roots) by hand pulling with or without the use of small hand tools. Weeds or woody vegetation is defined as any plant species not on the original planting list, seed lists and/or per the plan.
- Remove sediment, trash, debris, leaves, dead plants, etc.
- Hand-remove debris from structures, grates, under-drain access points and observation ports/clean outs (Jet-Vac of system will be performed by city crews as needed).
- Pruning of dead growth and live plants so there is unobstructed passage to residents or vehicles.
- Repair any eroded areas as soon as they are detected.
- Maintenance reports and photographs shall be maintained by the city.

The city will determine the best frequency of inspections upon the final design of the green infrastructure and may change the frequency as needed.

12

IMPROVEMENTS TO THE PLAN

THE CITY OF COLUMBUS
MICHAEL B. COLEMAN, MAYOR

DEPARTMENT OF PUBLIC UTILITIES

The Integrated Plan and
2015 WWMP Update Report

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SECTION 12

12 IMPROVEMENTS TO THE PLAN

The United States Environmental Protection Agency's (USEPA's) integrated planning framework memo recognizes that an integrated plan may need to be modified over time, and suggests that the plan include a process for proposing new projects and/or modifying existing projects. We believe the last ten years of implementing the Wet Weather Management Plan (WWMP) demonstrates a successful roadmap for implementing changes to a plan and we propose to continue using it. Whenever the city felt a significant change in scope, schedule or approach was warranted, we submitted a written request to the Ohio Environmental Protection Agency (Ohio EPA) with supporting documentation. We believe this has created a solid working relationship with the Ohio EPA and we propose to continue it. In addition, the city has been and will continue to submit annual reports that track and summarize the status of all projects, including any delays or changes.

While it is not possible to predict why changes to a plan may be necessary, there are several circumstances that are likely to necessitate a change.

DETAILED DESIGN: The ten years of implementation of the WWMP have demonstrated that sometimes moving from a conceptual plan into detailed design will reveal a better approach. The clearest example of this was the change in the Olentangy Scioto Interceptor Sewer Augmentation and Relief Sewer (OARS) from a near surface conduit to a deep tunnel. While Blueprint has fewer tunnels, it does include some, and detailed design may suggest further changes.

IMPLEMENTATION OF THE FIRST BLUEPRINT AREAS: The Blueprint plan was modeled using certain assumptions. The assumptions included participation (how many houses) and effectiveness (how well the technology would work). The city and Pilot Area Technical Committee (PATC) made a strong effort to ensure those assumptions were reasonable and conservative. However, we will not know how Blueprint really performs until it is fully implemented in one or more areas. Actual achieved inflow and infiltration (I/I) removal that is significantly less than or more than estimated for one or more of the Blueprint I/I removal technologies (lateral lining, downspout redirection and sump pumps) may result in adjustments to the plan.

COST ESTIMATES: Blueprint includes elements that the city has never built before, and that no city has built on this scale. Again, the city and PATC made a strong effort to determine reasonable unit prices for items like lateral linings, roof redirects and green infrastructure, but the reality is that these items are less familiar and there is far less industry experience with them. If the estimated unit prices turn out to be significantly higher or lower than the actual costs, adjustments to the schedule may be needed.

RATE MODEL: As noted in the affordability analysis (Section 9), there are certain assumptions in the model that might dramatically change rate impacts - in particular, revenue assumptions regarding population growth and consumption use. The city will continue to monitor these to determine if future adjustments are needed.

MEASURES OF SUCCESS: As set forth in Section 9, the city has selected four measures of success to ensure that its wet weather program stays affordable. If those measures are exceeded, the city will need to revisit the program and/or the schedule.

APPENDIX A

APPENDIX

A

THE CITY OF
COLUMBUS
MICHAEL B. COLEMAN, MAYOR

DEPARTMENT OF
PUBLIC UTILITIES

The Integrated Plan and
2015 WWMP Update Report

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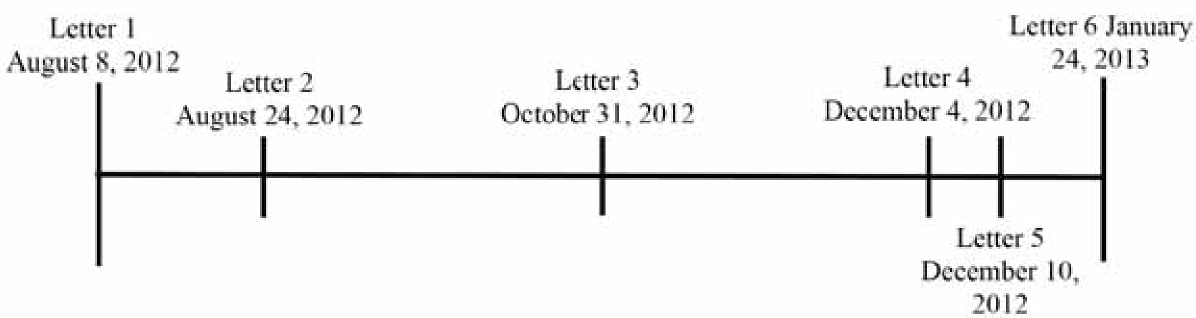
Appendix A

Official Communication between The City of Columbus and the Ohio EPA Agency regarding the WWMP and the IP.

This appendix contains the letters between the City of Columbus and the Ohio EPA Agency regarding the implementation of the WWMP initiatives/projects and the development of the Integrated Plan and 2015 WWMP Update. Letters 1 through 6 capture the communication between the City and the Agency regarding the Integrated Plan. **Figure A.1** is the timeline of the letters. The letters are in attached in the pages that follow in order from letter 1 to letter 6. Below is concise summary of each letter's content:

- Letter 1 is the City's official request to the Agency asking to delay certain WWMP projects in order to peruse the development of an Integrated Plan, incorporating I/I reduction and green infrastructure to reduce sewer overflows and backups.
- Letter 2 is the Agency's initial response to the City's request asking to delay certain WWMP projects in order to pursue the development of an Integrated Plan. The Agency requested more evidence and reasoning for why a delay in ART-A would be justified.
- Letter 3 is the City's report providing evidence and reasoning for further delaying the ART-A tunnel project.
- Letter 4 is the Agency's approval of delaying the ART-A tunnel project, but mandates that the High Rate Treatment (HRT) project's schedule completed date be accelerated from 2025 to 2019.
- Letter 5 is the City's response to the Agency's suggestion of building a HRT at Southerly by 2019. The City agreed and accepted the Agency's suggestion.
- Letter 6 is the Agency's letter to the City with their final approval of developing the Integrated Plan.

Figure A.1 Timeline of Letters between Ohio EPA and City of Columbus



Greg J. Davies
Director

THE CITY OF
COLUMBUS
MICHAEL B. COLEMAN, MAYOR
DEPARTMENT OF
PUBLIC UTILITIES

August 8, 2012

Mr. Scott J. Nally
Director
Ohio Environmental Protection Agency
P.O. Box 1049
Columbus, OH 43216-1049

Dear Director Nally:

The City of Columbus met with your staff in early July to discuss a proposal that we are very excited about. We believe it has the potential to put Columbus and Ohio on the cutting edge of how to sensibly address the tough issues of eliminating sewer overflows and improving water quality. The purpose of this letter is to request Ohio EPA's approval of the City's proposed plan. As set forth below, the City is not proposing **any** delay in compliance with its Consent Orders. Instead, the City is proposing to take a fresh approach to the Consent Orders, and to spend the capital dollars above ground, transforming neighborhoods and creating permanent local jobs, instead of investing solely in little-used tunnels. Our proposal is consistent with USEPA guidance on Integrated Planning and it should result in **greater water quality benefits** than the current gray infrastructure CSO/SSO plan by incorporating both stormwater and sewer overflows.

Background

The City of Columbus entered into Consent Orders with Ohio EPA in 2002 (SSOs) and 2004 (CSOs). Pursuant to those orders, the City submitted a Wet Weather Management Plan to Ohio EPA on July 1, 2005. That plan was conditionally approved by Ohio EPA in January 2009.

The City has spent over a billion dollars to date in implementing the WWMP. The City has expanded its two wastewater treatment plants so that they can each treat 50% more wet weather flows. This work was done on time, by July 1, 2010, and has resulted in a dramatic decrease in wet weather overflows and bypasses.

In addition, the City has started construction on a CSO tunnel that will virtually eliminate CSOs in the downtown area. The original WWMP called for a near-surface tunnel and partial treatment for CSOs to an agreed level of service (four overflows per year). That work was supposed to be completed in 2025. Instead, the City is building a deep tunnel that will virtually eliminate CSOs downtown and will have the City meeting its level of service for downtown CSOs in 2015. In other words, the City will have virtually resolved its CSO issues in just ten years, **and** ten years ahead of schedule.

Director's Office I 910 Dublin Road I Columbus,OH 43215 I T(614)645-6141 I F(614)645-8079
Sewerage and Drainage I 1250 Fairwood Avenue I Columbus,OH 43206 I T(614)645-7175 I F(614)645-3801
Power and Water I Administration I 910 Dublin Road I Columbus OH 43215 I T(614)645-7020 I F(614)645-3993
Customer Service I Power and Water I T(614)645-8276 I F(614)645-0222 I TDD(614)645-7188
columbus.gov

The work that remains to be done under the current WWMP is directed at eliminating SSOs and basement backups. Unfortunately, this work has a number of disadvantages. It is very expensive (estimated as an additional $2.5 B) and will remove far less volume of overflows compared to the current CSO tunnel. Most of the money will be spent on two large tunnels that will only be put in service an average of 5 or 6 times per year.

Another significant disadvantage to the current WWMP is that it does not include any green infrastructure. Columbus entered into consent orders with Ohio EPA earlier than most other cities in Ohio and elsewhere. At the time the WWMP was being developed, the advantages of green infrastructure and how it might help resolve wet weather issues was not well understood. As a result, Columbus is one of the few major cities that does not include green infrastructure in its plan. Columbus should not be penalized for its early cooperation with Ohio EPA.

The existing WWMP will also do very little to improve the discharges from the City's storm sewer system. Stormwater is one of the leading causes of water quality impairment in central Ohio.

Recently, USEPA has recognized the importance of allowing cities to take into consideration all of the regulatory challenges of complying with the Clean Water Act, and prioritize work to achieve water quality goals more efficiently. In June, 2012, USEPA issued the "Integrated Municipal Stormwater and Wastewater Planning Approach Framework." According to this policy, cities are encouraged to integrate work needed to comply with stormwater regulations and sewer overflow elimination. The Integrated Plan Framework strongly encourages the use of green infrastructure to meet these challenges.

Columbus' Proposal

The City would like the opportunity to explore whether there is a better alternative than the current gray WWMP. Specifically, the City believes it is possible to create an Integrated Plan that has two major elements: removing stormwater from the sewers (commonly known as inflow/infiltration or I/I removal), and then routing that stormwater to green infrastructure for treatment prior to being released. The I/I removal would include removing I/I from private sources, such as homeowners' sewer laterals. The green infrastructure would include improvements in the public right-of-ways in our neighborhoods, such as porous pavement sidewalks, rain gardens, and trees. We also envision the removal of vacant housing and the creation of pocket parks as part of the plan. The plan may also need to include some gray solutions as well, such as tunnels or relief sewers but we are unable to properly design these features today without an examination of the full suite of options and how they integrate.

The potential benefits of this plan are enormous. First, there are environmental benefits. We believe it will significantly improve water quality compared to the gray WWMP. In addition, green infrastructure has been recognized as providing many ancillary benefits, such as air quality improvements, habitat, etc. It will also put Columbus ahead of stormwater regulations that are eminent.

Second, there are many other benefits to our community. The improvements we are envisioning may improve property values and help stabilize some of our most challenging neighborhoods. We also recognize that these improvements will require perpetual maintenance, which will in turn lead to permanent jobs.

To determine if this is feasible, the City needs to analyze a number of things. Specifically, the City needs to determine: is it practically and legally feasible to remove private I/I; can I/I removal coupled with green infrastructure provide quantifiable and reasonably certain elimination of SSOs and basement backups; and is it possible to gain acceptance of this plan from the public and our suburban partners. While this is an enormous undertaking, unparalleled in scope, we stand ready to dedicate the resources necessary to determine the answers to these questions.

Proposed Schedule

The current WWMP was submitted to Ohio EPA with a schedule that concludes in 2045. The January 2009 conditional approval letter requires the City to resubmit the schedule for the post-2025 projects in January 2015, and the revised schedule must be shorter than the current schedule. The City is also required to resubmit its affordability analysis in January 2015 to support its proposed revised schedule.

The City is asking Ohio EPA for approval to do the following:

- Submit an Integrated Plan that will replace the WWMP on September 1, 2015
- Also on September 1, 2015, submit a revised schedule for the gray WWMP as required by the January 2009 approval letter. This would include a schedule for finishing the gray WWMP more quickly than the current schedule. If the Integrated Plan is not acceptable to Ohio EPA, the City can finish the current gray WWMP no later than is currently scheduled. In other words, no time will be lost as a result of the City's Integrated Planning effort.
- Submit the affordability analysis required by the January 2009 approval letter on September 1, 2015.
- Delay the projects listed in Attachment A until the Integrated Plan is approved or denied.

The Integrated Plan that the City will submit on September 1, 2015 will:

- Comply with USEPA's Integrated Planning Framework, and its recently issued "General Accountability Considerations for Green Infrastructure."
- Include modeling demonstrating that the Integrated Plan fully complies with the Consent Orders
- Compare water quality advantages of Integrated Plan to the gray WWMP.
- Include proposed schedules and milestones. The schedule will be as expeditious as practical, and will be no longer than the current proposed schedule.
- Set forth legal authority to accomplish private I/I removal.
- Include public input in plan development and a plan for future public involvement in implementation.
- Include results of suburban outreach.

The City is also prepared to undertake the following projects simultaneously with developing its Integrated Plan:

- Third Avenue Green Infrastructure for CSO and SSO areas
- Real Time Control of the Sewer Collection System
- Public Outreach
- Repurpose vacant lots in Barthman/Parsons area
- Priority Area Roof Control and Sewer Lining in Miller/Kelton area
- DSR 83 weir raise

The City requests a prompt response to its proposal for two reasons. First, we cannot meet the deadlines we are proposing unless we begin the work soon. We are ready to begin immediately, but need approval first. Second, some of the projects on Attachment A are scheduled to begin this year. If Ohio EPA does not authorize the City's Integrated Planning approach, we need to know as soon as possible so we can recommence the gray WWMP.

We are therefore requesting a response by September 10, 2012.

The City is very excited about the opportunity to be one of the leading examples of Integrated Planning. We look forward to answering any questions you have.

Sincerely,

Greg J. Davies
Director

GJD:sls

Attachment A

Near Term WWMP Projects (from the OEPA Schedule)

Proposed Delay in Schedule

1. ORT Preliminary Engineering (2015-2017)
2. ART Phase A Construction and Construction Management (2014-2019)
3. Markison Avenue Sewershed: Increased OSIS Capture Engineering (2015-2015)
4. King Avenue Sewershed: Local Storage Tank Engineering (2012-2015)
5. Indianola Avenue Sewershed: Connector Sewer, Local Storage Tank Engineering (2013-2016)
6. Frambes Avenue Sewershed: Local Storage Tank Engineering (2014-2017)
7. Alum Creek Sewershed: Storm Sewer Redirection Engineering (2015-2018)
8. Northwest Alum Creek Priority Area: System Optimization Engineering and Construction (2013-2014)
9. Northwest Alum Creek Priority Area: Suwanee/Railroad Relief Sewer Engineering & Easements (2014-2016)
10. Miller Kelton Priority Area: Gault Street Relief Sewer Engineering, Easements and Construction (2012-2016)
11. Barthman/Parsons Priority Area: Hinman Avenue Relief Sewer Engineering and Easements (2013-2015)
12. West Fifth Avenue Priority Area: King Avenue Relief Sewer Engineering, Easements and Construction (2013-2016)
13. West Fifth Avenue Priority Area: Third Avenue Relief Sewer Engineering and Easements (2014-2017)
14. Clintonville Priority Area: Whetstone Relief Sewer Engineering, Easements and Construction (2012-2017)
15. Clintonville Priority Area: Park of Roses Treatment Engineering, Easements and Construction (2012-2017)
16. DSR 250 Mitigation Activities: Engineering and Construction (2012-2014)

Proposed Schedule Maintained

1. Northwest Alum Creek Priority Area: Study (2008-2012)
2. Northwest Alum Creek Priority Area: Removal of DSR 317 (2013)

3. Northwest Alum Creek Priority Area: Raise DSR Weir Elevations Engineering and Construction (2013-2014)
4. Sullivant Avenue Priority Area: SSES Study (2010-2012)
5. Sullivant Avenue Priority Area: Physical Removal of DSR 96 (pending SSES Study) (2013-2014)
6. Early Ditch Priority Area: CIPP Lining Improvement Phase I Engineering and Easements (2013-2015)
7. Early Ditch Priority Area: CIPP Lining Improvement Phase II Engineering and Easements (2015-2017)
8. Miller Kelton Priority Area: Raise DSR 189 Invert Elevation (2012-2012)
9. Barthman/Parsons Priority Area: Weir Modifications to DSRs 205 and 208 (2012-2012)
10. Clintonville Priority Area: DSR 337 Mitigation (Richards Road Relief Sewer) Engineering, Easements and Construction (2010-2014)
11. OARS Phase I: Construction and CM (2010-2015)
12. OARS Phase II: Construction and CM (2011-2015)
13. Noble and Grant Sewershed: Inflow Redirection Construction and CM (2012-2014)
14. Town and 4th Sewershed: Inflow Redirection Construction and CM (2012-2014)
15. Cherry and 4th Sewershed: Inflow Redirection Construction and CM (2012-2014)
16. Mound e/o I-71 Sewershed: Inflow Redirection Construction and CM (2012-2014)
17. First Avenue Sewershed: Inflow Redirection Construction and CM (2012-2014)
18. Third Avenue Sewershed: Local Storage Tank Engineering and Construction (2011-2016) *
19. Moler Street Overflow Intercepting Sewer: Engineering (2015-2020)

Deleted Projects:

Plum Ridge Priority Area Removal of Driveway Drains Construction (2013-2014) **
Whittier Street Sewershed: Near Surface Conduit to OSIS Engineering and Construction (2010-2015)***

NOTES:

* The Third Avenue Sewershed Local Storage Tank project has been modified as the tank is no longer needed. Project is proceeding forward under new methodology.

** The Plum Ridge Priority Area Removal of Driveway Drains has been determined to be ineffective.

***Project negated by the deep tunnel option of the OARS project

August 24, 2012

Greg J. Davies, Director
Department of Public Utilities
City of Columbus
910 Dublin Road
Columbus, Ohio 43215

Re: WWMP Amendments

Dear Director Davies:

We have received and considered your letter of August 8, 2012, regarding Columbus desire to incorporate Green Infrastructure practices into Columbus' Wet Weather Management Plan, approved January 26, 2009. Green Infrastructure is an approach that has many benefits, as well as a suite of implementation challenges that come as a part of the approach. We have carefully considered your proposal, and based on discussion between our respective staffs on August 10, 2012, we have agreed with the approach described below.

Phase A of the Alum Creek Relief Tunnel (Art A), listed as item 2 on your proposed project delay list, is a Large Scale System Strategy (LSSS). A proposed delay in the implementation of a LSSS would require formal modification of the Wet Weather Management Plan, including a public participation process. Your staff has agreed to provide me with a report by October 31, 2012, which would justify and support such an action if deemed necessary by the City.

The existing Wet Weather Management Plan, however, also describes processes for identifying solutions to Priority Areas. These smaller scale solutions may be ideal for the use of Green Infrastructure. Given that you may need additional time to comprehensively study the potential of Green Infrastructure in the listed Priority Areas, it would seem that delaying the other mentioned projects might yield real benefits. I interpret the delay necessary to plan for increased use of Green Infrastructure in the Priority Areas to be consistent with the implementation of the existing, approved, Wet Weather Management Plan. The City of Columbus will provide an integrated Wet Weather Management Plan proposal by September 15, 2015 that is consistent with your August 8, 2012 proposal, with the exception of Item 2 (Art A) and the items mentioned below. The September 15 submittal shall also include the affordability analysis and the schedule Columbus would otherwise be required to submit by January 1, 2015, per the existing approved Wet Weather Management Plan.

In response to concerns raised by my staff regarding the high potential for public exposure and many complaints arising from the Sanitary Sewer Overflows in the Park of Roses and Clintonville, your staff agreed to substitute these areas for the Miller/Kelton Priority Area for a pilot project for Green Infrastructure Implementation. This will result in a more aggressive approach in these areas to reduce the SSOs, which will reduce public exposure as well as complaints.

If you have any questions, please feel free to contact George Elmaraghy, Chief, Division of Surface Water at 614-644-2041.

Sincerely,

Scott J. Nally, Director
Ohio Environmental Protection Agency

c: George Elmaraghy, Chief, DSW
Isaac Robinson, Chief, CDO
Paul Novak, DSW
Mike Gallaway, DSW-CDO
Dax Blake, City of Columbus
Susan Ashbrook, City of Columbus

SJN/MG/nsm West Weather management Plan Green Infrastructure Response August 13, 2012

October 31, 2012

Ms. Sheree Gossett-Johnson
Compliance / Enforcement Section
Division of Surface Water
Central District Office
Ohio EPA
50 West Town Street
Columbus, Ohio 43215

Re: Alum Creek Relief Tunnel, Phase A Project Delay Justification

Dear Ms. Gossett-Johnson,

INTRODUCTION

In 2002 and 2004, the City of Columbus and Ohio EPA entered into two consent orders focused on remedying the City's Sanitary Sewer Overflows (SSOs), and Combined Sewer Overflows (CSOs). As required by the consent orders, the City of Columbus submitted a Wet Weather Management Plan (WWMP) on July 1, 2005. This plan outlined a 40-year program to address overflows and obtain compliance with the consent orders. Ohio EPA provided conditional approval of the WWMP in 2009. The major condition in the approval letter is a requirement that the City re-examine the schedule for the WWMP in 2015, and submit to Ohio EPA a schedule that is shorter than the schedule in the WWMP.

In the seven years since the WWMP was submitted, the City has invested over $1 billion implementing the plan. The City made a major investment in its treatment plants, and those plants are now successfully treating 50% more wet weather flows. The City also made improvements in the collection system, and began construction of a large tunnel to convey and store combined sewage for full biological treatment at the wastewater treatment plants.

The investment is already paying off. The City has seen the total overflows from the system plummet since the plant work was completed, see **Figures 1** and **2** at the end of the letter. Moreover, by 2015, the City will see even more improvements to its system. These improvements will be on both the combined and separate systems.

On the CSO side, the WWMP proposed that by 2025 a new CSO located at the Jackson Pike WWTP would not overflow more than 4 times in a typical year, CSO regulators in the downtown area would not overflow but once every ten years on average, and remaining CSOs would be fully controlled in a typical year. With the design changes that have taken place to the tunnel (OARS) over the last several years, that goal will largely be achieved with only a small volume of CSO remaining to be addressed, mainly along the Olentangy corridor. This is an enormous success that is ten years ahead of schedule.

On the SSO side, there is one location, known as DSR 083 that accounts for over half of the SSO volume on an average annual basis. The City is targeting 2015[1] for collection system improvements including a weir raise at DSR 083 that will allow the City to eliminate the DSR 083 SSO, or, more precisely, control it to the proposed level of service of one overflow once every ten years on average. This means that the City will have eliminated over half of its SSOs (by volume) in 2015-17, many years earlier than predicted in the WWMP.

The City has been and will continue to make strong progress in terms of controlling its overflows. However, as set forth in the City's August 8, 2012 letter to Ohio EPA's Director Nally, the City believes this progress should take a different path in the future, green rather than gray.

In the City's August letter, Columbus sought to delay certain projects from the WWMP so that it could investigate whether an Integrated Plan approach would provide more benefit to our community and better meet Clean Water Act objectives. Integrated Planning is a concept USEPA set forth in its June 2012 "Integrated Municipal Stormwater and Wastewater Planning Approach Framework." It allows a community to prioritize its clean water obligations to maximize water quality benefits. The Integrated Plan framework also strongly encourages the use of green infrastructure. The City proposed pausing some WWMP gray projects until September 15, 2015, at which time the City would submit an Integrated Plan.

Ohio EPA responded to the City's letter on August 24, 2012. Ohio EPA largely agreed with the City's proposal to delay certain WWMP projects. The one exception was concerning the Alum Creek Relief Tunnel Phase A project (ART-A). Ohio EPA requested that the City submit this report by October 31, 2012 that would "justify and support" the delay of ART-A.

Please note the City is not requesting, at this time, any actual change in the WWMP technologies. We are not asking permission to abandon ART (or ORT) at this time. The request is simply for a delay in schedule. In the seven years since the WWMP was submitted, we have asked for and received permission to change the schedule on several occasions.

History of ART-A

The WWMP addressed the elimination of SSOs primarily through the construction of two large-diameter tunnels. One was on the east side of the City known as the Alum Creek Relief Tunnel (ART). The other was on the west side, known as the Olentangy Relief Tunnel (ORT). In addition to the large tunnels, the WWMP included additional treatment plant expansions and localized solutions for certain high priority areas that will not be resolved by the tunnels alone.

Each tunnel was divided into three phases, A, B and C, see **Figure 3**. ART-A was scheduled first with the belief that it would address substantial health and environmental issues. Those issues included mitigation of DSR 083, which as discussed above, is a very active and the highest volume SSO in the City's system. In addition, it was believed that ART-A was necessary to provide relief to the Livingston/James area basement backups.

[1] As discussed below, the weir raise is currently scheduled to be completed in 2015 but detailed design is just starting. It is possible that issues such as easement acquisition or radio/SCADA issues may delay completion to 2017; however, the city will work to complete the improvement as expeditiously as practicable.

The current ART-A schedule approved by the OEPA has the ART-A completed in 2019. The schedule includes engineering and geotechnical work between 2005 and 2011, land acquisition between 2008 and 2013, and construction and construction management between 2014 and 2019.

The current schedule then has phases A and B of ORT being constructed next, and then ART phase B, ORT phase C, and ART phase C. This is the current schedule, in terms of year the tunnel section is to be completed:

- ART-A: 2019
- ORT-A:2029
- ORT-B: 2036
- ART-B: 2039
- ORT-C: 2042
- ART-C: 2045

In other words, ART-A will not be joined to ART-B until 2039, 20 years after ART-A is completed. Again, this was scheduled this way because of the immediate benefits the City thought ART-A would provide.

As set forth in detail below, it turns out that the City was mistaken in its assumption that ART-A would provide any significant benefits by itself. The City has completed substantial analyses since the WWMP was submitted including a completely new collection system model and detailed study of the Livingston/James area, as seen in **Figure 3**. Based on the detailed evaluations it is now clear that ART-A provides no significant benefit with regard to overflows or basement back-ups. This finding could not have been determined based on the time and data available during the original plan development.

At this point, it is clear to the City that the **only** solutions for basement backups and overflows in the ART-A area are local solutions. The Integrated Plan, with its emphasis on Infiltration and Inflow (I/I) removal and green infrastructure, may well be the best and most expeditious solution for these local issues by addressing stormwater quality issues at the same time as controlling sewer overflows and basement backups.

Proposed Integrated Plan

If the Ohio EPA approves the City's request to delay ART-A, the City will pursue the following plan. By September 15, 2015, the City will submit to Ohio EPA an Integrated Plan that relies more heavily on I/I removal and green infrastructure. The Integrated Plan will include all of the attributes set forth in the City's August letter.

Also on September 15, 2015, the City will propose a new schedule for the default, gray WWMP that includes a schedule that is shorter than the current schedule. In other words, any delay in the ART tunnel benefits will be recovered.

Delaying ART-A makes sense for at least the following reasons. First, ART-A does virtually nothing to reduce overflows and basement backups until ART-B is connected 20 years later.

Second, it is a very expensive project. The WWMP estimated the cost of ART-A at $261,000,000 for construction and construction services in January 2005 costs. Utilizing the Engineering News Record (ENR) construction cost index to scale this cost to July 2012 dollars yields $334,000,000. The City is not proposing that the Integrated Plan will be less expensive; indeed, we believe it will cost at least as much as the current WWMP. But spending $334,000,000 on ART-A in the next couple of years will effectively prevent the City from pursuing the Integrated Plan fully. It will commit the City to building all of ART (as building only ART-A would be pointless, since it has no value by itself). Once ART is built, the City would have to complete the rest of the gray plan on the east side to fully take advantage of ART so that the investment is not wasted. In other words, requiring the City to proceed with ART-A now will effectively prevent the City from exploring an option that may have much greater benefits – environmental, social and economic.

The third reason to allow the City to delay ART-A is because ART-A is fundamentally inconsistent with the direction we should be heading. The future of stormwater control is to move toward managing stormwater where it falls, using natural systems. This trend, which encourages infiltration, will only continue to make overflows worse unless it is paired with aggressive control of I/I. In other words, the current gray solution of tunnels may ultimately fail as the City moves toward compliance with the new stormwater regulations, which will require more attempts at infiltration, which will result in more infiltration into sanitary sewers.

One question that has arisen is how quickly could the City start construction of ART-A if and when the Integrated Plan becomes non-feasible. It is likely that the scope of the gray infrastructure will be further refined as the plan is reevaluated for the 2015 submittal. Some land acquisition also will require either revision or completion. If necessary, the City could begin construction on ART-A within three years of determining that such construction was necessary.

COLLECTION SYSTEM MODELING

A Storm Water Management Model (SWMM) was utilized to determine the detailed impact that ART-A has on the collection system overflows. The SWMM model used was an updated version from the one utilized during the WWMP development. The model was simulated utilizing 2015 conditions, and the most current rainfall information available. This section describes the collection system modeling in detail.

Model Information

The collection system model utilized for this current analysis was not the one utilized during the WWMP. Since the submission of the WWMP in 2005 the City has been continually improving their collection system model. The current model is built on the most recent SWMM platform, SWMM 5.

The new model has been enhanced to include all 12-inch and larger pipes, whereas the WWMP model only included 18-inch and larger pipes. This has more than doubled the number of pipes in the model.

In addition, the model calibration has been enhanced. The current model has been calibrated utilizing a continuous year-long storm profile. In contrast, the WWMP models were calibrated only for a single large storm event for the SECAP, and for the LTCP, only one continuous month of data was used for calibration. This improvement has enhanced the predictive capability of the model.

The updated model also includes updated ground water and I/I data. In fact, the future build-out conditions for I/I were improved. The WWMP models utilized the historical I/I values, even for new development. New development in the updated model uses more realistic, lower I/I values.

The new model includes updated population estimates from the 2010 Census and Mid-Ohio Regional Planning Commission (MORPC), as well as updated operational information. For over a year the model development effort included meetings and coordination with the collection system and wastewater treatment plant operators in order to improve model operations. The current model now is better able to simulate real operations.

RPM Model

After model development, the updated SWMM model was then modified in order to generate a Reduced Pipe Model (RPM). The RPM was created in order to speed simulation time. The RPM is the same model; however, the number of pipes in the model has been reduced by combining pipes. Pipes that were combined were those in stretches with the same diameter, slope, and other similar hydraulic characteristics. The RPM model was verified against the more detailed model to ensure that it provided accurate predictions.

2015 Condition Key Features

In order to determine the impact that ART-A will have on the collection system overflows the model was updated to a 2015 condition. This includes the completion of OARS (Olentangy Scioto Intercepting Sewer Augmentation and Relief Sewer), the Scioto Main Relief structure (SMR), the weir raise at DSR 083, CSO regulator weir raises, WWTP expansions, and inflow redirection projects, as described below:

The largest update to the WWMP collection system model is the construction of OARS. The OARS is a 20-foot diameter tunnel from the Henry Street Regulator to Jackson Pike WWTP in order to convey CSO flow for treatment. The OARS is scheduled for completion in 2015.

Another key feature of the updated model is the addition of the SMR. The SMR is a connection between the Scioto Main Trunk Sewer and the Interconnector Sewer, located just north of the Jackson Pike WWTP. This relief allows flow from the Scioto Main Trunk Sewer to discharge directly to the Interconnector Sewer. This new structure improves the hydraulics and control of flows from the OARS, Olentangy-Scioto Intercepting Sewer, and Scioto Main Trunk Sewer, three very large sewers that terminate just upstream of the Jackson Pike WWTP.

Another planned improvement is a weir raise at DSR 083. The City is currently evaluating the impact of the weir raise on basement backups and how to mitigate those impacts. While the weir raise is currently scheduled to be completed by the end of 2015, this schedule may well have to be adjusted if easement acquisitions are needed and if radio/SCADA systems are not ready. Nonetheless, for purposes of this model run, the weir raise is included in the 2015 scenario. The 2015 scenario has the weir raised to an elevation of 705 feet from a current elevation of approximately 699 feet. This increase in weir height level eliminates all predicted overflow at the DSR for the historical 16-year rainfall record.

Additional improvements also include the 2008 weir raises at CSO regulators, expanded peak flow capacities at the WWTPs, and several inflow redirection projects the City has completed.

Sixteen Years of Rainfall

When the City initially began collection system modeling, a need was identified to install rain gages across the City in order to augment the relatively few rain gages available from the National Weather Service. These City-owned rain gages would provide data that would vary temporally and spatially that could be utilized in the collection system model.

The current model uses data from the City's 27 rain gages and an additional 28 DIAD rain gages to generate rainfall distribution for each meter basin in the model. Using this data the RPM model is run continuously for the full 16 years of rainfall in order to predict collection system overflow statistics.

For example, based on the model output, if an overflow location is predicted to be active 11 times in the 16 years, a 1.45 year level of service is therefore achieved.

Model Scenarios Investigated

Utilizing the RPM model, the 16 years of rainfall information and the updated collection system configuration, the 2015 RPM model was simulated with and without ART-A. The modeling results are described below.

MODELING RESULTS

The City's RPM model was used to analyze the impact that ART-A has on the 2015 collection system in order to report the impacts of delaying the project while an Integrated Plan is developed. The modeling results are presented in detail below. The Base 2015 Conditions Section below presents CSOs, SSOs and plant bypass information without ART-A while the 2015 Conditions and ART-A Section presents the same information with ART-A. In addition to CSOs, SSOs and bypasses, the City also used the model to determine other flows that might escape the system by manhole flooding or basement back-ups.

Base 2015 Conditions

The base condition model is the City's RPM model adjusted as discussed earlier. In general, this condition includes the following completed collection system upgrades:

- OARS
- SMR
- DSR 083 weir raise
- All other 2005-2015 collection system and WWTP upgrades
    - Weir and orifice modifications at Cherry/Fourth
    - Weir and orifice modifications at Town /Fourth
    - Sewer separation project at First Avenue
    - Incorporated separation upstream of contributory area and closed overflow at Fulton/Grant

The model overflow statistics are presented in **Table 1** for all overflows in the collection system. The first row in the table holds the statistics for the Base 2015 Conditions. In addition, **Table 2** quantifies the average annual overflows based on the 16 year analysis.

SSOs for Base Condition

Table 1 quantifies the total SSO flow from the collection system as 189 Million Gallons (MG) over the 16 year period or an average of 12 MG per year. It is important to note that in the 16-year analysis the model shows no activations at DSR 083, which has historically been the most active SSO location in the City's collection system. A better control strategy for DSR 083 has been one of the major benefits of the work that has taken place since the City submitted the WWMP.

Another key location is DSR 244, the SSO just downstream of the Livingston/James area. In the base condition DSR 244 activates six times in 16 years of record and spills 6.34 MG (less than 0.4 MG per year on average).

CSOs for Base Condition

Table 1 quantifies the total CSO flow from the collection system as 5785 MG over the 16-year period or an average of 362 MG per year. The key location that would potentially benefit from ART-A is the Alum Creek Storm Tank (ACST) location. During the 16-year period the ACST activated 23 times (less than two times per year on average) and spilled 90.2 MG (less than six MG per year on average).

Southerly Bypass for Base Condition

Table 1 shows three columns for Southerly WWTP bypass. The first two columns (in white) are SWWTP Mechanical Bypass and SWWTP Gravity Bypass. During wet weather, the plant uses the SWWTP Mechanical Bypass first and is maximized at 110 MGD, at which time the SWWTP Gravity Bypass is activated. In other words, every time the gravity bypass is activated, the mechanical bypass is already activated.

The column labeled "Total WWTP Bypasses" is the sum of the two Southerly bypasses. The volume from the two bypasses combined is 2701 MG over the 16 years of record, or an average of 169 MG per year. Activations remain at 28 days (less than 1.8 times per year on average), as the 12 days the gravity bypass is activated are included in the 28 days the mechanical bypass is activated.

<u>2015 Conditions and ART-A</u>

The 2015 Conditions and ART-A model is the City's RPM model configured as discussed above. In general, this condition includes the following completed collection system upgrades:

- ART-A, as described in the WWMP (14-foot diameter)
- OARS
- SMR
- DSR 083 weir raise
- All other 2005-2015 collection system and WWTP upgrades
    - Weir and orifice modifications at Cherry/Fourth
    - Weir and orifice modifications at Town /Fourth
    - Sewer separation project at First Avenue
    - Incorporated separation upstream of contributory area and closed overflow at Fulton/Grant

The model overflow statistics are presented in **Table 1** for all overflows in the collection system. The second row of the table holds the statistics for the 2015 Conditions and ART-A. Likewise, **Table 2** quantifies the average annual overflows based on the 16 year analysis.

SSOs with ART-A

Table 1 shows that ART-A reduces the system SSOs from 189 to 181 MG in the 16 years of record. The average annual overflow reduces from 11.8 MG per year to 11.3 MG per year. This is a reduction of 8 MG of SSO over the 16-year period, or 0.5 MG per year. The SSO most significantly influenced by the construction of ART-A is DSR 244 downstream of the Livingston/James area but directly upstream of the Alum Creek Trunk and proposed ART-A tunnel. This SSO was reduced to one overflow in the 16 years of record and 0.85 MG of overflow. This is a reduction of 5.49 MG of overflow in 16 years, or 0.34 MG per year. There are no overflows at DSR 083 with or without ART-A as a result of the proposed weir raise and associated pump stations the City is targeting to install by 2015 (or no later than 2017).

CSOs with ART-A

The modeling results summarized in **Table 1** show that ART-A reduces the total system CSO flow from 5785 to 5683 MG, a reduction of 102 MG in 16 years of record. The majority of the reduction is from the reduced overflow from OARS, the other portion is coming from the reduction in overflow at the Alum Creek Storm Tanks. At that location, the analysis shows that in the 16 years of record there is one less activation, and 32.2 MG less overflow with ART-A.

It should also be noted that ART-A does reduce 0.02 MG of overflow in a single event at the Whittier Street Storm Tanks in the 16 years of record as well.

Southerly Bypass with ART-A

The column labeled Total WWTP Bypasses summarizes the impact ART-A will have on the bypasses at Southerly WWTP. Total days of activations are reduced by one over the 16 years, from 28 to 27. Total volume is reduced by 215 MG of overflow at the Southerly bypass in 16 years of record.

Manhole Flooding

With the 16 year historical storm record run over the RPM collection system model it was found that there were manholes that were flooding. Using the RPM models described above the total manhole flooding volume was determined in the Alum Creek Trunk basin, with and without ART-A.

If ART-A is not installed manhole flooding in the 16 years of record totals 297.5 MG. With ART-A for the same 16 years of record there are 206.4 MG of overflow from the manholes. This is a reduction of 91.1 MG in 16 years, or about 5.7 MG of reduction per year.

ART-A does not provide a complete or significant solution for manhole flooding in the Alum Creek Trunk (ACT) basin.

Basement Backup Analysis

The collection system model was utilized in order to determine the impact that ART-A would have on basement backups or Water-In-Basement events (WIBs). In order to perform the analysis the RPM was used to determine how the hydraulic grade lines (HGL) in the main trunk sewers were affected by ART-A. Then the areas where the HGL increased were simulated in the detailed model network (which contains pipes 12 inches in diameter and larger) and elevations of basements were correlated with the detailed model nodes using a Geographic Information System (GIS). A rainfall event was simulated using this detailed model network both with and without ART-A to determine the benefits of the tunnel.

A single storm event was selected from the 16-year record for this analysis. The storm event was selected based on the ACT flow into ART-A. The selected storm event was the April 16, 1998 event, which was the highest flow event for the connection of the ACT to ART-A. Using the Plotting Position statistical approach with Cunnane parameters to determine the peak flow return period, this equates to a 27-year peak flow recurrence.

Using the RPM model it was determined that the HGL of several trunk sewers were impacted by ART-A. In the areas where the RPM model showed a change in HGL in the trunk sewer, this area was defined as the area of influence for ART-A.

Knowing the area of influence of ART-A, the detailed model was run for the April 16, 1998 event. This highlighted a total of 86 buildings with the potential for a WIB event out of the 23,383 buildings in the area of influence. Of those 86 buildings, 73 are still at risk, whether ART-A is installed or not. However, ART-A does reduce the WIB potential for an estimated 13 buildings for the April 16, 1998 event. In other words, ART-A's only impact on basement backups is to potentially eliminate the overflows for 13 buildings during a storm event that far exceeds the ten year storm that the WWMP is designed to meet.

CONCLUSION

Table 3 below summarizes the modeled overflow reduced by constructing ART-A.

Table 3: Summary of ART-A Benefits

Flow Classification	Base Condition Volume (MG) Over 16 Years	Volume Reduction (MG) Over 16 Years	Estimated Annual Volume Reduction (MG)
SSO	189	8	0.5
CSO	5785	102	6.4
Southerly Bypass	2701	215	13.4
Manhole Flooding	297.5	91	5.7
Total	**8972.5**	**416**	**26**

The **Table 3** shows that ART-A reduces the volume of overflow by less than 5% over 16 years, with an estimated annual overflow reduction of 26 MG.

Detailed collection system modeling described above illustrates that for the largest storm event in the 16-year record ART-A would potentially alleviate 13 WIBs in the area buildings.

ART-A, by itself, is not a good investment for the City. ART-A, by itself, would result in a small reduction of overflows that would cost $12.85 per gallon per year. To contrast this with the recent efforts, the City has spent roughly $1 billion to remove over a billion gallons of overflow annually or $1.00 per gallon per year.

Rather than proceeding on the current schedule that has ART-A being built only to be virtually useless for the following 20 years, the City is requesting a delay in ART-A. As set forth in the City's request, dated August 8, 2012, if Ohio EPA allows a delay in ART-A, then by September 15, 2015, the City will submit a schedule that is shorter than the current WWMP schedule and will make up any ground lost in delaying the start of ART-A.

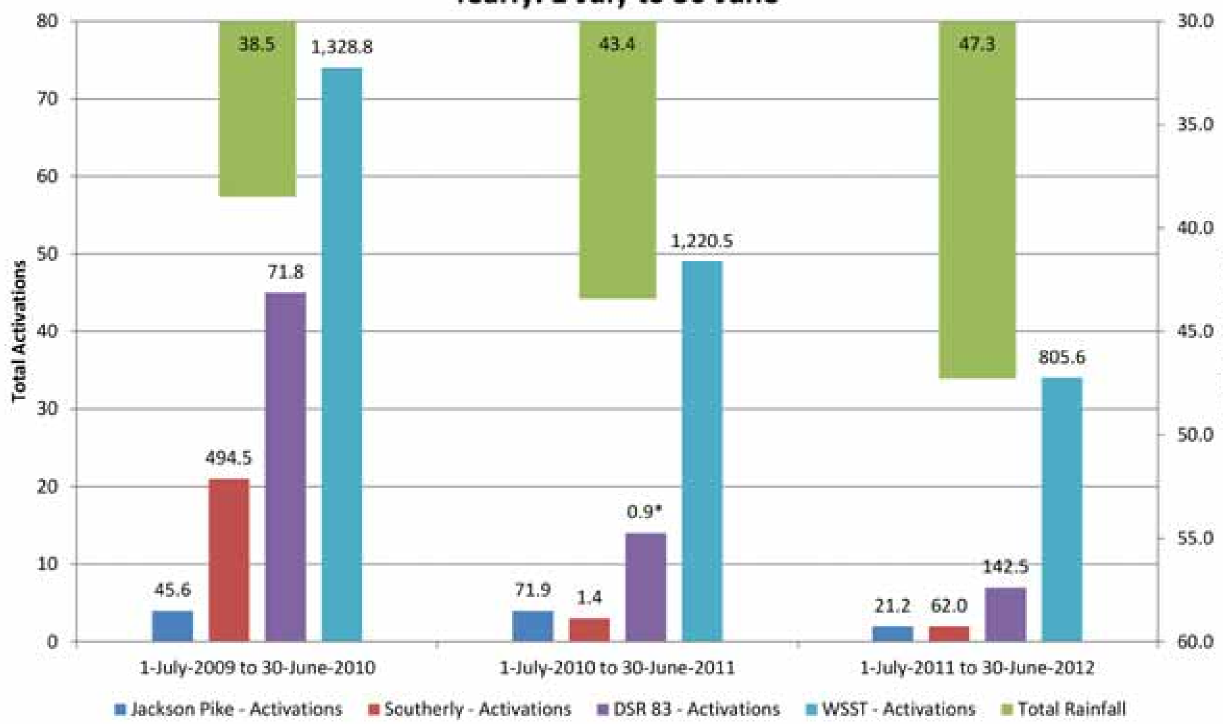
Please contact us if you have additional questions regarding this analysis.

Sincerely,

Dax J. Blake, P.E.
Administrator
Division of Sewerage and Drainage

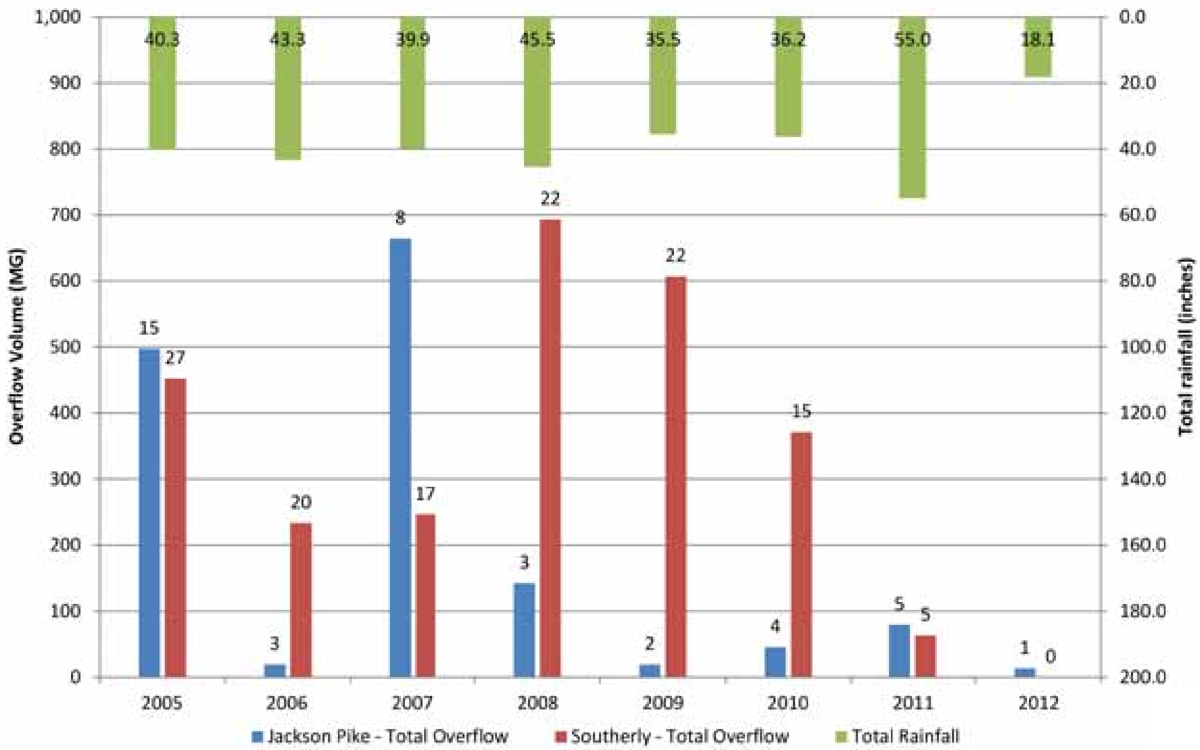
cc: George Elmaraghy, Chief DSW Ohio EPA
Paul Novak, DSW Ohio EPA
Mike Galloway, DSW-CDO Ohio EPA
Greg Davies, Director Columbus DPU
Susan Ashbrook, Assistant Director Columbus DPU

Figure 1: Jackson Pike, Southerly, DSR 083, Whittier Street Storm Standby Tanks Total Activations
Yearly: 1-July to 30-June



* DSR 083 activations during this period were estimated utilizing an upstream flow meter, only available volume information is reported.
All activation bars are labeled with volume in Million Gallons (MG).

Figure 2: Jackson Pike and Southerly WWTP Total Overflow Volume (MG) Years 2005 thru May 2012



All volume bars are labeled with number of activations.

Figure 3: Tunnel Phases, DSR 083, and Livingston/James Study Area

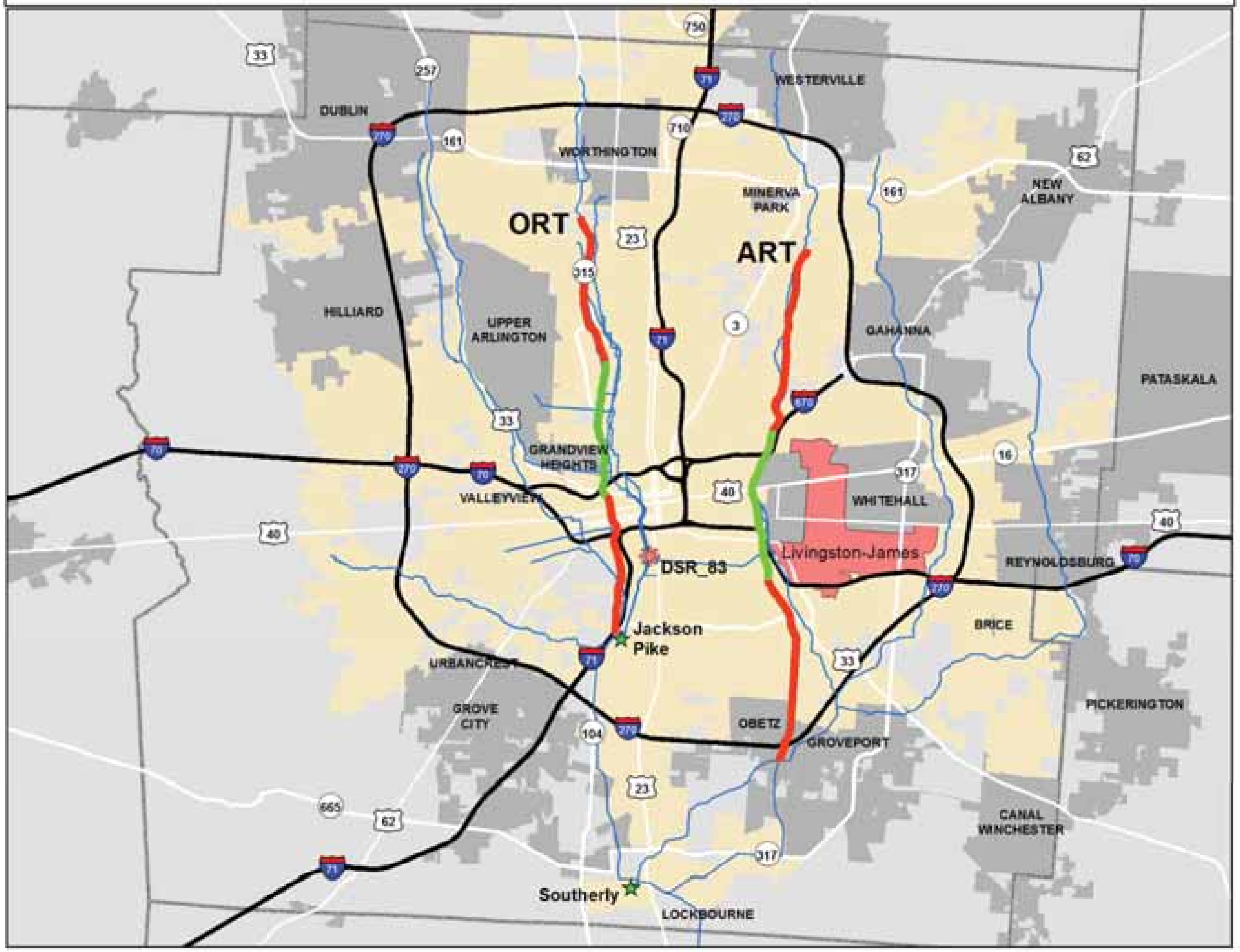


Table 1: Modeling Overflow Statistics at Key Locations, 16 Years of Record

		OARS Weir OF	WSST Weir OF	WSST Emergency Gates	JPWWTP Mechanical Bypass	JPWWTP Gravity Bypass	SWWTP Mechanical Bypass	SWWTP Gravity Bypass	DSR 083 Deschler	DSR 244 Livingston/James	ACST	Total WWTP Bypasses	Total System CSO	Total System SSO	Total System Overflow
Base 2015 Conditions	16Y Total Overflow Volume (MG)	5,501	0.02				1,739	962		6.34	90.2	2,700	5,785	189	8,674
	16Y Number of Activations	48	1				28	14		6	23	28			
2015 Conditions and ART-A	16Y Total Overflow Volume (MG)	5,432					1,631	855		0.85	58	2,486	5,683	181	8,351
	16Y Number of Activations	48					27	12		1	22	27			

OF = Overflow
MG = Million Gallons
Y = Year

Table 2: Modeling Overflow Statistics at Key Locations, Average Annual

		OARS Weir OF	WSST Weir OF	WSST Emergency Gates	JPWWTP Mechanical Bypass	JPWWTP Gravity Bypass	SWWTP Mechanical Bypass	SWWTP Gravity Bypass	DSR 083 Deschler	DSR 244 Livingston/James	ACST	Total WWTP Bypasses	Total System CSO	Total System SSO	Total System Overflow
Base 2015 Conditions	AA Total Overflow Volume (MG)	344	0.00				109	60		0.40	5.64	169	362	11.8	542
	AA Number of Activations	3	0.06				1.75	0.88		0.38	1.44	1.75			
2015 Conditions and ART-A	AA Total Overflow Volume (MG)	340					102	53		0.05	3.63	155	355	11.3	522
	AA Number of Activations	3					1.69	0.75		0.06	1.38	1.69			

AA = Average Annual, the information provided in Table 1, but divided by 16 to determine the average annual estimate

OF = Overflow

MG = Million Gallons

Y = Year

40 years and moving forward

John R. Kasich, Governor
Mary Taylor, Lt. Governor
Scott J. Nally, Director

December 4, 2012

Dax J. Blake, P.E.
Administrator, Division of Sewerage and Drainage
1250 Fairwood Avenue
Columbus, Ohio 43206

Re: Alum Creek Relief Tunnel, Phase A Project Delay

Dear Mr. Blake:

We have received your submittal of October 31, 2012, regarding the delay of the Alum Creek Relief Tunnel, Phase A (ART-A) project and have completed our preliminary review. In addition we met on November 21, 2012, to clarify our mutual understanding of the issues.

Your letter requests a delay of construction of ART-A until after you have completed the preparation of an Integrated Plan of storm water and CSO/SSO control, which we have agreed is due to be submitted by September 15, 2015. Currently, ART-A is due to be completed by 2019, and construction is due to commence prior to the submission of the integrated plan.

We have carefully considered your request but remain concerned about the volume of overflows that are predicted to occur once current system improvements are complete. These volumes are outlined in Table 3 of your submission, which is reproduced below. The Integrated Plan, as proposed, is to focus on a combination of green infrastructure and aggressive I/I removal to help address these overflows. These methodologies have a high level of technical, political, and jurisdictional uncertainty associated with them. Because of this uncertainty and the need to address the overflows as expeditiously as practical, Ohio EPA is willing to agree on delay of ART-A if the City will commit to addressing the overflow volumes at the Southerly Bypass and remaining CSO discharges utilizing some sort of high rate treatment (HRT) or chemically enhanced primary treatment (CEPT). The HRT/CEPT would be completed and fully operational by 2019 and would be designed to achieve a TSS discharge of 30 mg/L or better with disinfection (averaged across 7 consecutive activations).

It is our position that any extended delay in completing Large Scale System Strategies (LSSS) contained in your currently approved Wet Weather Management Plan (WWMP) would require formal modification of the plan, as indicated in Director Nally's letter of August 25, 2012. However, if the City can commit to installation of HRT/CEPT no later than the current 2019 schedule for ART-A, then Ohio EPA will take the position that the City is exchanging one LSSS for another LSSS that will be completed within the current schedule, and no modification of the WWMP will be required at this time.

Please let us know your intentions in this matter. If you have any questions, please don't hesitate to contact me at 614-728-3847 or at Sheree.Gossett-Johnson@epa.state.oh.us .

Sincerely,

Sheree Gossett-Johnson
Environmental Specialist
Division of Surface Water
Central District Office

c: George Elmaraghy, Chief, DSW
Isaac Robinson, Chief, CDO
Paul Novak, DSW
Mike Gallaway, DSW-CDO
Erin Sherer, DSW-CDO
Susan Ashbrook, City of Columbus

SGJ/nsm Wet Weather Art A Delary Proposal Comments December 4, 2012

Table 3: Summary of ART-A Benefits

Flow Classification	Base Condition Volume (MG) Over 16 Years	Volume Reduction (MG) Over 16 Years	Estimated Annual Volume Reduction (MG)
SSO	189	8	0.5
CSO	5785	102	6.4
Southerly Bypass	2701	215	13.4
Manhole Flooding	297.5	91	5.7
Total	**8972.5**	**416**	**26**

GREG J DAVIES
Director

THE CITY OF
COLUMBUS
MICHAEL B. COLEMAN, MAYOR

DEPARTMENT OF
PUBLIC UTILITIES

December 10, 2012

Ms. Sheree Gossett-Johnson
CDO/Division of Surface Water
Lazarus Government Center
50 West Town Street, Suite 700
Columbus, OH 43215

Dear Ms. Sheree Gossett-Johnson:

Thank you for your letter of December 4, 2012 in response to the ART-A report the City submitted to Ohio EPA on October 31, 2012.

Your letter requests that the City commit to building high rate treatment (HRT) or chemically enhanced primary treatment (CEPT) at Southerly by 2019. That proposal is acceptable to the City. We anticipate that the HRT/CEPT would be designed to treat up to 110 MGD peak flow and include disinfection. We are also amenable to design the HRT/CEPT to meet a discharge limit of 30 mg/l TSS averaged across 7 activations.

We are not able to commit to that limit as a performance criterion at this point. We plan to study what an achievable limit would be for our system, including potentially doing a pilot study. By the time we submit the Integrated Plan in September 2015, we would be prepared to discuss an achievable performance standard, with supporting data.

The City proposes the following schedule for the HRT/CEPT:

Design Start: April 2014

Start Construction: May 2017

Operational: December 16, 2019

Please let us know if this is acceptable.

Sincerely,

Dax J. Blake, P.E., Administrator
Division of Sewerage and Drainage

Director's Office | 910 Dublin Road | Columbus OH 43215 | T (614) 645.6141 | F (614) 645.8019
Sewerage and Drainage | 1250 Fairwood Avenue | Columbus OH 43206 | T (614) 645.7175 | F (614) 645.3801
Power and Water | Administration | 910 Dublin Road | Columbus OH 43215 | T (614) 645.7020 | F (614) 645.3993
Customer Service | Power and Water | T (614) 645.8276 | F (614) 645.0222 | TDD (614) 645.7188
columbus.gov

40 years and moving forward

John R. Kasich, Governor
Mary Taylor, Lt. Governor
Scott J. Nally, Director

RECEIVED
JAN 24 2013
Central District Office
Ohio EPA

Greg J. Davies, Director
Department of Public Utilities
City of Columbus
910 Dublin Road
Columbus, OH 43215

Re: **WWMP Amendments**

Dear Director Davies:

I am writing to formalize an agreement made between our respective staffs regarding Columbus' path toward Integrated Planning, which includes both Green Infrastructure and achievement of the goals of the approved Wet Weather Management Plan (WWMP). In my approval letter of August 24, 2012, I indicated that there were still outstanding issues with the City's proposal regarding Large Scale System Strategies (LSSS) under the WWMP, and asked that a report be submitted by October 31, 2012 with a more detailed analysis of the situation.

The City subsequently submitted a report on October 31, 2012, and our respective staffs met to discuss this report on November 21, 2012. In a December 4, 2012 letter, Ohio EPA provided comments on the City's proposal outlining the agreement reached in that meeting. On December 10, 2012, the City responded to the comments, agreeing to the options discussed in Ohio EPA's letter of December 4, and provided a schedule of activity associated with achieving LSSS implementation in accordance with the existing schedule in the approved WWMP.

The City has agreed to advance the installation of High Rate Treatment (HRT) technology from the current 2025 due date, so that installation will be complete by the current 2019 due date for completion of the Alum Creek Relief Tunnel, Phase A (ART A). By substituting the HRT, specifically Chemically Enhanced Primary Treatment with Disinfection (CEPT) for ART A, the City has chosen to implement one LSSS sooner than another LSSS.

The results of the Integrated Planning Effort is due on September 30, 2015, as part of a WWMP modification request. The current WWMP requires that construction on ART A begin in 2014. The due date for the beginning of construction of ART A will be delayed until after the September 30, 2015 due date for the WWMP modification request to allow for consideration of ART A in the integrated planning effort. Columbus will submit its revised analysis regarding the construction of ART A in the September 2015, WWMP modification request.

With this letter I am approving the substitution of HRT/CEPT for ART A in order that the City might undertake the Integrated Planning Effort and still maintain the current schedule in the approved WWMP. The City has agreed to adhere to the following schedule for the implementation of HRT/CEPT that will achieve a discharge level of 30mg/l Total Suspended Solids averaged across 7 activations:

Design Start: April, 2014

Start Construction: May, 2017

Complete Construction: December 16, 2019

I believe this approach allows for the City to begin storm water and CS0/SSO integrated planning, along with the inclusion of Green Infrastructure practices into the WWMP, while still protecting water quality.

If you have any questions, please contact George Elmaraghy, Chief, Division of Surface Water, at 614-644-2041.

Sincerely,

Scott J. Nally, Director
Ohio Environmental Protection Agency

c: George Elmaraghy, Chief, DSW
Isaac Robinson, Chief, CDO
Paul Novak, DSW
Mike Gallaway, DSW-CDO
Sheree Gossett-Johnson, DSW-CDO
Susan Ashbrook, Columbus Department of Public Utilities
Dax Blake, Columbus Department of Public Utilities

SJN/MG/nsm Wet Weather HRT Substitution Approval January 7, 2013 Final

APPENDIX

B

APPENDIX B

THE CITY OF COLUMBUS
MICHAEL B. COLEMAN, MAYOR

DEPARTMENT OF PUBLIC UTILITIES

The Integrated Plan and 2015 WWMP Update Report

BLUEPRINT COLUMBUS

Clean streams.
Strong neighborhoods.

Clean streams. Strong neighborhoods.

APPENDIX B - PROJECTS TABLE FOR SECTION 2.2

#	Project CIP Name	WWMP Dates: Design Start / Operationally complete	Operational	Partially Constructed	On Hold	Original Scope/Schedule	Canceled	Added	Modified Scope/Schedule	Comments
LSSS Projects (SECAP)										
Olentangy Relief Tunnel (ORT)										
1	Phase A	2015 / 2030				X				
2	Phase B	2025 / 2037				X				
3	Phase C	2031 / 2043				X				
4	Olentangy Pump Station	2019 / 2029				X				
Alum Creek Relief Tunnel (ART)										
5	Phase A	2005 / 2016			X					Project on hold: See Appendix B August 12th, 2012 Letter and HRT-CEPT Approval January 24th, 2013 Letter. OEPA approved but asked the City to accelerate the HRT/CEPT project schedule.
6	Phase B	2028 / 2040				X				
7	Phase C	2035 / 2046				X				
Priority Area Projects (SECAP)										

APPENDIX B - PROJECTS TABLE FOR SECTION 2.2

#	Project CIP Name	WWMP Dates: Design Start / Operationally complete	Operational	Partially Constructed	On Hold	Original Scope/Schedule	Canceled	Added	Modified Scope/Schedule	Comments
8	Castle Rd. / Williams Rd	2036 / 2042				X				
9	Cleveland / Ferris	2019 / 2027							X	This priority area was combined with N.W. Alum Creek priority area. See #13.
10	Clintonville	2006 / 2023		X	X					Whetstone Relief and Park of Roses projects on hold: See Appendix B August 8th, 2012 Letter. DSR 337 mitigation (Richards Road Relief) completed construction in 2013 awaits final mitigation after completion of model results.
11	Early Ditch	2006 / 2035			X					Design Report Completed in 2010. Phase I lining construction completion 2013. Phase II lining construction to begin 2015. DSR 250 mitigation on hold: See Appendix B August 8th, 2012 Letter.
12	Miller / Kelton	2008 / 2021			X					Design Report Completed in 2011. Gault Street Relief sewer project on hold:See Appendix B August 8, 2012 Letter.
13	N.W. Alum Creek	2006 / 2024			X					Design Report complete 2012. System Optimization and Weir Raises completed on schedule. Suwanee/Railroad Relief project on hold: See Appendix B August 8, 2012 Letter.
14	Barthman / Parsons	2007 / 2024			X					Design Report completed in 2011. Hinman Avenue Relief Sewer project on hold: See Appendix B August 8th, 2012 Letter.
15	Plum Ridge	2008 / 2026			X					Design Report completed in 2011. Per the 2012 Annual WWMP Projects Progress report, the removal of Area Driveway Drains was determined to be ineffective.
16	Preston Road	2006 / 2007	X							DSR Bulkheaded operationally completed January 2007.

APPENDIX B - PROJECTS TABLE FOR SECTION 2.2

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17	West 5th Ave	2006 / 2027			X					Design Report completed in 2010. King and Third Avenue Relief Sewer projects on hold: See Appendix B August 8, 2012 Letter.
18	Winslow	2008 / 2008	X							Work done by SMOC; DSR Bulkheaded, operationally completed in 2008.
19	Sullivant Ave	2006 / 2013	X							Point Repair completed in 2006. Engineering work began 2007. CIPP work completed; Design Report completed 2012. DSR removed in 2013.
20	Livingston James	2005 / 2012			X					Design Report completed, began in 2005, Project on hold .
LTCP Projects										
21	OSIS Augmentation Relief Sewer (OARS) Phase I	2006 / 2010							X	The OEPA approved the design change from an 18' diameter near surface conduit to a 20' diameter deep tunnel in 2008. New operationally complete date of 2014. See Appendix A: 2010 Revised Interim Plan Approval Letter. Currently the deep tunnel design is completed but construction is delayed due to the tunnel boring machine having issues and ground condition issues. New operationally complete date has not yet been determined.
22	OARS Phase II	2009 / 2017							X	Oringal scope was an 18' conduit that connected to OARS phase I at the WSST and extended north to W. Main Street. Per the 2010 Revised Interim Plan (Appendix A) all four phases of OARs are to be constructed together. The scope of phase II then changed to a pump station for the OARS deep tunnel design. See comment for #21.
23	OARS Phase III	2012 / 2021							X	Original scope was an 18' near suface conduit that connected to OARS phase II at W. Main street following the Scioto River's east bank up to Neil Ave. Per the 2010 Revised Interim Plan (Appendix A) all four phases of OARS are to be constructed together. Hence this project was Incorporated into phase I, see comment for #21.

APPENDIX B - PROJECTS TABLE FOR SECTION 2.2

#	Project CIP Name	WWMP Dates: Design Start / Operationally complete	Operational	Partially Constructed	On Hold	Original Scope/Schedule	Canceled	Added	Modified Scope/Schedule	Comments
24	OARS Phase IV	2016 / 2025							X	Original Scope was an 18' near surface conduit that connected to OARS phase III at Long Street and Neil Ave. continuing north to I-670 where the conduit stops. Per the 2010 Interim Plan (Appendix A) all four phases of OARS are to be constructed together. Hence this project was Incorporated into phase I, see comment for #21.
25	Moler Street Overflow Intercepting Sewer	2015 / 2024				X				
26	Transport and Treatment Peak Storage	2013 / 2019					X			10 million gallon storage tank for OARS tunnel. Canceled due to OARS tunnel design changed from 18' diameter to 20' diameter.
27	HRT/CEPT	2011 / 2017							X	OARS modified to deep tunnel therefor no need of HRT at JPWWTP eliminated by OARS design change. CEPT is added at SWWTP as a subsitute for the Far East Train project (#62) and ART-A project(#5). New schedule with design starting in 2015 and operational in 2019. See Appendix B HRT-CEPT Approval
CSO Sewershed Improvements										
28	Markison Avenue Sewershed (Increased OSIS Capture)	2008 / 2010			X					Project on hold: See Appendix B August 8, 2012 Letter
29	Moler Street Sewershed (Selective Stormwater Separation)	2015 / 2024				X				Design began in 2017, scheduled to be operational in 2021.
30	Whittier Street Sewershed (WR, Near Surface Conduit to OARS Phase 1)	2006 / 2016		X					X	Weir raise operational in 2008, under CIP 719 (Design began in 2006). The near surface conduit to OARS phase I operational in 2014 (Design began in 2010) but its use is dependent on the operational completion of OARS.
31	Peters Run Storm Tanks (WR)	2006 / 2008					X			Weir raise not recommend by RW Armstong design report for CIP 719. Design report completed in 2007.

APPENDIX B - PROJECTS TABLE FOR SECTION 2.2

#	Project CIP Name	WWMP Dates: Design Start / Operationally complete	Operational	Partially Constructed	On Hold	Original Scope/Schedule	Canceled	Added	Modified Scope/Schedule	Comments
32	Noble and Grant Sewershed (IR, WR, LS)	2006 / 2023		X		X				Weir raise operational in 2008 (Design began in 2006). Inflow redirection work operational in 2014 (Design began in 2008). Local Storage scheduled to be operational in 2022 (Design began in 2017).
33	Mound and Grant Sewershed (WR, LS)	2006 / 2015		X		X				Weir raise operational in 2008, under CIP 695 (Design began in 2006)
34	Town and 4th Sewershed (WR, IR)	2006 / 2015		X			X			Weir raise not recommended by Resource Interational design report (Design began in 2006).. Modified inflow redirect operational in 2014, under CIP 721 (Design began in 2008).
35	Cherry and 4th Sewershed (WR, IR)	2006 / 2015	X							Weir raise operational in 2008, under CIP 721 (Design began in 2006). Inflow redirection operational in 2014 (Design began in 2008).
36	Mound e/o I-71 Sewershed (IR, WR, LS)	2006 / 2022		X		X				Weir raise operational in 2008, under CIP 721 (Design began in 2006). Inflow redirect constructed in 2012 (Design began in 2008). Local Storage to be operational in 2021.
37	Dodge Park Combined PS Sewershed (Selective Stormwater Separation)	2017 / 2024				X				Future redevopement may modify project plans.
38	State Street Sewershed (WR)	2006 / 2008	X							Weir raise operational in 2008, under CIP 719 (Design began in 2006)
39	Capital Street Sewershed (WR)	2006 / 2008	X							Weir raise operational in 2008, under CIP 719 (Design began in 2006)
40	Broad Street Sewershed (WR)	2006 / 2008	X							Weir raise operational in 2008, under CIP 719 (Design began in 2006)

APPENDIX B - PROJECTS TABLE FOR SECTION 2.2

#	Project CIP Name	WWMP Dates: Design Start / Operationally complete	Operational	Partially Constructed	On Hold	Original Scope/Schedule	Canceled	Added	Modified Scope/Schedule	Comments
41	Long Street Sewershed (WR)	2006 / 2008	X							Weir raise operational in 2008, under CIP 719 (Design began in 2006)
42	Chestnut Street Sewershed (WR)	2006 / 2008	X							Weir raise operational in 2008, under CIP 719 (Design began in 2006)
43	Kerr and Russell Streets Sewershed (WR, LS)	2006 / 2022		X		X				Weir raise operational in 2008, under CIP 719 (Design began in 2006). Local storage scheduled to be operational in 2021 (Design begin in 2016).
44	First Avenue Sewershed (WR, IR, LS)	2006 / 2015		X			X			Weir rease not recommended by FMSM (Design began in 2006). Inflow redirective and local storage to be operational in 2014 (Design began in 2008). GET UPDATE ON THIS PROJECT FROM HAZEM-Kathleen is checking into this
45	Third Avenue Sewershed (WR, Sel. Stormwater Separation, LS)	2006 / 2024		X			X		X	Weir raise operational in 2008, under CIP 723 (Design began in 2006). Local storage componet canceled. Sewershed flowpath modified sending more flow to 1st street sewershed. Inflow redirection replaced with green infrastructure componet: design began in 2013, to be operational in 2016.
46	King Avenue Sewershed (LS)	2012 / 2018			X					Project on hold: See Appendix B August 8, 2012 Letter.
47	Indianola Avenue Sewershed (WR, LS)	2006 / 2020			X		X			Weir raise was not recommended by FMSM design report, CIP 723 (Design began in 2006). Local storage tank project on hold: See Appendix B August 8, 2012 Letter.
48	Frambes Avenue Sewershed (WR, LS)	2006 / 2020		X	X					Weir raise operational in 2008, under CIP 732 (Design began in 2006). Local storage tank project on hold: See Appendix B August 8, 2012 Letter.

APPENDIX B - PROJECTS TABLE FOR SECTION 2.2

#	Project CIP Name	WWMP Dates: Design Start / Operationally complete	Operational	Partially Constructed	On Hold	Original Scope/Schedule	Canceled	Added	Modified Scope/Schedule	Comments
49	Hudson Avenue Sewershed (WR)	2006 / 2008	X							Weir raise operational in 2008, under CIP 732 (Design began in 2006).
50	Alum Creek Sewershed (IR, Storm Sewer Redirection)	2015 / 2025			X					Project on hold: See Appendix B August 8, 2012 Letter.
Wastewater Treatment Plant Projects										
51	Second Barrel of Interconnector (Phase 2)	2032 / 2037				X				
52	JPWWTP B-Plant Final Clairifier Upgrade (CIP 245)	2005 / 2010	X							Facility operational in 2010 (Design in 2005). Contract closed out.
53	JPWWTP A-Plant Wet Weather Hydraulic Improvements (CIP 247)	2006 / 2010	X							Facility operational in 2010 (Design in 2006). Contract closed out.
54	JPWWTP Disinfection Chemical handling Facility Improvements (CIP 253)	2005 / 2010	X							Facility operational in 2010 (Design began in 2005). Contract closed out.
55	SWWTP Effluent Disinfection Improvements (CIP 355)	2005 / 2008	X							Facility operational in 2007(Design began in 2004). Contract closed out.
56	SWWTP Center Train Concrete Rehabilitation (CIP 358)	2005 / 2010	X							Facility operational in 2010 (Design began in 2005). The project work was combined into CIP 367

APPENDIX B - PROJECTS TABLE FOR SECTION 2.2

#	Project CIP Name	WWMP Dates: Design Start / Operationally complete	Operational	Partially Constructed	On Hold	Original Scope/Schedule	Canceled	Added	Modified Scope/Schedule	Comments
57	SWWTP Sludge Thickening Improvements & Add'l Ren. (CIP 359)	2005 / 2010	X							Facility operational in 2011 (Design began in 2006). See Appendix A OEPA Correspondance WWTP Expansion Sludge Thickening Improvements for reasoning in project delay.
58	SWWTP New Effluent Pump Station and Outfall (CIP 363)	2006 / 2010	X							Facility operational in 2009 (Design began in 2006). Contract closed out.
59	SWWTP New Headworks Part 2 (CIP 364)	2006 / 2010	X							Facility operational in 2010 (Design began in 2006). Contract closed out.
60	SWWTP Final Clairifier and Aeration Tank Improvements (Project added in 2006)	Was not in WWMP	X					X		Facility operational in 2010 (Design began in 2006). Contract closed out.
61	SWWTP Primary Clairifier and Aeration Tank Improvements (Projects added in 2006)	Was not in WWMP	X					X		Facility operational in 2010 (Design began in 2010). Contract closed out.
Wastewater Facilities Program Needs (CIP 345)										
62	SWWTP Far East Train	2022 / 2030							X	See HRT/CEPT (#27). Far East Train at SWWTP is not needed by 2030 due to CEPT system and biololgical treatment expansion on center train at SWWTP (#61).
63	Effluent Disinfection Improvements Part 2	2022 / 2027				X				
64	Headworks Part 4 (Schedule beyond 2020)	2032 / 2036				X				
SWWTP Other Real Needs (CIP 380)										

APPENDIX B - PROJECTS TABLE FOR SECTION 2.2

#	Project CIP Name	WWMP Dates: Design Start / Operationally complete	Operational	Partially Constructed	On Hold	Original Scope/Schedule	Canceled	Added	Modified Scope/Schedule	Comments
65	SWWTP Floodway Bridge	2021 / 2027				X				
66	Headworks Part 3	2021 / 2027							X	See SWWTP Far East Train (#62) and HRT/CEPT (#27). Headworks part 3 is not needed if Far East Train is not constructed.
67	Effluent Pump Addition No. 1	2021 / 2026							X	See SWWTP Far East Train (#62) and HRT/CEPT (#27). Effluent Pump Addition No. 1 is not needed if Far East Train is not constructed.

APPENDIX

C

APPENDIX C

THE CITY OF
COLUMBUS
MICHAEL B. COLEMAN, MAYOR

DEPARTMENT OF
PUBLIC UTILITIES

The Integrated Plan and 2015 WWMP Update Report

Clean streams. Strong neighborhoods.

BLUEPRINT
COLUMBUS
Clean streams.
Strong neighborhoods.

BIA

The Home Builders

September 3, 2015

The Honorable Michael B. Coleman, Mayor
City of Columbus
90 West Broad St
Columbus, Ohio 43215

Dear Mayor Coleman:

Thank you for the opportunity to have representation of the BIA of Central Ohio serve on the Community Advisory Panel (CAP) for the Department of Public Utilities. Over the last two years, the CAP met to improve panel members understanding of the existing sewer system, its limitations, and potential solutions to overflows. Presentations and discussions provided substantial background to evaluate the options for achieving compliance with Ohio Environmental Protection Agency (EPA) requirements.

Based on our review of the options presented to address the overflow problem, affordability, sustainability, and water quality outcomes associated with the potential solutions, we offer our support for the Blueprint Columbus plan developed by the Department of Public Utilities.

As a business association, we support this option as one that can both achieve the desired outcomes and also provide local businesses the opportunity to do the work required. Local residents and businesses will pay the fees associated with any solution that is implemented. We believe that the Blueprint Columbus plan is a significant improvement over a more conventional gray solution in terms of providing local employment opportunities. A competitive local construction industry can provide multiple options to government to help manage costs in a responsible manner and keep utility users' fee payments in the central Ohio economy.

Thank you for the opportunity to offer our perspective on this issue.

Sincerely,

James B. Hilz
Executive Director

NAHB
National Association of Home Builders

The Building Industry Association of Central Ohio
495 Executive Campus Drive ▪ Westerville, Ohio 43082
Phone: (614) 891-0575 ▪ Fax: (614) 891-0535
www.biahomebuilders.com

OHBA
OHIO HOME BUILDERS ASSOCIATION, INC.

BLUE PRINT COLUMBUS
Clean streams.
Strong neighborhoods.

September 8, 2015

The Honorable Michael B. Coleman, Mayor
City of Columbus
90 West Broad St
Columbus, Ohio 43215

Dear Mayor Coleman:

Thank you for the opportunity to serve on the Blueprint Columbus Community Advisory Panel (CAP). As you know, the CAP was created in 2013 to advise the Columbus Department of Public Utilities on the development of a plan to address stormwater runoff and sanitary sewer overflows. The CAP is comprised of 22 neighborhood and organization representatives from a broad cross section of the Columbus community. Over the last two years, the CAP met nine times and participated in educational field trips to improve understanding of the existing sewer system, its limitations, and potential solutions to overflows. Presentations and discussions provided substantial background to evaluate the options for achieving compliance with Ohio Environmental Protection Agency (EPA) requirements.

Based on our review of extensive technical data about the overflow problem, affordability, sustainability, and water quality outcomes associated with the potential solutions, we offer our support for the Blueprint Columbus plan developed by the Department of Public Utilities. We believe that the Blueprint Columbus plan is a significant improvement over a more conventional gray solution that offers the City significant benefits by: eliminating the source not just the symptoms of sanitary sewer overflows; addressing the specific needs of each neighborhood; investing in green infrastructure; building in repair and replacement of existing infrastructure; improving water quality; creating new jobs; and improving property values.

We look forward to assisting in any way we can to ensure the plan's approval by the Ohio EPA. Thank you for the opportunity to serve the great City of Columbus.

Sincerely,

Jennifer Adair
Chair, North Linden Area Commission

Lisa Boggs
South Central Hilltop

Michael Cadwell
Director, Knowlton School of Architecture
The Ohio State University

Kristen Easterday
Director of Local Government Relations
Columbus Chamber of Commerce

Jennifer Fish
Director, Franklin County Soil & Water Conservation District

Catherine Girves
Executive Director, Yay Bikes!

Steve Gladman
Columbus Sewer and Water Advisory Board
Representing Suburban Communities

Linda Henry
Co-President, Reebs-Hosak Area Planning Committee

Ed Lentz
Executive Director, Columbus Landmarks Foundation

Carla Fountaine
Senior Community Relations Specialist
Nationwide Children's Hospital

William Murdock
Executive Director
Mid-Ohio Regional Planning Commission

Robert Patterson
Columbus Sewer and Water Advisory Board/Marion Franklin Civic Association

Elwood Rayford
Chair, Northeast Area Commission

Rachel Robinson
Resident, Southern Orchards

Fran Ryan
Senior Advocate, Central Ohio Area Agency on Aging/Founder of Senior Services Roundtable of Columbus and Franklin County

George Walker, Jr.
Chair, South Linden Area Commission

Rob Wood
Clintonville Area Commission

Gloria Ann Zebbs Anderson
President, Argyle Park Civic Association

September 8, 2015

The Honorable Andrew J. Ginther, President
Columbus City Council
90 West Broad St
Columbus, Ohio 43215

Dear President Ginther:

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Based on our review of extensive technical data about the overflow problem, affordability, sustainability, and water quality outcomes associated with the potential solutions, we offer our support for the Blueprint Columbus plan developed by the Department of Public Utilities. We believe that the Blueprint Columbus plan is a significant improvement over a more conventional gray solution that offers the City significant benefits by: eliminating the source not just the symptoms of sanitary sewer overflows; addressing the specific needs of each neighborhood; investing in green infrastructure; building in repair and replacement of existing infrastructure; improving water quality; creating new jobs; and improving property values.

We look forward to assisting in any way we can to ensure the plan's approval by the Ohio EPA. Thank you for the opportunity to serve the great City of Columbus.

Sincerely,

Jennifer Adair
Chair, North Linden Area Commission

Lisa Boggs
South Central Hilltop Area Block Watch

Michael Cadwell
Director, Knowlton School of Architecture
The Ohio State University

Kristen Easterday
Director of Local Government Relations
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President, Argyle Park Civic Association

FRIENDS OF THE RAVINES
PO Box 82021
Columbus, Ohio 43202

Website:
Friendsoftheravines.org

September 4, 2015

The Honorable Michael B. Coleman, Mayor
City of Columbus
90 West Broad St
Columbus, Ohio 43215

Re: Letter of Support for City Blueprint Columbus Program

Dear Mayor Coleman;

Friends of the Ravines (FOR) supports Blueprint Columbus' plan to eliminate sanitary sewage overflows to local waterways, and supports reducing water infiltration and inflow to sanitary sewers to attain this goal. Four major elements are included in the program including: sanitary lateral lining to improve the connections between residences and City sanitary sewer lines, roof water redirection to storm sewers; a voluntary sump pump program for eligible residents, and green infrastructure.

An important tenet of the Blueprint program is to "do no harm" to the water resources of central Ohio, which will be of utmost importance during implementation. Storm water is the leading cause of water quality impairments across the nation, so it will be important for Blueprint to be teamed with robust management of stormwater to improve the health of the ravines and waterways of central Ohio.

Blueprint Columbus moves our City in the right direction for our ravines and water resources, and toward greater environmental sustainability. Green infrastructure will be good for Columbus in providing local job opportunities that promote better stewardship of our waterways, adding aesthetic value to our neighborhoods and better protecting our ravines and streams.

Best Regards,

Alice Waldhauer
Trustee, Friends of the Ravines
Member, Blueprint Community Advisory Panel

APPENDIX

D

THE CITY OF
COLUMBUS
MICHAEL B. COLEMAN, MAYOR

DEPARTMENT OF
PUBLIC UTILITIES

The Integrated Plan and
2015 WWMP Update Report

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Strong neighborhoods.

Clean streams. Strong neighborhoods.

APPENDIX D

ARCADIS U.S., Inc.
1900 Polaris Parkway
Suite 200
Columbus
Ohio 43240-2020
Tel 614 888 4953
Fax 614 888 6295

MEMO

To:
Dax Blake

Copies:
Cosmo Bertino
Kathleen Smith

From:
Dan Gernant

Date:
July 19, 2012

ARCADIS Project No.:
00228782.0001

Subject:
WWMP Population Projections

Population projections created during the Wet Weather Management Plan (WWMP) were used as a basis for determining base wastewater flow used in the collection system modeling. The results from this modeling impacted the sizing of projects recommended in the plan. The WWMP population projections were based on 2000 census data, obtained from the Mid-Ohio Regional Planning Center (MORPC). In July 2012, these population projections were updated to reflect 2010 census data. Both the WWMP population projections and the updated population projections are included in Figure 1 at the end of this memo.

WWMP Population Projections

The 2005 WWMP examined population projections for the service area of the City of Columbus, Division of Sewerage and Drainage. The Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP) planning horizon for the WWMP was 2005 to 2025. The year 2025 was chosen as the end year of the planning horizon because the CSO consent order required attainment of the LTCP goals by 2025. The Sewer Evaluation and Capacity Assurance Plan (SECAP) planning horizon was not defined by the Sanitary Sewer Overflow (SSO) Consent Order. The SECAP planning horizon was developed during the WWMP effort. For the SECAP, a primary planning horizon of 2030 and a secondary planning horizon of 2050 was established. The secondary planning horizon allowed for the evaluation of projects with longer implementation schedules.

Population projections for the WWMP were conducted using data from MORPC. Data was processed on the basis of traffic analysis zones (TAZs). Each zone had associated data for population and employment for 2000 and 2030. Using Geographic Information Systems (GIS) software, the TAZ layer was overlaid with a layer of the Facilities Planning Area (FPA). The FPA is the boundary for the City of Columbus, Division of Sewerages and Drainage service area. All TAZs within the FPA boundary were selected. In cases where a TAZ did not fall entirely within the FPA, population and employment were apportioned based on the percentage of the TAZ area within the FPA.

In the 2005 WWMP, the 2000 population was estimated at 1.13 million and the 2030 population was estimated at 1.40 million. Employment in 2000 was estimated to be 0.7 million and the 2030 employment was estimated to be 0.98 million. These figures were summarized in the WWMP in Exhibit 6.2.1 and in Table 1 below.

In order to estimate the sewer flow, an equivalent population was developed. The equivalent population was developed by multiplying the population by 1, the employment by 0.5, and adding the results. The assumption was that people employed in the service area would generate half the wastewater that someone living in the service area would. Equivalent Population for 2000 was estimated at 1.48 million, 2030 estimated at 1.89 million, and 2050 estimated at 2.10 million.

Table 1: WWMP Population Projections

	Population	Employment	Equivalent Population
2000	1.13	0.7	1.48
2030	1.4	0.98	1.89
2050	-	-	2.1

Updated Population Projections

In July 2012, the WWMP population projections were updated. This update generally followed the WWMP methodology, although there were some necessary deviations as explained below.

In July 2012, the most current MORPC data for Central Ohio contained population and employment data for 2010 and 2035, as opposed to years 2000 and 2025 used during the WWMP. In addition to the base year being different, MORPC provided the data in planning grids instead of TAZs. Grids are uniform, square units of approximately ¼ mile by ¼ mile. TAZs varied in size and in some cases were several times larger than grids. Since the grids offer better resolution than TAZs, they were adopted for this analysis. Once again, GIS was used to overlay a grid layer with a FPA layer. All grids that intersected the FPA area were selected. Due to the finer resolution of the grids, there was not an attempt to determine fractional percentages of grids that were only partially within the FPA.

The updated projections estimate the 2030 population to be 1.52 million, the 2030 employment to be 0.90 million, and the equivalent 2030 population be 1.97 million. These estimations are summarized in Table 2 below.

Projecting the population into the future by adding a trend line to the yearly projections in Figure 1, the 2050 equivalent population was estimated at 2.3 million. The WWMP estimate for 2050 equivalent population was 2.1 million. The updated estimates are about 10% higher at 2050 than the WWMP estimates. It is interesting to note that the WWMP estimates for 2010 were actually close to the 2010 census data, meaning the 10 year projections based on the 2000 census data were fairly accurate. Nevertheless, based on the 2010 census data future population was projected to increase at a higher rate.

As stated earlier, equivalent population is composed of population and employment. The WWMP projected population of 1.4 million in 2030 while the updated projections estimate 1.5 million in 2030, a 9% increase. The WWMP estimated 2030 employment at 0.98 million and the updated projections estimate 2030 employment at 0.90 million, a 9% lower projection. This indicates population grew at a larger rate than expected while employment did not increase as expected.

Table 2: Updated Population Projections

	Population	Employment	Equivalent Population
2030	1.52	0.90	1.97
2050	-	-	2.3

Served vs. Unserved Areas

The population figures presented above are total values representing the entire population of the FPA. This includes areas served by the City of Columbus Division of Sewerage and Drainage as well as areas that are not connected to the Columbus sewer system. It was projected that in 2000, the total FPA population was 1.13 million while the served area population was 0.99 million. This means that approximately 140,000 people, or about 12% of the total population, were living in the FPA but received their sewer service from a provider other than the City of Columbus.

The 2010 estimate for total FPA population is 1.27 million. The 2010 estimate for served population is 1.12 million. This means that approximately 155,000 people, or about 12% of the total population, were living in the FPA but were not served by the City of Columbus. The portion of the population living in unserved areas remained the same from 2000 to 2010. This indicates that these areas are growing at the same rate as the served areas. This trend also indicates that the unserved areas did not connect to the Columbus system between 2005 and 2010.

The population projections for this analysis used total FPA population instead of the served area. The reasoning is that unserved areas may connect to the Columbus system in the future if it becomes cost prohibitive to maintain their local treatment units. The Columbus system should ultimately be prepared to handle the potential population as well as the currently served population. This same assumption was also applied to the WWMP projections.

Conclusion

Updated population projections show equivalent population growing faster than WWMP projections. This results in equivalent population 5% higher in 2030 and 10% higher in 2050 than estimated during the 2005 WWMP effort.

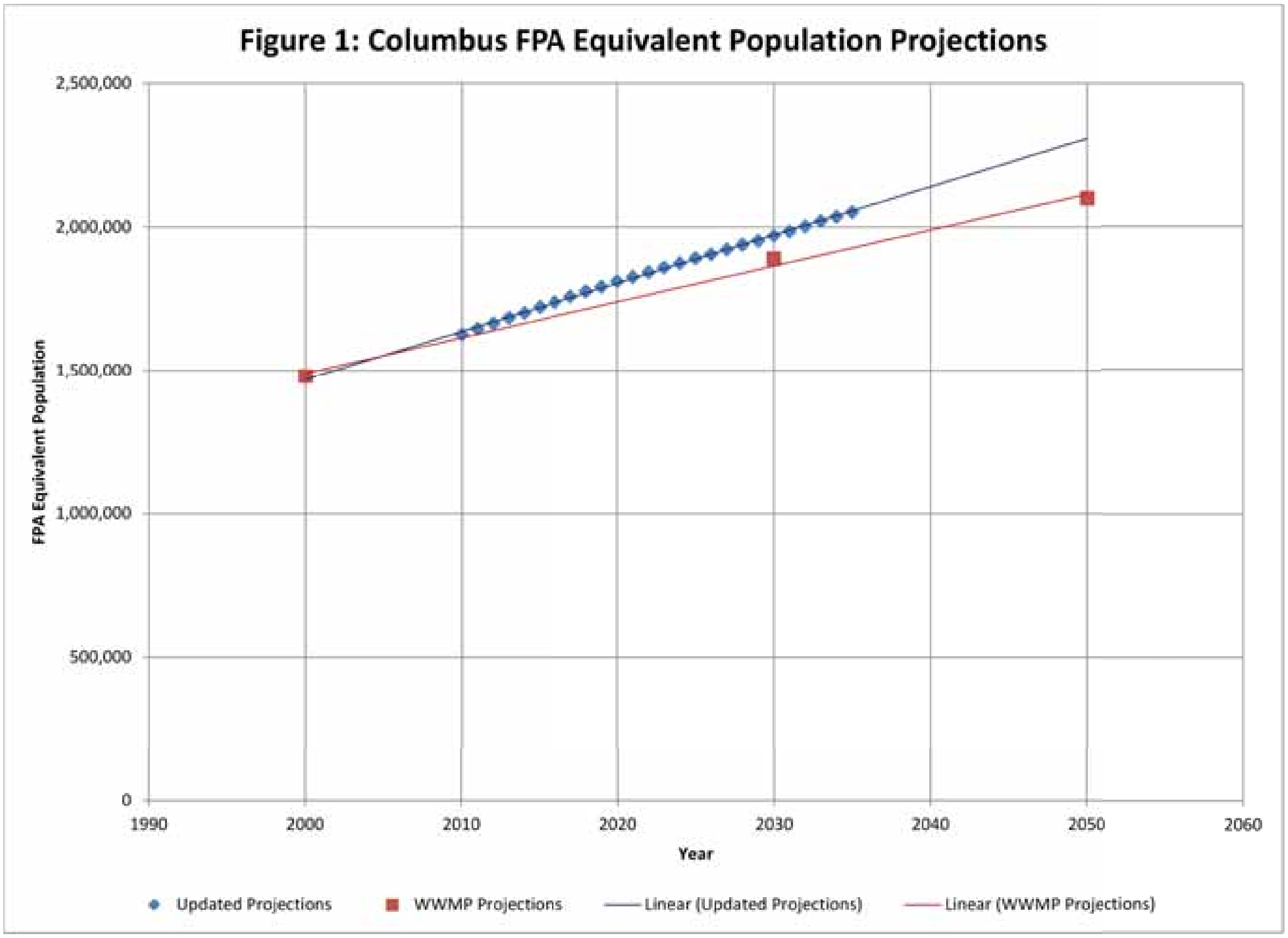

Figure 1: Columbus FPA Equivalent Population Projections
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
FPA Equivalent Population
1990
2000
2010
2020
2030
2040
2050
2060
Year
Updated Projections
WWMP Projections
Linear (Updated Projections)
Linear (WWMP Projections)

APPENDIX

E

THE CITY OF
COLUMBUS
MICHAEL B. COLEMAN, MAYOR

DEPARTMENT OF
PUBLIC UTILITIES

The Integrated Plan and
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APPENDIX E

APPENDIX E – COST ESTIMATING METHODOLOGY

In 2011 the City of Columbus utilized the Wet Weather Management Plan (WWMP) to develop an updated cost estimating methodology for infiltration/inflow (I/I) projects in the collection system. The methodology contains unit costs for different technologies, as well as markups for mobilization, bonds, insurance, contractor overhead & profit, engineering, and contingency. These costs were benchmarked to the October 2011 Engineering News-Record (ENR), 20-city Construction Cost Index (CCI). The unit costs in the 2011 Cost Estimating Methodology Report were used as a basis for the unit costs in this report, except as specified below.

The 2011 Cost Estimating Methodology Report was written so that all estimated costs were indexed to the 2011 ENR CCI index. For this report, all unit costs for the various types of system improvement are revised per the January 2015 Construction Costs Index (CCI) to reflect January 2015 dollars.

Typically these costs include overhead and profit and mobilization, bonds and insurance but not engineering and contingency unless otherwise indicated. Exhibit E.1 depicts the recommended percentages for planning level construction cost estimating. These values were selected based on our evaluation of construction costs estimates, bid tabulations, and completed projects costs of recently completed projects identified in the WWMP and the City at large.

This figure shows there are three categories of markups, one typical markup used on most projects and two special markups. Tunnels by nature are more complicated and riskier than other projects, so they have a higher markup. Lining projects do not require an engineer's design, so they have a smaller markup to cover legal and administrative issues associated with any lining contract.

EXHIBIT E.1 MARKUPS USED FOR COST ESTIMATIONS

Category	Type of Markup	Percent
Typical	engineering	20%
	contingency	50%
Tunnel	engineering	30%
	contingency	50%
	tunnel risk factor	20%
Sewer & Lateral Lining	legal & administrative	20%
	contingency	50%

Specific unit costs

Although the unit costs used for the Integrated Plan generally follow the 2011 cost estimating methodology, there are a number of instances where they do not, either due to a technology not being present in the methodology or more up to date data being available to the City. The following list explains the source of all unit costs used. The estimated costs listed below are construction costs and include mobilization, bonds, insurance, and contractor overhead and profit. Engineering and contingency were applied to these cost separately, as detailed in **Exhibit C.**1 above.

Tunnels – These costs were based on data from the City of Columbus regarding costs of previous tunnel jobs. Based on the area of the proposed tunnels, unit costs for soft ground tunnels were used. Exhibit E.2 at the end of this section contains the unit costs used for tunnels in the report.

EXHIBIT E.2-TUNNEL COSTS, SOFT GROUND CONSTRUCTION

Tunnel Diameter (ft)	Unit Cost ($/LF)
9	$4,264
10	$5,261
11	$5,986
12	$6,811
13	$7,749
14	$8,817

Open cut sewers – These costs were based on the 2011 Cost Estimating Methodology, updated to January 2015 dollars using the Engineering News Record Construction Cost Index. A table of unit costs for open cut sewers can be found in Exhibit E.3.

It should be noted that the cost estimating methodology had 3 different classifications for complexity and 3 different ranges of depth. For this report, all new pipes were considered to be medium complexity. Also, all pipes were assumed to be medium depth. During the first round of estimates, GIS was used to attempt to assigned depths to the pipes. The ground level and the manhole invert at the beginning and the end of each pipe was used to estimate an average depth for each conduit. It was determined that the vast majority of pipes were in the medium depth category and the rest were evenly split between shallow and deep classification. It was determined for subsequent cost estimations that it was reasonable to assume medium depth for all the new sewers.

EXHIBIT E.3 OPEN-CUT SANITARY SEWER CONSTRUCTION COSTS		
Diameter (inches)	**Complexity**	**Depth 8' to 15'** ($/foot)
8	Medium	$382
10	Medium	$436
12	Medium	$545
15	Medium	$600
18	Medium	$654
21	Medium	$763
24	Medium	$872
27	Medium	$927
30	Medium	$981
36	Medium	$1,036
42	Medium	$1,090
48	Medium	$1,199
54	Medium	$1,254
60	Medium	$1,308
66	Medium	$1,363
72	Medium	$1,417
78	Medium	$1,526
84	Medium	$1,690

Trenchless sewers – These costs were based on the 2011 Cost Estimating Methodology. According to this report, trenchless sewers cost 1.6 times what an equivalent open cut sewer would cost.

Weir Raise – These costs were based on existing weir raise projects for the combined system, namely weirs at State Street, Capital Street, Broad Street, Long Street, and Chestnut Street. The costs were estimated in the 2005 WWMP and updated to January 2015 dollars using the Engineering News Record Construction Cost Index. The 2005 WWMP cost was $41,000 and the updated cost was $56,030.

New Weir – These costs were based on bid tabs from CIP 650737 which included the weir raise at DSR 83. Since this was a weir raise and not a new weir project, estimates were made for the new constructions based on the amount of materials needed for the project. The unit costs of note were $200,000 for a weir less than 10 feet long, $400,000 for a weir of 10 to 15 feet in length, and $600,000 for a new weir greater than 15 feet long.

Pipe Bulkhead – These unit costs were based on sewer point repair costs from the 2011 Cost Estimating Methodology, updated to January 2015 dollars using the Engineering News

Record Construction Cost Index. A pipe bulkhead was assumed to be equal to a 3’ long sewer point repair. A table of unit costs for sewer point repairs can be found in Exhibit E.4. The same depth and complexity assumptions were made for sewer point repairs as for open cut sewers above.

EXHIBIT E.4 SEWER POINT REPAIR COSTS		
Diameter	**Complexity**	**Depth 8' to 15'**
(inches)		**($/foot)**
8	Medium	$13,082
10	Medium	$13,082
12	Medium	$13,082
15	Medium	$13,082
18	Medium	$16,353
21	Medium	$16,353
24	Medium	$16,353
27	Medium	$17,443
30	Medium	$21,804
36	Medium	$21,804
42	Medium	$27,255
48	Medium	$32,706
54	Medium	$38,157
60	Medium	$43,608
66	Medium	$49,059
72	Medium	$49,059
78	Medium	$49,059

Boltdown manholes – A unit cost of $30,000 was used, based on engineering judgement and recent experience at the City.

Green infrastructure – For this cost estimation exercise, a per acre cost was used for green infrastructure instead of a technology based cost. This is due to the fact that designs are not completed for green infrastructure pilot project in Clintonville. A unit cost of $13,821/acre was used based on the Clintonville Pilot.

Manhole Rehabilitation - These costs were based on the 2011 Cost Estimating Methodology, updated to January 2015 dollars using the Engineering News Record Construction Cost Index. The 2011 report gave a unit cost of $2500 per manhole, which was updated to $2725.

Lateral lining – This cost of $6000 per lateral was based on recent bid tabs from City of Columbus work, accounting for economies of scale in a widespread lateral lining program.

Roof Disconnection and Redirection – The Clintonville pilot provided the information for this unit cost. Roof drain disconnection (disconnection from the sanitary lateral) was assumed to be $2000 per house. Roof drain redirection (taking the roof water to the street) was assumed to be $1000 per downspout.

Sump Pumps – A unit cost of $4325 per sump pump was used, based on a project in Milwaukee, WI in the Cooper Park Neighborhood.

Sewer Lining – These costs were based on the 2011 Cost Estimating Methodology, updated to January 2015 dollars using the Engineering News Record Construction Cost Index. A table of unit costs for lining sewers can be found in Exhibit E.5**.** It should be noted that there are 3 levels of complexity for sewer lining listed. These are present to account for the condition of the pipe being lined. In order to assign pipes to a given complexity, SCREAM scores were used. SCREAM scores take into account structural and maintenance information about the pipes. For SCREAM scores, the higher the score, the worse the condition of the pipe. Pipes with a SCREAM score of 0-84 were assumed to be low complexity, scores of 85-94 were assumed to be medium complexity, and score of 95-100 were assumed to be high complexity.

EXHIBIT E.5-SEWER CIPP REHABILITATION COSTS		
Diameter	**Complexity**	**CIPP (All Depths)**
(inches)		$/foot
6	High	58
6	Medium	48
6	Low	38
8	High	65
8	Medium	55
8	Low	44
10	High	75
10	Medium	63
10	Low	50
12	High	90
12	Medium	75
12	Low	60
15	High	98
15	Medium	82
15	Low	65
18	High	131
18	Medium	109
18	Low	87
21	High	180
21	Medium	150
21	Low	120
24	High	213
24	Medium	178
24	Low	142

*See top of second column

EXHIBIT E.5 SEWER CIPP REHABILITATION COSTS (CONTINUED)		
Diameter	**Complexity**	**CIPP (All Depths)**
(inches)		$/foot
27	High	245
27	Medium	205
27	Low	164
30	High	294
30	Medium	245
30	Low	196
36	High	327
36	Medium	273
36	Low	218
42	High	368
42	Medium	306
42	Low	245
48	High	409
48	Medium	341
48	Low	273
54	High	491
54	Medium	409
54	Low	327
60	High	572
60	Medium	478
60	Low	382
66	High	654
66	Medium	545
66	Low	436

Sewer Lining – These costs were based on the 2011 Cost Estimating Methodology, updated to January 2015 dollars using the Engineering News Record Construction Cost Index. A table of unit costs for lining sewers can be found in **Exhibit C.5.** It should be noted that there are 3 levels of complexity for sewer lining listed. These are present to account for the condition of the pipe being lined. In order to assign pipes to a given complexity, SCREAM scores were used. SCREAM scores take into account structural and maintenance information about the pipes. For SCREAM scores, the higher the score, the worse the condition of the pipe. Pipes with a SCREAM score of 0-84 were assumed to be low complexity, scores of 85-94 were assumed to be medium complexity, and score of 95-100 were assumed to be high complexity.

APPENDIX

F

THE CITY OF
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MICHAEL B. COLEMAN, MAYOR

DEPARTMENT OF
PUBLIC UTILITIES

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APPENDIX F

ECONOMIC IMPACT OF THE CITY OF COLUMBUS BLUEPRINT PROGRAM: AN UPDATE

Bill LaFayette, Ph.D.
Owner, Regionomics® LLC
August 30, 2015

Regionomics®
From Trends to Insight to Action

1293 S. Fourth St., Columbus, OH 43206
www.regionomicsllc.com

ECONOMIC IMPACT OF THE CITY OF COLUMBUS BLUEPRINT PROGRAM: AN UPDATE

Bill LaFayette, Ph.D.
Owner, Regionomics® LLC
August 30, 2015

Introduction and Summary

The City of Columbus Department of Public Utilities is evaluating a more environmentally friendly alternative to the original Wet Weather Management Plan required under an Ohio Environmental Protection Agency (EPA) consent order. The original plan takes a traditional approach to mitigating storm runoff and sewer overflow problems, including treatment plant upgrades and systems of tunnels and holding tanks. The City has been given permission by the Ohio EPA to evaluate an alternative system, Blueprint, that would accomplish the same mitigation goal through more environmentally friendly means, including rain gardens, porous pavements, gutter and downspout improvements on private property, and other more sustainable measures. The City argues that this alternative approach will provide increased employment opportunities to local residents and business opportunities to small, locally-owned businesses.

This study seeks to estimate the impact of the program on the economy of the Columbus Metropolitan Statistical Area (MSA). Principal findings include:

- Over the next 20 years, the Blueprint program will increase Columbus MSA output by nearly $2.8 billion in discounted, constant dollars, more than twice as much as the original (gray) program. Household and business earnings increase $977 million in discounted, constant dollars, 73 percent more than the estimated earnings impact of the gray program. Blueprint employment averages more than 700 jobs over the 20-year period, versus 400 jobs on average under the gray program.
- These differences are understated because they include impacts of capital costs only and not the substantial activity and employment needed to maintain the green infrastructure.
- In contrast to the wild employment swings of the gray program, the Blueprint program offers steady employment – primarily from the maintenance activity. This reduces employment search and hiring costs, reduces the risk of project delays, and reduces the strain on households and the workforce and public assistance systems. These benefits are in addition to those quantified in the economic impact analysis.
- Unlike the gray program, the Blueprint program will provide a boost to small businesses and entrepreneurs in the region, and will thus help to address a significant weakness of the local economy.

Meaning of Economic Impact

The point of an economic impact analysis is to measure the increase in **output** of a geographical area's economy resulting from a specific economic activity. In this case, the economic impact is the difference between the impact on the 10-county Columbus Metropolitan Statistical Area (MSA)[1] of the Blueprint

[1] Delaware, Fairfield, Franklin, Hocking, Licking, Madison, Morrow, Perry, Pickaway, and Union Counties.

plan net of the impact of the gray plan. In other words, is the local economy better off by implementing Blueprint, and if so, by how much?

Output is measured by the value of goods and services produced in the Columbus MSA over a given period of time. The production of output requires labor, thereby generating earnings to business owners and workers. The economic impact assessment also estimates both these earnings and the jobs that are created or sustained as a result of the target activity.

The output created by the installation and later maintenance of the various Blueprint facilities or the installation of the tunnels and treatment plant upgrades of the gray plan, along with the employment and earnings of workers installing these facilities, constitute the **direct** impacts of each of the two activities. But direct impacts are only part of the total impact. Local suppliers of goods and services to enable construction of the facilities also generate output by providing those goods and services, and increase their own purchases of supplies to accommodate the increased demand. Suppliers' employment may increase as well to accommodate the increased activity. These supplier output, earnings, and employment are referred to as **indirect** impacts. In addition, business owners will earn profits and their employees will earn salaries, wages, and tips. These workers will use their earnings to purchase household goods of all kinds. To the extent that these payments for purchases and wages and salaries are made to suppliers and employees within the Columbus MSA, the region's economic activity and output is increased further. This household spending is referred to as an **induced** impact. It is important to emphasize that the direct activities cause the indirect and induced spending, and this other spending would never have occurred had the construction not generated the additional economic activity in the first place. For this reason, the indirect and induced impacts are as much a part of the total economic impact as are the direct impacts. This is the essential point that makes economic impact analysis legitimate.

These impacts are specific both to a given industry and to a given region. The array of suppliers that benefit from construction and maintenance activities is generally the same regardless of where the construction occurs. But if the structure of the Columbus MSA economy is such that the construction companies and the City are forced to make most of their purchases from vendors outside the region, then most of the impact will leak from the economy. Conversely, a broad economy with many local suppliers will keep more of the impact of the output increase circulating within the economy, and the indirect and induced impacts will be much greater. Thus, the analysis is unique to the geographical area as well as to the industry.

Impact Measurement

This study uses the most recent (2013) I-RIMS data from IMPLAN, Inc. These data consist of unique impact factors (multipliers) for each of 536 detailed industries within the Columbus MSA. The multipliers implicitly reflect the structure of the region's economy and the presence or absence of local suppliers. However, It is important to keep in mind that the results of this (or any) economic impact study represent only the order of magnitude of the actual impacts and cannot be regarded as precise.

The choice of the Columbus MSA rather than Franklin County as the area of analysis is deliberate. MSAs are defined by the federal government based primarily on worker commuting patterns. This makes the MSA the fundamental economic unit. Workers can be expected to commute from other MSA counties to the job sites in Franklin County, and spend a share of their earnings in their home county. But because of the economic integration of Franklin County with the other counties of the MSA, even this spending should benefit Franklin County as successive rounds of indirect and induced impacts occur. So isolating Franklin County as the area of impact would be understating the true benefit on the local economy.

The capital expenditures of the Blueprint program over 20 years total $1.718 billion in constant (2015) dollars, or $1.469 billion in discounted terms. In contrast, the gray plan's constant-dollar expenditures total $1.593 billion, or $1.335 billion discounted. But the real difference in the economic impact of these two plans lies in the fact that a sizeable share of the gray plan's spending goes to firms and workers outside of the Columbus MSA, while most of the Blueprint spending remains within Central Ohio. As discussed earlier, spending directed to entities outside the MSA constitutes a leakage from the regional economy. This spending sustains economic activity elsewhere, while most of the spending under the Blueprint program goes to local entities and sustains economic activity in Central Ohio. The non-local spending of the gray program has no opportunity to create indirect and induced impacts; consequently, its impact is zero.

Answering the question of the incremental benefit of the Blueprint program requires an assessment of the expenditures of both this program and the gray program. Each assessment was made over a 20-year period, 2016 through 2035. Budgets were supplied by the Department of Public Utilities. Five substantial tunnel projects in the gray plan are assumed to be non-local. Future amounts were discounted to present-value terms assuming a two percent rate.

Summarized results are shown in Table 1. The output and earnings totals are the sum of 20 years of discounted annual estimates. The employment estimates are not totals but averages of the annual estimates. Employment cannot be averaged across time because many of the jobs likely continue for more than a year, so to sum employment would introduce double-counting. The results imply that the output of the Central Ohio economy would be $1.4 billion higher, earnings would be $411 million higher, and employment will average more than 300 additional jobs over the next 20 years if Blueprint is implemented. The impact of keeping spending within the local area is substantial and is the primary driver of the output difference: in the gray plan, direct impact arising from local expenditures is less than half of total expenditures, while Blueprint's local direct output is nearly all of those expenditures.

Table 4
Economic Impact of Blueprint vs. Gray Plan on the Columbus MSA, 2013

	Direct	Indirect	Induced	Total
Total output ($000)				
Blueprint	$ 1,469,248	$ 697,441	$ 614,651	$ 2,781,339
Gray plan	687,000	311,154	356,086	1,354,240
Output difference ($000)	**$ 782,247**	**$ 386,287**	**$ 258,565**	**$ 1,427,099**
Total household and business earnings ($000)				
Blueprint	$ 514,676	$ 251,754	$ 211,031	$ 977,461
Gray plan	319,660	124,337	122,257	566,253
Earnings difference ($000)	**$ 195,016**	**$ 127,417**	**$ 88,774**	**$ 411,207**
Annual average employment				
Blueprint	320	209	206	734
Gray plan	184	93	115	393
Employment difference	**136**	**115**	**91**	**342**

Source: Generated by the economic impact model.

It is important to note that **the difference between Blueprint and the gray plan is substantially understated in this analysis**. The inputs to this analysis include only capital costs; i.e., the cost to install the green infrastructure and not the expenditures and employment required to maintain it. This leads to an important feature of Blueprint: employment is significantly more stable over time because the work is ongoing rather than the gray plan's major projects that start and stop, creating wild swings in employment demands.

The practical problems with the extreme variability of the gray plan's workforce need is that it fails to provide steady employment and it forces those responsible for installing the infrastructure to undertake repeated mass hiring and layoff of workers. Employee search and training costs are higher, and labor could be expensive and the project could be delayed if the labor market happens to be tight when hiring has to be undertaken. The overall experience level of workers available in a tight labor market may be lower, which would lead to lower levels of efficiency and productivity. Further, the repeated layoffs disrupt households and place strains on the workforce and public assistance systems. The more steady employment offered by the Blueprint program thus leads to lower costs and substantially better social outcomes. These advantages cannot be reflected in the economic impact comparison, but they are no less real than those that can be reflected.

Impact of the Blueprint Program on Small Business Development and Growth

The City correctly argues that the Blueprint program will be far more beneficial to small, locally-owned businesses. Because of the scale and complexity of the more significant projects in the gray plan, these must be contracted out to specialized firms located outside of Central Ohio. As noted in the previous section, this prevents these expenditures from having the impact on local output, earnings, and employment that the same expenditures made locally would have. Municipal tax revenues are less because the indirect and induced employment is not created.

In a larger sense, the small scale of the projects in the Blueprint plan lend themselves well to locally-owned small businesses. Consequently, implementing this program will be far more likely to increase the size and profitability of existing small businesses and encourage new businesses to develop. This will help to address a significant weakness of Central Ohio's economy. Analysis of statistics provided as part of Community Research Partners' *Benchmarking Central Ohio 2013* reveals that out of the 100 largest MSAs in the U.S., the Columbus MSA ranks 75th in the percentage of all workers who are self-employed, 80th in the percentage of firms that are small (employer firms with fewer than 20 employees), and 82nd in the birth rate of these small employer firms. Not directly relevant to the businesses that would benefit from the implementation of Blueprint, but also indicative of the weak status of small business in the region, is the analysis of the environment for independent retail businesses undertaken by Civic Economics and published in *The Indie City Index 2011: A Measure of Independent Retail Vitality in Every American Metropolitan Area*. This study found that out of all 363 MSAs nationwide, Columbus ranks 350th in the health of its environment for local retail businesses.

The small business birth rate has been in fairly steady decline both locally and nationally since at least the late 1970s. In the Columbus MSA, local births of firms with fewer than 20 employees accounted for 11 percent of all employer firms in 1977 but 7.5 percent of firms in 2011 (an improvement from slightly more than six percent in the recession year of 2009). To make matters worse, the death rate of these small firms has generally hovered between seven and eight percent throughout the 34-year period. The birth rate fell below the death rate in 2006 and has remained below the death rate ever since – implying that more small firms are dying than are being born.

This weak environment for small businesses imposes at least two negative impacts on the Central Ohio economy. The first is that fewer firms come into the market and introduce innovative products and services. These innovations force existing firms to become more innovative as well in order to remain competitive. Those firms that fail to respond to this challenge will fail and cede their market share to the innovator. Without this business churn, economic efficiency and the ability of the economy to meet consumers' and businesses' needs are both reduced. Second, locally-owned, locally-serving businesses trap spending within the Central Ohio economy. As discussed earlier, this leads to additional rounds of spending that increase regional output, earnings, and employment beyond the impact of the local business itself. The weakness of small business development in the Central Ohio economy implies that the multiplier effect of local spending is less than it should be, and output, earnings, and employment are all diminished as a result.

The opportunities provided by the Blueprint program will help to address these problems. With suitable focus on entrepreneurial development, individuals within the targeted neighborhoods who might otherwise never consider starting a business might be encouraged to do so. The Blueprint program on its own cannot hope to solve Central Ohio's entrepreneurship problem, but every step in the right direction is a worthwhile step to take.

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