Springfield Water and Sewer Commission

Integrated Wastewater Plan

VOLUME I

April 2014

MWH

KLEINFELDER
Bright People. Right Solutions.

May 7, 2014

Mr. Douglass Koopman
U.S. Environmental Protection Agency
Region 1
5 Post Office Square, Suite 100
Boston, MA 02109-3912

Dear Mr. Koopman

The Springfield Water and Sewer Commission (the Commission) are submitting this Integrated Wastewater Plan (IWP) to the U.S. Environmental Protection Agency (EPA), Region 1, and the Massachusetts Department of Environmental Protection (DEP). This is an update to the Final Long Term Control Plan (FLTCP) submitted to EPA and DEP in May 2012, which was prepared in compliance with the requirements of EPA Administrative Order 08-037, EPA's 1994 CSO Control Policy, and DEP's 1997 Policy for Abatement of Pollution from CSOs.

It is the Commission's intent to submit this IWP to MEPA as the next phase of CSO compliance efforts on or about June 5, 2014, 30 days from the date of this letter.

This IWP expands upon the precedent set by the May 2012 FLTCP and aligns more effectively with EPA's integrated planning framework. It demonstrates the Commission's ongoing commitment to CSO control while sustaining the Commission's core goals through the following objectives and achievements:

- Improving the water quality of the Connecticut River.
- Satisfying the intent of Administrative Orders for CSO control and NPDES Permit Compliance.
- Providing adequate CSO control while addressing existing and future infrastructure needs.
- Providing sustainable and cost effective projects that balance the level-of-service to its customers, water quality benefits, and life-cycle operations and maintenance costs.
- Maintaining a plan which is based on a greater understanding and accuracy of existing conditions. This greater level of confidence will help to ensure that recommended projects and plans will achieve the desired objectives and minimize the need for project changes over the duration of the IWP implementation program.

This IWP includes an enhanced re-evaluation of the Commission community's financial capability to sustain CSO and wastewater collection and treatment system expenditures. Census tract and billing data records were examined for an understanding of rate-payer capability on a micro-community level. The assessment indicates a financial hardship on rate-payers if shorter implementation periods are pursued. Pursuant to the May 2012 FLTCP and EPA guidance, the

IWP continues to seek to provide a balance between the requirements for CSO reduction and existing system needs within the financial limits of the rate-payer community.

The Commission remains confident the IWP is consistent with EPA CSO policies and guidance and will sustainably serve the environment, the rate-payers, and affected stakeholders.

Thank you for your continued participation.

SPRINGFIELD WATER AND SEWER COMMISSION

Kath J. Pedersen

By: Katherine J. Pedersen
Executive Director

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ES.1 INTRODUCTION

The objective of this report is to provide an updated comprehensive Integrated Wastewater Plan (IWP) that captures the most recent status of the implementation of the Final Combined Sewer Overflow (CSO) Long Term Control Plan which was submitted in May 2012 (May 2012 FLTCP) by the Springfield Water and Sewer Commission (the Commission) and work performed as part of the Commission's Wastewater Capital Plan. The Commission is committed to ensuring their CSO control plan is technically feasible, affordable, comprehensive, and maximizes benefit to the impacted receiving waters while providing their core services of delivering drinking water and treating wastewater in the greater Springfield area. To that end, the Commission has initiated the following actions since May 2012:

- Completed design of the first FLTCP project (the Washburn CSO Control Project) and its construction is in progress;
- Completed additional wastewater system investigations and analyses to verify system conditions an identify needed rehabilitation and replacement requirements for the existing system;
- Further refined the hydraulic model based on findings of system investigations;
- Further refined and improved system optimization and flow balancing components of the 2012 recommended plan;
- Commenced an update to the affordability analysis to account for the system updates and enhancements to the 2012 recommended plan.
- Completed the Final Environmental Impact Report for MEPA filing.

The IWP approach seeks to identify a sustainable and effective CSO control program that provides achievable regulatory compliance and environmental gains in the context of continued and responsible operations and maintenance of the water and wastewater system infrastructure. The methodologies used to develop this integrated plan support an implementation goal that provides for:

- Largest CSO reductions in the first phases of implementation of the program;
- Maximum risk reduction for wastewater infrastructure in the first phases of the program;
- A flexible and expandable program that can be adjusted for changing regulatory, financial, technological, and environmental conditions;
- Continued and reliable water and wastewater service that is affordable to the community.

The Commission has been addressing CSOs to the surrounding receiving waters since a regional CSO planning study was performed in 1988. In the late 1990's the Commission started the process of developing a draft CSO LTCP for the three receiving waters in the City. The Draft Long Term CSO Control Plan and Environmental Impact Report was completed in March of 2000. This document identified projects and an implementation schedule for CSO controls across the service area. Work completed under the Draft CSO LTCP includes the following:

- Construction of system optimization measures (SOMs) and CSO control projects for the Mill River receiving water area – completed in 2003
- Installation of the new Washburn Street Regulator Structure – completed in 2008
- Construction of the Chicopee River CSO Control Projects – completed in 2009
- Construction of the Phase I Connecticut River CSO Control projects – completed in 2011

To date the Commission has invested $100 million (including $12 million in debt service interest payments to date) toward reduction of CSOs and improvements to the existing wastewater collection system in completed projects and is approaching substantial completion of the $21 million Washburn CSO Control Project. Work completed between 2000 and 2012 has reduced the annual CSO volume for the typical year (1976) by 98.1% in the Mill River area and 98.7% in the Chicopee River area. Connecticut River CSO volume reduction is currently 1.6% from completed projects. However, completion of the Washburn CSO Control Project is projected to reduce CSO volume to the Connecticut River by 12% for the typical year (1976) and the CSO control elements of this updated IWP focuses on those remaining overflows to the Connecticut River.

Throughout this process, the Commission has demonstrated its commitment to CSO control and will continue to fulfill this responsibility in a manner that is responsible and sustainable. The Commission's core goals remain:

- Improving the water quality of the Connecticut River.
- Satisfying the intent of Administrative Orders for CSO control and NPDES Permit Compliance.
- Providing adequate CSO control while addressing existing and future infrastructure needs.
- Providing sustainable and cost effective projects that balance the level-of-service to our customers, water quality benefits, and life-cycle operations and maintenance costs.
- Maintaining a plan which is based on a greater understanding and accuracy of existing conditions. This greater level of confidence will help to ensure that recommended projects and plans will achieve the desired objectives and minimize the need for project changes over the duration of the IWP implementation program.

This IWP, which serves as an update to the May 2012 FLTCP, will be submitted to the Massachusetts Department of Environmental Protection (DEP) and U.S Environmental Protection Agency (EPA) Region 1 to inform those agencies of progress since 2012 and will constitute the MEPA filing as the next phase of Commission's CSO control compliance efforts and satisfy the existing CIP and NPDES compliance steps.

ES.2 HYDRAULIC MODEL REFINEMENTS AND UPDATES

During the period of time since the FLCTP was submitted in 2012, there have been a number of model updates, changes and new findings which have been reflected in the model. To understand the impact of these changes, additional work has been conducted to update the model and in doing so revisit the model predictions; specifically relating to the ability to predict CSO results for the typical year (1976).

The evolution in the model configuration from the understanding as reflected in the May 2012 FLTCP to present is owed to additional knowledge gained from field surveys, review of record drawings, ongoing collection system investigations and assessment and progression of CSO abatement projects in the collection system. Table ES.2-1 characterizes changes to the baseline network configuration since the May 2012 FLTCP.

Table ES.2-1: Summary of Hydraulic Model Updates

CSO Regulator	Change to Baseline Model	Source	Result
CSO 007	Updated record information for 007/049 project, added network connectivity for the catchment.	007/049 post-construction information, additional field and record information from Washburn construction.	Increase of approx. 75,000 gal of available storage capacity in the 007 catchment and decrease of underflow to CRI.
CSO 008	Added network connectivity for the catchment and extended Garden Brook Sewer to actual length, updated lower catchment areas that were partially separated.	Additional field and record information from Washburn construction.	Increase of approx. 435,000 gal of available storage capacity in the 008 catchment and reduction of volume runoff in some sub-catchments.
CSO 012 / CSO 013 / CSO 016	Adjusted configuration of Taylor St connections between CSO 012/013, disconnected Taylor St from Main St, and adjusted Worthington St connection to Main Street.	Additional field and record information gathered to support refinement of baseline and recommended plan model	Less storage volume in the Worthington St sewer, less relief to Main St from Taylor/Worthington, greater pressure on CRI from CSO 012/013 and greater discharge at CSO 016.
CSO 014	Re-routed State St trunk line around Civic Center connecting State St to Main St upstream of Elm St.	Additional field and record information gathered to support refinement of baseline and recommended plan model	Greater flow to CSO 014 via Elm St connection to Main St.
CSO 019 / CSO 046	Deleted non-permitted overflow (CSO 019-SI)	SWSC O&M records	CSO relief for the Dickinson St sewer shifted to CSO 019. Decrease in capacity in the MIS to receive underflow from 046

The Commission performed a temporary metering program between June 2013 and August 2013 to support future design work and help correlate some of the information from the annual CSO and rainfall monitoring and analysis with model output data. This information was used, in conjunction with the additional field and record information in Table ES.2-1, to update the model.

Eleven temporary flow meters and six rain gauges were installed in the area tributary to the Connecticut River. Data from these meters and gauges were used to review the previous calibration of the model and update areas of the model where additional confidence or understanding was required. Figure ES.2-1 is a schematic of the temporary metering program. The figure also shows the ADS permanent flow meters and their locations that were included as part of this analysis. Temporary flow meters are denoted as S101 through S111 and the permanent meters are shown on their representative CSO outfalls.

The temporary metering program yielded three storms that were selected as calibration events. These events represented 1.) a long duration event, 2.) a high intensity event, and 3.) an intermediate intensity/duration event and occurred when the majority of the meters in the study area returned good data.

The continuous updates and understanding of the baseline model configuration, plus the findings of the short term flow metering and calibration review result in revised baseline CSO frequency and volume predictions. While not significantly different when compared to the baseline conditions reported in the May 2012 FLTCP, the updates for the CRI CSOs are presented in Table ES.2-2 and represent the Commission's understanding of the existing system CSOs, as predicted for the typical year (1976) rainfall, going forward.

Figure ES.2-1: Schematic Plan of the Temporary Flow Metering Program

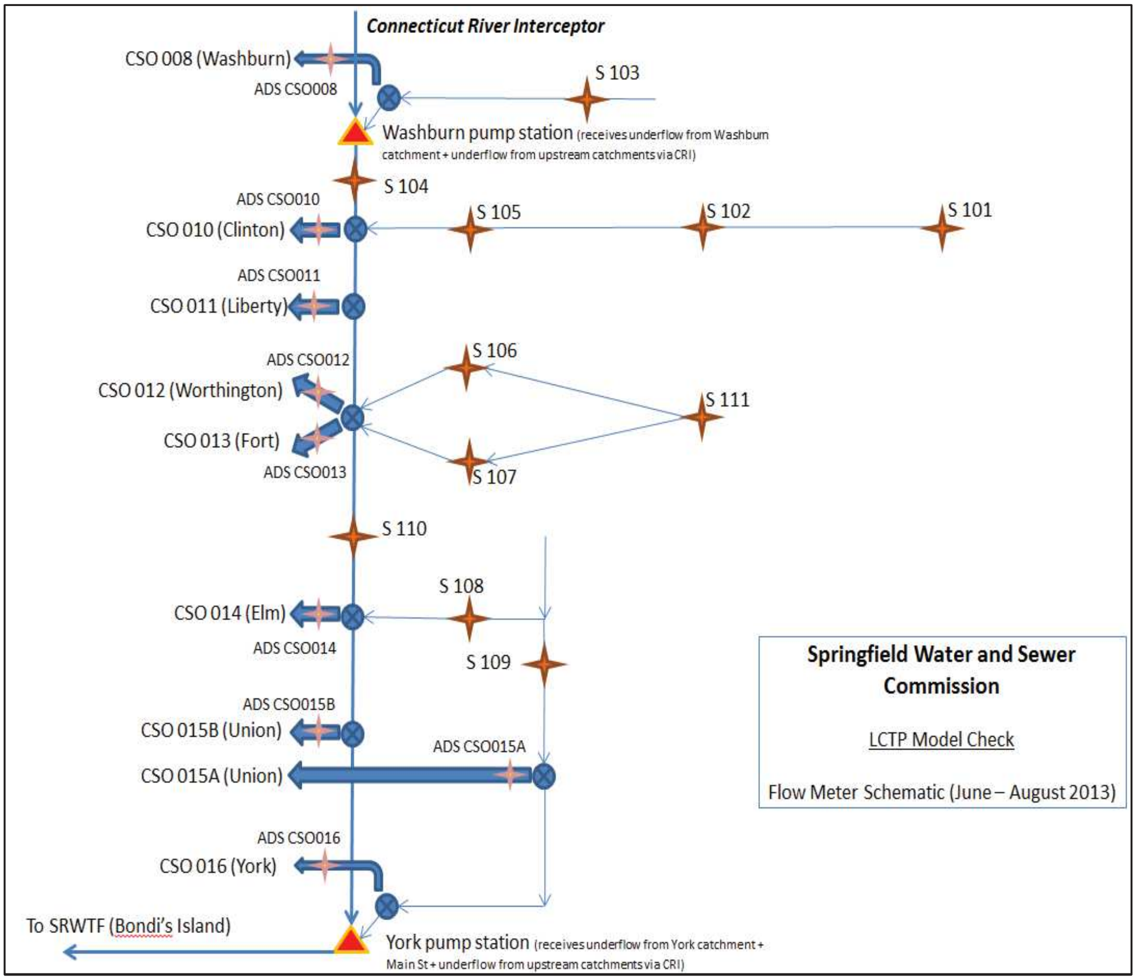

Table ES.2-2: Updated Baseline Activations and Volumes for the CRI – January 2014

Connecticut River				
CSO Regulator / By-Pass				
	# Activations	Volume (MG)	# Activations	Volume (MG)
CSO 007	0	0.0	0	0.0
CSO 008	45	63.2	38	43.6
CSO 010	71	163.5	69	157.4
CSO 011	19	6.3	19	6.6
CSO 012	40	50.0	39	54.1
CSO 013	19	34.7	19	36.9
CSO 014	50	41.2	53	42.2

CSO 015A	35	24.8	42	26.8
CSO 015B	13	1.9	15	2.1
CSO 016	39	58.9	42	69.8
CSO 018	1	0.01	1	0.01
CSO 049	3	0.7	1	0.04
Outfall 042	4	1.2	4	1.3
CRI Totals	**1-71 (Avg. 26.1)**	**445**	**1-69 (Avg. 26.3)**	**441**

The current Commission hydraulic model is considered reflective of the 2014 sewer system and operational practices. Updates made since the May 2012 FLTCP have caused the model predictions for the CSO overflows to be redistributed but in all cases the changed results are directly attributable the reconfiguration of the sewer system as a result of new and updated information coming to light. The overall volume balance between the 2012 and 2014 baseline models shows only 0.7% variance, demonstrating that the latest overall model results are comparable to those reported following the 2012 analyses. As the sewer assessment and asset management programs are advanced, the Commission anticipates further information will be introduced that will require additional metering and modeling, and as such the collection system hydraulic model should be considered dynamic.

ES.3 ENVIRONMENTAL IMPACT REPORT

The Final Environment Impact Report (FEIR) component of the CSO Control Program pursuant to Section 11.07 (6) (a) of the Massachusetts Environmental Policy Act (MEPA) regulations is included in this updated IWP. The following project information is provided as part of the FEIR for the Commission's FLTCP:

Project Name: Integrated Wastewater Plan
Project Location: Springfield
EOEA File Number: 11525
Type of EIR: Final EIR
Proponent: Springfield Water and Sewer Commission
Prepared By: Kleinfelder/MWH
Date of Filing: February 2014

On March 11, 1998, an Environmental Notification Form was filed for the Long Term CSO Control Plan with the Executive Office of Environmental Affairs (EOEA) resulting in a recommendation by EOEA that the Commission draft an Environmental Impact Report (EIR) for the project.

A Draft EIR (DEIR) was filed on March 31, 2000 and the DEIR certificate was issued on June 23, 2000. The scope of this FEIR has been developed based on EOEA comments in the DEIR certificate as well as in meetings attended by EOEA and Commission. The DEIR required

Commission to address specific issues in the FEIR. The issues identified and addressed in either the FEIR or FLTCP are listed below.

- Methodology of the affordability analysis.
- Potential for greater reliance on stormwater controls and artificial wetlands.
- Ongoing coordination with Connecticut Department of Energy and Environmental. Protection (CTDEP).

Since the submission of the DEIR (June 2000), four Notices of Project Change (NPC) have been filed and related waivers from draft Record of Decisions (ROD) have been issued. In a May 22, 2012 meeting, DEP and the EOEA requested that the FEIR also address and include the following components:

- A description of changes between previous submissions and most recent submission.
- All previous NPC filed under the previous DLTCP.
- Comments and responses made under NPC or MEPA filings under the previous DLTCP.
- Copies of all Final Records of Decision (FRODs) under previous NPC or MEPA filings under the previous LTCP.

The FEIR included as part of the IWP describes the potential temporary and permanent impacts of implementing CSO control measures for the Connecticut River tributary area. Most of the alternatives require a below grade construction of new pipeline, conduits, and storage or pumping facilities. Temporary impacts will be intermittent disruption to adjacent property, including limited access to activities, such as recreation. The Commission will commit to undergoing consultation with appropriate agencies and stakeholder groups, for example, but not limited to, US Army Corps of Engineers, US Fish and Wildlife, and Massachusetts Historic Commission, during each phase of the implementation to avoid, minimize, and mitigate any impacts to meet regulatory requirements.

The Commission will also mitigate any temporary impact by implementing BMP during construction including sedimentation control measures such as the use of silt fence and hay bales and turbidity curtains in the River; settling tanks and other methods for the removal of sediment prior to the discharge of groundwater; silt sock inserts to protect catch basins; and temporary and permanent vegetation and natural fiber erosion control blankets to protect embankments from erosion. Construction will proceed as rapidly as possible and the contractors will be responsible for delays. Other mitigation measures include the following:

- All appropriate works will be fenced and secured to prevent unauthorized access.
- The undertaking will adhere to the Springfield and Agawam Conservation Commissions' work specification and design standards.
- The contractor will be responsible for implementing standard dust control mitigation measures.

- The contractor will be responsible for conforming to Springfield and Agawam noise ordinances.
- Construction related traffic is anticipated to be minimal. A traffic management plan will be developed prior to any phase implementation to minimize impacts. MassDOT approval will be sought for activities that will take place in state roads.

MEPA regulations further require that Proposed Section 61 Findings are included as part of this FEIR. These Section 61 Findings for the Commission's LTCP have been prepared to comply with MGL Chapter 30, Section 61. Under this regulation, before any agency can approve a project that required an EIR, the agency must first evaluate and determine the impacts on the natural environment and confirm that all feasible measures have been taken to avoid and minimize those impacts.

The implementation of the LTCP will reduce the frequency of untreated discharges into the Connecticut River resulting in long term improved water quality. There will be some temporary, short term impacts related to construction, such as dust and noise, but these impacts will be minimized by the implementations of BMP by the Commission and its contractors.

In summary, the Commission finds that all feasible and prudent measures will have been taken to avoid or minimize adverse impacts to the environment relating to the implementation and construction of recommended CSO control projects identified in the IWP. Additional mitigation measures may be required as a result of implementation of each phase and will be addressed and developed prior to the start of construction for that phase.

ES.4 RECOMMENDED INTEGRATED WASTEWATER PLAN UPDATE

CSO Control Updates

The Commission continues to invest significant time and effort to refine and further evaluate the CSO Control Alternative H-5 as the most cost effective and Recommended CSO Control Plan. As stated in the May 2012 FLTCP, the Recommended Plan meets and exceeds State and Federal CSO guidelines for minimum performance measurements of long term control plans (LTCPs) (based on typical year (1976) rainfall conditions), including 89% CSO volume reduction on a system-wide annual basis. The Plan consists of several projects to be completed in phases over 20 years. The updated capital cost of the Plan is estimated at $183.3 million for CSO control.

Broadly, the Plan continues to provide 62 MGD of pumping capacity at the York Street pump station, a new 48-in diameter river crossing from the collection system to the SRWTF (1,400LF), new storage and conveyance conduits (3,800LF of 12-ft x 12-ft box culvert and 4,000LF of 48-in pipe) for relief of the Connecticut River Interceptor, targeted sewer separation and inflow removal, widespread system optimization measures via flow control structures, and stormwater management features. The updated Plan provides an upsized Locust Street sewer and parallel sewer on York Street, in addition to junction/diversion structures, to enable sewer river crossing isolation for maintenance or repairs. These improvements are illustrated in Figure ES.4-1.

The Recommended CSO Control Plan components are to be implemented over a period of 20 years. The project sequencing continues to provide rapid CSO abatement in the first two project phases, accounting for greater than 52% reduction in CSO volume, within the first 5-10 years of Plan implementation.

The baseline conditions representing the system configuration today and the updated Recommended CSO Control Plan were simulated for the typical year (1976). Results for the Connecticut River CSOs are presented in Table ES.4-1 along with a comparison to the May 2012 FLTCP results.

In baseline conditions, the total annual CSO volume from the CRI system is predicted to be 441 million gallons (MG). The updated Recommended CSO Plan is projected to result in an annual overflow volume of 59.0 MG from the CRI system, which is an 87% reduction in volume upon completion. The Recommended Plan projects overflow frequencies of 1 to 7 overflows per regulator per typical year (1976) in the CRI system. No change in overflow activity is predicted to occur as a result of the Recommended Plan in either the Mill River or Chicopee River CSO Systems. No work is proposed in the Recommended Plan in the Chicopee River CSO System, where Commission has already implemented CSO control improvements under an administrative order.

Figure ES.4-1: Recommended CSO Control Plan Improvements (Alternative H-5) – Updated

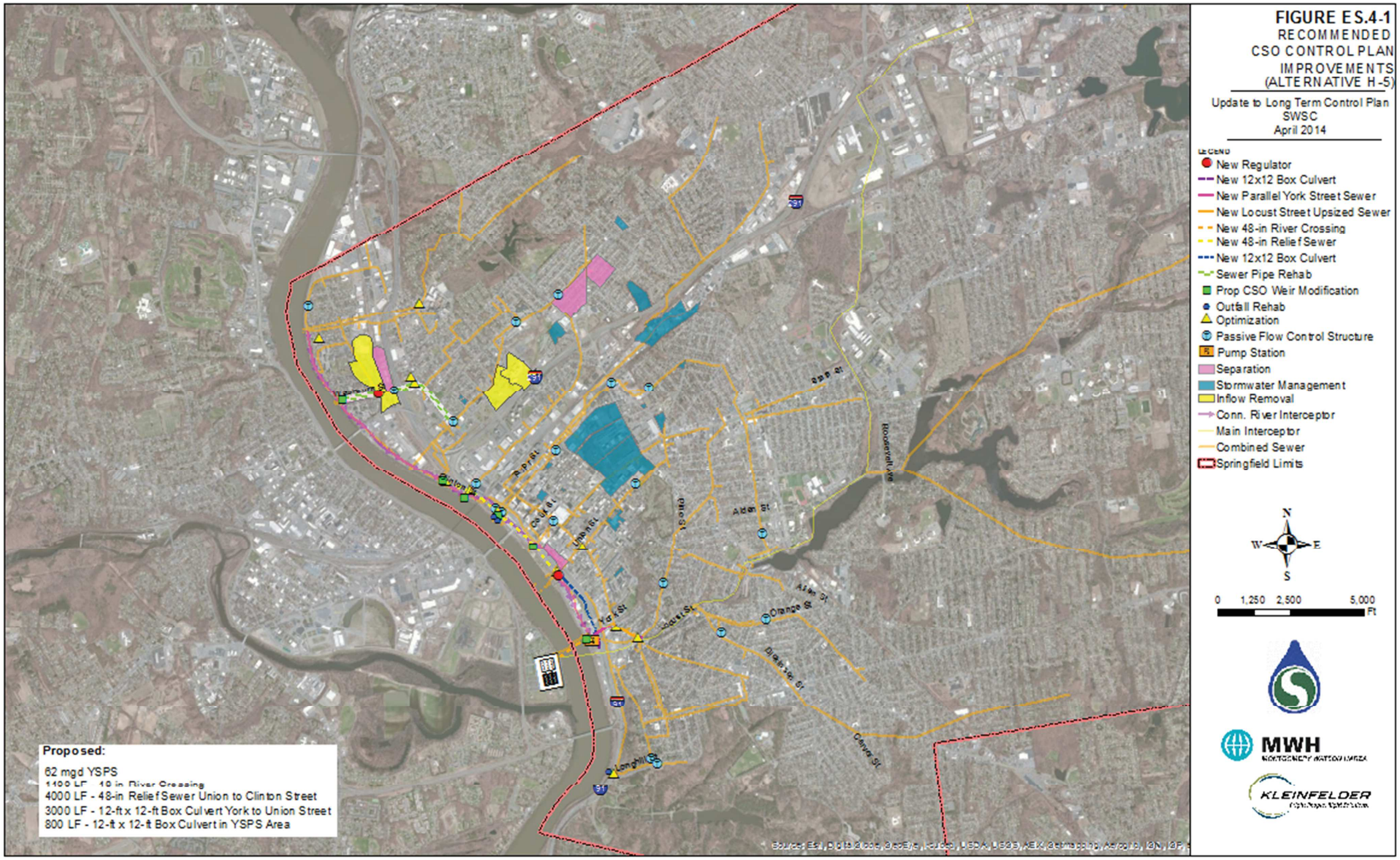

Table ES.4-1: Updated Recommended Plan CSO Activations and Volumes

CSO Regulator/ By-Pass	Baseline Conditions (Typical Year - 1976)		Recommended Plan 2012 (Typical Year - 1976)		Updated Recommended Plan 2014 (Typical Year - 1976)	
	# Activations	Volume (MG)	# Activations	Volume (MG)	# Activations	Volume (MG)
	Connecticut River					
CSO 007	0	0.0	4	2.8	2	0.1
CSO 008	38	43.6	4	0.7	4	1.5
CSO 010	69	157.4	6	7.7	6	6.9
CSO 011	19	6.6	7	6.5	6	1.2
CSO 012	39	54.1	8	4.9	4	0.5
CSO 013	19	36.9	6	9.9	7	12.0
CSO 014	53	42.2	7	5.6	6	2.0
CSO 015A	42	26.8	6	4.3	6	6.1
CSO 015B	15	2.1	5	3.9	6	3.1
CSO 016	42	69.8	5	4.1	7	16.8
CSO 018	1	0.01	1	0.01	1	0.01
CSO 049	1	0.04	4	0.4	4	0.4
Outfall 042	4	1.3	5	8.4	5	8.4
CRI Totals	1-69 (Avg. 26.3)	441	1-8 (Avg. 5.2)	59.2	1-7 (Avg. 4.9)	59.0

The updated performance statistics represent a further reduction in the activation frequency across the CRI system with 4.9 activations on average versus 5.2 activations in the May 2012 FLTCP while again producing a modest decrease in total CSO volume to 59.0 MG versus 59.2 MG previously reported in the May 2012 FLTCP. Differences in activation frequency at individual regulators between the current plan and the previous plan are realized due to refinements in specific project features.

With the updated Recommended CSO Plan predictions above for the CRI system, and considering the CSO reductions achieved from the previous Chicopee River CSO System and Mill River CSO system the total CSO volume reduction since 2000 will be 89% upon completion, as indicated in Table ES.4-2 below.

Table ES.4-2: CSO Volume Reduction at Plan Completion

Receiving Water	Summary (Typical Year)	
	Total Annual CSO Volume (MG)	% Reduction of Total CSO Volume
Mill River	1.2	**11.2%**
Chicopee River	0.2	**3.0%**
Connecticut River	59.0	**74.8%**
Totals	61.4	**89%**

The updated estimated capital cost for the Recommended Plan is $183,323,000. A breakdown of the capital cost by project is listed in Table ES.4--3. Costs are escalated to November 2013 dollars, from July 2011 dollars as previously reported in the May 2012 FLTCP.

Table ES.4-3: Estimated Capital Cost of Updated CSO Recommended Plan

Recommended Improvement	Capital Cost (Nov 2013 Dollars)
Washburn CSO Control	$20,927,000
CSO 012/013/018 Modifications	$5,640,000
York Street Pump Station and River Crossing	$58,043,000
York to Union Box Culvert	$32,131,000
Locust Transfer Structure/Conduit and Flow Optimization in Mill System	$17,100,000
Union to Clinton Relief Conduit	$18,720,000
Worthington/Clinton Targeted Sewer Separation and Stormwater Management	$30,761,000
Plan Total	$**183,323,000**

Wastewater Collection and Treatment System Updates

Since the submission of the May 2012 FLTCP, the Commission has continued to improve its existing collection system infrastructure through a program of targeted and prioritized infrastructure improvements. These improvements have included a continued plan of diagnostics and system assessment; improvements to the Commission's Asset Management Program which is used to prioritize the improvements and also improve Operations and Maintenance response; continued cleaning of the existing infrastructure including the removal of grit, roots, and Fats, Oils and Grease (FOG) issues throughout the collection system; and improvements to structurally failing and aged collection system infrastructure.

In addition to updates to the May 2012 FLTCP which have already been or are currently being completed, the Commission continues to update its Wastewater and Sewer Capital Improvements Plan to address ongoing non-CSO related needs. Several enhancements to the Plan are included herein and are summarized in Table ES.4-4 below:

Table ES.4-4: Substantive Wastewater and Sewer Capital Improvements Plan Updates

Completed / On-going / Planned	Wastewater and Sewer CIP Update	Source	Result/Benefit	Total Cost
Completed	Ashley and Pine Streets Sewer Rehabilitation Project	Asset Management – Risk Based Prioritization	Structural Improvements and Extended Service Life for Large Diameter Critical Infrastructure	$2.75M
Completed	Allen/Bradley/Spruce Streets Sewer Rehabilitation Project	Asset Management – Risk Based Prioritization	Structural Improvements and Extended Service Life for Existing Infrastructure	$0.38M
Under Construction	Pine/Thompson/Ingersoll Grove Streets Sewer Rehabilitation Project	Asset Management – Risk Based Prioritization	Structural Improvements and Extended Service Life for Existing Infrastructure and Protection for Adjacent Critical Infrastructure	$2.60M
Under Construction	"21 Streets" Rehabilitation Project	Asset Management – Risk Based Prioritization	Structural Improvements and Extended Service Life for Existing Infrastructure	$8.70M
Under Design	Main Interceptor, Dickinson Siphon, CSO 018, and CSO 012/013 Outfalls Improvements Project	Asset Management – Risk Based Prioritization	Structural Improvements and Extended Service Life for One of the Commission's Top 3 Most Critical Infrastructure; Reduction in SSOs near Dickinson St; Improvements to Failing Outfalls	Approx $25.00M
Planned	67 Additional Sites w/ Structurally Failing Infrastructure	Asset Management – Risk Based Prioritization	Structural Improvements and Extended Service Life for Existing Infrastructure	$25.00M

Completed / On-going / Planned	Wastewater and Sewer CIP Update	Source	Result/Benefit	Total Cost
Completed / On-going / Planned	Continued Pipeline Cleaning and Diagnostics	Asset Management – Risk Based Prioritization	Improved Hydraulic Capacity Through Cleaning Program; Improved Operations and Maintenance Performance; Better Information Necessary for Decision Making When Prioritizing Additional Improvements	$12.50M
Planned	SRWTF Bar Screen Upgrades	SRWTF Operations and Condition Assessment	Reduction in Floatables to SRWTF Which Will Result in Better Operational Performance	$0.30M
Planned	SRWTF Electrical Distribution System Rehabilitation	SRWTF Operations and Condition Assessment	Improved Reliability and Risk Reduction Associated With Failures to the SRWTF Electrical Distribution System	$20.00M
Planned	Grit and Screening Facility at SRWTF	SRWTF Operations and Condition Assessment	Reduction in Grit and Debris to the SRWTF. Results in Increased Treatment Performance, Reliability, and Improvements to Operations and Maintenance	$36.60M

Table ES.4-5 presents a summary of the major components for the recommended Wastewater Capital Improvement Plan and the updated costs associated with those improvements. The Wastewater Capital Plan in its entirety is planned over a 40 year implementation period, which would extend through FY 2051. Costs and sequencing presented herein represent the full length Wastewater Capital Plan.

Table ES.4-5: Recommended Wastewater Capital Improvement Plan and Cost

Recommended Improvement	Estimated Cost
Capital Pipe Rehabilitation Cost	$142,842,000
Continued Diagnostics and Pipeline Cleaning	$24,221,000
Capital Improvements at SRWTF (0-30 years)	$139,011,000
Capital Improvements at Pump Stations (3-10 years)	$2,325,000
Capital Improvements at Pump Stations (20-40 years)	$70,000,000
Misc Annual Capital Improvements – Collection System / SRWTF / Pump Stations (0-20 years)	$16,800,000
Totals	**$395,199,000**

The Wastewater Capital Improvement Plan was updated to provide an ongoing IWP for the Commission's collection and treatment system. With the completion of the Ashley and Pine Streets Sewer Rehabilitation Project and the Allen/Bradley/Spruce Streets Sewer Rehabilitation Project, and the on-going Pine/Thompson/Ingersoll Grove Streets Sewer Improvements Project and the "21 Streets" Sewer Rehabilitation Project, the Commission has already successfully addressed many of its high priority existing wastewater and sewer collection system needs. However, there continues to be many additional priorities which have been and will be developed as a result of the on-going Continued Pipeline Cleaning and Diagnostics Project and using the Commission's Asset Management and Risk Based Prioritization Program. As of the end of 2013, in addition to the Projects listed above, 67 additional discrete sites have been identified with failing infrastructure and need to be addressed. This list will be modified each year as new condition information comes in, as projects are completed, and priorities and rankings change. These projects and existing system improvements are required to maintain what is already in place and allow the Commission to perform its primary wastewater collection and treatment services.

<u>Green Infrastructure Opportunities</u>

The May 2012 FLTCP offered three potential green infrastructure sites for stormwater management in the Recommended CSO Control Plan – one along the Albany Street area, another in the vicinity of Springfield Technical Community College, and a third along Chapin Terrace (part of Phase 1 of the Recommended CSO Control Plan and subsequently removed from the construction contract due to stakeholder resistance). However potential BMP technologies for these locations were not specifically recommended. As part of this updated IWP, additional work has been undertaken to identify BMP technologies, feasible sites within the City of Springfield, and applicability of various BMP technologies to those sites. These Green Infrastructure opportunities would be sited for additional benefits to solve issues relating to combined sewer overflows, sanitary sewer overflows, and stormwater quality.

BMPs can be designed to both treat and slow runoff from impervious areas including roadways, sidewalks, and building surfaces. In urban areas, natural drainage patterns have changed over time due to the incremental increase of impervious surface areas. Hardscape replacement with BMPs offers the opportunity to effectively manage wet weather runoff. The list below identifies the functions each of the BMP techniques could provide as solutions to managing the first inch of rainfall in Springfield.

- **Bioretention Basins (Rain Garden)** – a planting bed or landscaped area used to hold runoff, filter rainwater and to allow it to infiltrate;
- **Dry Wells and Infiltration Trenches** – areas backfilled with granular material that promote infiltration;
- **Level Spreader** – an aggregate filled trench designed to convert concentrated flow to sheet flow to promote infiltration and reduce soil erosion.
- **Grassed Swales** – channels designed to collect and convey flow. They offer treatment and retain runoff from storm events. Swales can be designed to be dry or wet. Wet swales are designed to contain water tolerant vegetation and use natural processes to remove pollutants.
- **Cisterns and Rain Barrels** – containers connected to the end of roof downspouts to provide storage to roof runoff. Collected runoff can be used for non-potable purposes such as watering of vegetation.
- **Permeable Pavements** – a type of road surface material (porous asphalt, pervious concrete, etc) commonly used in parking lots that encourage infiltration of precipitation to ground water.
- **Planter Boxes** – a landscaped area similar to a rain garden but with a vertical wall. They are used to collect runoff from sidewalks, parking lots, and streets, thereby reducing stormwater runoff flow rate, volume, and pollutants.

Potential sites were developed where land acquisition would not likely be required and where BMPs may be acceptable to the community (e.g. publicly owned land areas and institutional green spaces). Within the proposed grey infrastructure construction areas approximately 165 acres of land have been identified with potential for these types of improvements. Outside the proposed grey infrastructure construction areas approximately 204 acres of land have been identified. For purposes of updating the IWP it was assumed that approximately 182 acres of land would benefit from green infrastructure improvements and the costs have been included in the revised plan. These areas will be further detailed with applicable BMPs during design development.

ES.5 FINANCIAL CAPABILITY ASSESSMENT

Included in this updated IWP is a discussion and measurement of the Commission community's financial capability to undertake water quality related capital improvements (CSO and non-CSO work), both to comply with regulatory requirements of EPA and Massachusetts DEP, but also to pursue risk-based priority projects in the wastewater collection and treatment system, and for advance financial planning purposes for the Commission. The financial capability assessment within the IWP reflects a balance between the requirements for water quality goals and existing system needs within the financial limits of the rate-payer community, while being sustainable and adaptable to adjust to changing needs. The Financial Capability Assessment follows the EPA's 1997 Guidance Methodology and then continues with an enhanced approach evaluating affordability impacts on the community when viewed as a collection of micro-communities by utilizing both billing data and census tract data. The combination of these two affordability assessment approaches demonstrates an immediate financial burden on the citizens of Springfield, MA.

As previously stated, the Commission's IWP was developed by analyzing and comparing multiple project alternatives to select the most cost-effective solution. The Plan consists of numerous CSO and wastewater projects to be completed in phases over the next 20 to 40 years to achieve more than 85% reduction in CSO discharge volume and better than 95% water quality compliance, while maintaining the required investment in renewal of other treatment and collection system infrastructure. Moving forward the Commission will, to the extent of its financial capability, continue to strive to meet state and federally mandated goals and requirements. As such, the Commission estimates it will invest nearly $447.2 million (un-escalated) in capital projects, including CSO control, wastewater collection and treatment systems, and shared utilities projects through FY 2035, as shown in Table ES.5-1. Beyond that time frame it has identified another $146 million in future wastewater CIP projects.

Table ES.5-1: Long-Term Capital Improvement Costs

Capital Improvements	Estimated Cost
CSO Projects	$183,322,000
Wastewater Projects	$249,039,000
Shared Cross Utility Projects	$14,803,000
Total	$447,164,000

With a service area population of approximately 152,000, the Commission present worth capital requirement of $447.2 million equates to about $2,940 per person. Put another way, with a household total of approximately 63,000, this capital requirement equates to about $7,100 per household.

The EPA Guidance stipulates how the financial capability analysis should be undertaken for CSO control programs. In Phase 1 it is a process that calculates a Residential Indicator. Using the EPA guidance if the Cost Per Household (CPH) is less than one percent of Median Household Income (MHI) then this cost related factor is assigned a *low* Financial Impact value. If the CPH is between one and two percent of MHI then this factor is assigned a *mid-range* Financial Impact value. If the CPH is more than two percent of MHI then this factor is assigned a *high* Financial Impact value.

Table ES.5-2: Phase 1 Financial Criteria for Springfield

Cost per Household (CPH)	Adjusted Median Household Income (MHI)	Residential Indicator (RI)
$603.77	$40,588	1.49%

The Residential Indicator, per the above table, is determined to be 1.49% of MHI. Because the CPH is between one and two percent of MHI, the Residential Indicator is indicated to be of "Medium" Financial Impact, as indicated by the EPA Guidance criteria.

The Phase 2 assessment looks at the permittee's financial capability. Those indicators include the following: debt indicators of bond ratings and overall net debt as a percent of full market property value; socioeconomic indicators of unemployment rate and Median Household Income; and financial management indicators of property tax revenue collection rate and property tax revenues as a percent of full market property value. The EPA Guidance provides that each "Weak" financial capability indicator shall be assigned a numeric value of "1". Similarly, "Mid-Range" indicators are assigned "2" and "Strong" indicators are assigned "3." One of the Commission indicators score "1," four of the Commission indicators score "2," and one Commission indicator scores a "3." Using EPA's Financial Capability criteria to evaluate the six indicators for Springfield shows a "mid-range" score of 2 for financial capability using a simple arithmetic average of the six Commission indicators.

The intersection of the Phase 1 ("medium" financial capability burden) and Phase 2 ("mid-range" for financial capability) determinations shows that the overall assessment is "Medium Burden". While this initial and simplified approach based on 1997 guidance materials provides for a broad-brush financial capability assessment for the Commission, the actual affordability impact on customers in the City of Springfield requires a more detailed review of actual customer bills and income distribution levels.

This IWP has applied an enhancement to EPA's original methodology. The enhanced methodology differs from EPA by looking at the utility's service area on a census tract level. Residential customer data is collected from client billing data and an average bill is calculated within each census tract. These average bills are then matched up according to the MHI and income distribution data within each of those census tracts. The average bills are then indexed annually by the expected rate increases during the study period on a real basis where inflation is discounted. This allows one to analyze the average bill in 2014 dollars for every future year projected in the study period.

The enhanced methodology also utilizes a calculation of the Weighted Average Residential Index (WARi). Census data provides the income distribution of each census tract. Understanding income distribution is a critical element in assessing affordability issues for utility customers. Every census tract does not contain the same number of households and incomes are not evenly spread within each census tract. A weighted-average calculation is required to resolve the problem of income skew. When comparing the two methodologies side by side the enhanced approach demonstrates that when viewing the entire set of customers as a collection of micro-communities, the average bill is already unaffordable for many census tracts as compared to the EPA's approach.

Table ES.5-3 provides the "Financial Capability Matrix" based upon an enhanced methodology by taking into effect the weighted average of income distribution of households by census tract. The table shows the Phase 2 Permittee Financial Capability Indicators to be in the "Mid-Range" category. This is because the average scores are between 1.5 and 2.5. The Enhanced Phase 1 Residential Indicator under the new Weighted-Average methodology shifts the EPA's simplified calculation of the level of burden from "Medium Burden" to a "High Burden".

Table ES.5-3 Weighted Average Financial Capability Matrix with Enhanced Methodology

PHASE 2: Economic Indicators	PHASE 1 : Residential Indicator		
	Low (below 1.0 %)	Mid-Range (between 1.0 and 2.0 %)	High (greater than 2.0 %)
Weak (Below 1.5)	Medium Burden	High Burden	High Burden
Mid-Range (Between 1.5 and 2.5)	Low Burden	Medium Burden	High Burden
Strong (Above 2.5)	Low Burden	Low Burden	Medium Burden

Based on this analysis, the Commission requests a lengthy implementation period in order to accommodate the capital and operational requirements within the economic bounds of the community. Financial-based causes for subsequent extension of the implementation schedule may occur as well. For example, if the median household income of the Commission's service area significantly decreases in the future, if the population decreases substantially, if construction costs increase, if unemployment swells, or if the City's industrial base substantially shrinks, then the residential rates and charges necessary to pay for the projects proposed in the IWP may become overly burdensome due to the increased financial responsibility associated with implementing all elements of the IWP. The flexibility afforded by the integrated planning framework allows for the necessary re-evaluations to be conducted.

ES.6 IWP IMPLEMENTATION

The IWP seeks to strike a balance between the requirements for water quality goals and existing system needs within the financial limits of the rate-payer community, while being sustainable and adaptable to adjust to changing needs. The H-5 alternative continues to serve as the Recommended CSO Control Plan, with minor updates developed for this IWP. The major components of H-5 are packaged into projects for phased implementation, over a recommended 20 year period. Table ES.6-1 summarizes the CSO control projects implementation schedule.

Table ES.6-1: Recommended 20-Year Implementation of CSO Control Projects

CSO Components		
Recommended Improvement	**Capital Cost (Nov 2013 Dollars)**	**Schedule**
Phase 1: Washburn CSO Control	$20,927,000	2012 - 2014
Phase 1.5: CSO 012/013/018 Modifications	$5,640,000	2014-2016
Phase 2: York Street Pump Station and River Crossing	$58,043,000	2015 - 2020
Phase 3: Locust Transfer Structure/Conduit and Flow Optimization in Mill System	$17,100,000	2020 - 2021
Phase 4: York to Union Box Culvert	$32,131,000	2022-2029
Phase 5:Union to Clinton Relief Conduit	$18,720,000	2025-2030
Phase 6: Worthington/Clinton Targeted Sewer Separation and Stormwater Management	$30,761,000	2027-2031
Recommended Plan Totals	**$183,323,000**	**20 years**
Previous CSO Projects	**$100,000,000**[1]	**2000 - 2012**
Total CSO Control Costs	**$283,323,000**	

[1]Previous CSO Project Costs include debt service payments incurred to date (approximately $12M) in addition to $88M in capital monies previously committed.

The level of control derived from implementation of the CSO Control Plan in terms of reduction of CSO activations and reduction in CSO volume is presented in Table ES.6-2.

Table ES.6-2: CSO Reduction by Program Phase

Recommended Improvement	# Activations	Peak # Activations / Regulator	% Reduction in # Activations	CSO Volume (MG)	% Reduction in CRI CSO Volume
Baseline	342	69	0%	441	0%
Phase 1 - Washburn CSO Control	334	68	2%	390	12%
Phase 1.5: CSO 012/013/018 Modifications	334	68	2%	390	12%
Re-Evaluate CSO Control Plan after Completion of Phase 1.5					
Phase 2 - York Street Pump Station and River Crossing	203	38	41%	216.7	51%
Re-Evaluate CSO Control Plan after Completion of Phase 2					
Phase 3 - Locust Transfer Structure/Conduit and Flow Optimization in Mill System	200	38	42%	213	52%
Re-Evaluate CSO Control Plan after Completion of Phase 3					
Phase 4 - York to Union Box Culvert	147	38	57%	181.2	59%
Re-Evaluate CSO Control Plan after Completion of Phase 4					
Phase 5 - Union to Clinton Relief Conduit	129	20	62%	112.0	75%
Re-Evaluate CSO Control Plan after Completion of Phase 5					
Phase 6 - Worthington/Clinton Sewer Separation and SWM	64	7	81%	59.0	87%
Re-Evaluate CSO Control Plan after Completion of Phase 6					

The proposed sequencing of the CSO control projects continues to provide a front loading of CSO reduction in the combination of Phases 1 and 2 and works within the affordability framework for the rate payers. It is also recommended that an adaptive management approach continue to be taken for plan implementation. That is, upon completion of each phase of CSO control projects, the overall plan, measured performance, and cost of the program be evaluated against this 20 year projection and adapted to the latest conditions.

Table ES.6-3 provides a summary and projected schedule for the Wastewater Capital Improvement Plan components. This Plan reflects the additional level of detail developed since the May 2012 FLTCP to refine risk-based analyses of Commission assets. Wastewater capital projects have been further detailed and/or re-prioritized in the following phased asset classes:

- capital improvements at pump stations (Phases 1 and 10)
- collection system (Phases 2 and 7),
- ongoing collection system assessment needs (Phases 3 and 8)
- capital improvements at SRWTF (Phases 4, 5, 6, and 9)

Table ES.6-3: Recommended 40-Year Implementation of Wastewater CIP

Wastewater Capital Plan Components		
Recommended Improvement	**Estimated Capital Cost (Nov 2013 $)**	**Schedule**
Phase 1 – Capital Improvements at Pump Stations	$2,325,000	2016 - 2024
Phase 2a – Collection system pipe rehab – Ashley/Pine	$2,750,000	2012
Phase 2b – Collection system pipe rehab – Pine/Thompson/Grove	$2,600,000	2014
Phase 2c – Collection system pipe rehab – Allen/Bradley/Spruce	$1,067,000	2013 - 2014
Phase 2d – Collection system pipe rehab – '21 Streets'	$8,700,000	2014 - 2015
Phase 2e – Collection system pipe rehab – Main Interceptor	$12,780,000	2014 - 2016
Phase 2f – Collection system pipe rehab – 67 failing sites	$25,000,000	2017 - 2031
Phase 2g – Collection system pipe rehab - Miscellaneous	$30,017,000	2016 - 2031
Phase 3a – Continuing pipeline diagnostics – FY2013	$3,000,000	2012
Phase 3b – Continuing pipeline diagnostics – FY2014	$3,700,000	2013
Phase 3c – Continuing pipeline diagnostics – FY2015	$3,000,000	2014
Phase 3d – Continuing pipeline diagnostics – FY2016	$3,000,000	2015
Phase 3e – Continuing pipeline diagnostics – FY2017-2031	$2,220,000	2016 - 2031
Phase 4 – Bar Screen facility upgrades	$212,000	2015 - 2017
Phase 5 – Capital Improvements at the SRWTF – Elec Distribution System Rehab	$20,000,000	2015 - 2035
Phase 6 – Grit and screenings facility at the SRWTF	$36,464,000	2021 - 2025
Phase 7 – Additional collection system pipe rehabilitation and replacement	$59,928,000	2032 - 2041
Phase 8 – Additional pipeline diagnostics	$9,301,000	2032 - 2041
Phase 9 – Capital Improvements at the SRWTF	$82,335,000	2032 - 2041
Phase 10 – Capital Improvements at Pump Stations	$70,100,000	2032 - 2051
Phase 11 - Misc Annual Capital Improvements – Collection System / SRWTF / Pump Stations	$16,800,000	2014 - 2031
WW CIP Totals	**$395,199,000**	**40 years**

Both plans and projected stormwater expenditures were incorporated into a detailed financial model to determine overall IWP affordability. The financial analysis indicates that shorter implementation periods would create an adverse financial burden on the rate payers. Similarly, an emphasis on one plan over the other (CSO Control vs. Wastewater Capital) would place undue risk to both water quality and levels-of-service throughout the system. The IWP seeks to strike a balance between the requirements for CSO reduction and existing system needs within the financial limits of the rate-payer community.

The updated recommended implementation program is designed to achieve greater than one half of the full program's ultimate CSO reduction in the earliest phases of the program yet retain enough financial flexibility to perform needed existing system wastewater capital projects. The first three phases are high impact projects in terms of CSO reduction with an average cost of $377,000/ million gallons of CSO removed which is an efficient use of limited capital. This compares with a final program efficiency of $571,000/million gallons removed as steps to reduce CSO volumes become more difficult and cost intensive.

In addition, these early projects provide system redundancy and risk reduction with a third river crossing and provide the Commission the opportunity to more effectively inspect, maintain, and rehabilitate, if needed, the existing river crossings. The age, condition and criticality of the two river crossings were identified as the highest risk assets in the existing system. Therefore the early phases of the CSO Control Plan implementation also address the highest Wastewater Capital Improvement Plan priorities.

At the same time, the implementation program continues to provide for other critical wastewater capital projects identified in the risk based model that will address existing system needs, including pipe rehabilitation and replacement, limited improvements to pump stations and the treatment plant, and continuing collection system diagnostics that identify additional collection system needs. These needs cannot be ignored at the expense of the CSO Control Plan since they represent a high risk to water quality and levels-of-service as well.

Section 1
Introduction

SECTION 1 – TABLE OF CONTENTS

1.1 SUMMARY OF DEVELOPMENTS SINCE MAY 2012 FLTCP

The objective of this report is to provide an update on the status of the implementation of the Final Combined Sewer Overflow (CSO) Long Term Control Plan (FLTCP) which was submitted in May 2012 (hereafter referred to as ‘May 2012 FLTCP’) by the Springfield Water and Sewer Commission (hereafter referred to as ‘‘the Commission’). The Commission is committed to ensuring their CSO control plan is technically feasible, affordable, comprehensive, and maximizes benefit to the impacted receiving waters. To that end, the Commission has initiated the following actions since May 2012:

- Completed design of the first May 2012 FLTCP project (the Washburn CSO Control Project) and its construction is in progress;
- Completed additional system investigations and analyses to verify system conditions;
- Further refined the hydraulic model based on findings of system investigations;
- Further refined and improved system optimization and flow balancing components of the recommended CSO plan from the May 2012 FLTCP;
- Commenced an update to the affordability analysis to account for the system updates and enhancements to the 2012 Recommended Plan, with an integrated planning approach that is aligned with recent EPA guidance on community financial capability.

This document provides further detail on these efforts in the sections herein.

1.1.1 Comments Received on May 2012 FLTCP

On January 17, 2012, the Commission submitted a preliminary draft of its CSO Specific Abatement Plan to the U.S. Environmental Protection Agency (EPA) and Massachusetts Department of Environmental Protection (DEP) in accordance with US EPA Administrative Order Docket No. 08-037 et al. The CSO Specific Abatement Plan is a component of the May 2012 FLTCP. On April 30, 2012, the DEP transmitted a letter with comments on the CSO Specific Abatement Plan and other information previously presented to DEP and the EPA. The primary focus of DEP’s comments related to the proposed level of control (LOC) of the Commission’s abatement plan. The Commission reviewed DEP’s comments, but the Commission’s approach and overall Recommended Plan did not change. The Commission’s May 2012 FLTCP was subsequently submitted to EPA and DEP in May 2012.

On July 12, 2012, the Commission provided responses to the comments in DEP’s letter dated April 30, 2012. In this letter, the Commission also affirmed that its May 2012 FLTCP Recommended Plan provides the highest level of CSO control achievable and affordable pursuant to EPA and DEP guidelines and policies. The Commission then provided a presentation to DEP and EPA staff on December 17, 2012, detailing the specifics of the Recommended Plan in the May 2012 FLTCP. A productive dialogue occurred subsequent to the presentation, in which all parties acknowledged that the May 2012 FLTCP should be reviewed as an integrated plan.

On April 16, 2013, the DEP transmitted a letter with review comments for the full May 2012 FLTCP -. In the letter, DEP indicated its support for implementation of the first three phases of the May 2012 FLTCP Recommended Plan, but that additional work may be required by the agency upon completion of the Recommended Plan. The Commission responded in a letter dated August 12, 2013, in which the Commission took exception to the DEP's conditional support of a portion of the May 2012 FLTCP Recommended Plan. The Commission stated that the May 2012 FLTCP should instead be finalized using the EPA's *Integrated Municipal Stormwater and Wastewater Planning Approach Framework*, and that the Commission was willing to actively engage the DEP and EPA in this process. The EPA's "integrated planning framework" is further described in Section 1.2 below. Copies of correspondence listed herein can be found in Appendix A.

1.1.2 Washburn CSO Control Project

The first phase of the May 2012 FLTCP Recommended Plan is the Washburn CSO Control Project. The programmed cost of this project is $20,500,000. Project final design started in August 2011, and was completed in July 2012. Subsequently, the Commission advertised for bids, awarded a contract, and issued construction Notice-to-Proceed (NTP) in November 2012. Construction is in progress and on schedule for substantial completion by July 2014. Additional updates and details regarding the current status of the project are included in Section 2 of this document.

The primary objective of the project is to meet the Washburn CSO level of control for the typical precipitation year (1976) as indicated in the Recommended Plan. Secondary objectives are to extend the service life of key collection system infrastructure in the Washburn catchment area, such as the 84-inch Washburn Street combined sewer and the 66-inch Garden Brook sewer via trenchless rehabilitation; upgrades to critical water infrastructure; and potentially install green infrastructure in the area to improve stormwater runoff control and treatment.

1.1.3 Progress toward Sewer Collection System Diagnostics and Rehabilitation

Since May 2012, the Commission has completed assessment of approximately 825,000 LF of its collection system pipelines, including associated structures and facilities. The primary objective of this ongoing diagnostics program is to identify system vulnerabilities and continuously update the Commission's prioritization of its capital improvement projects included in the May 2012 FLTCP, while simultaneously meeting CMOM requirements in its Administrative Order. The secondary objective is to confirm hydraulic connectivity of system components to further refine the system inputs to the hydraulic model. In conjunction with this effort, the Commission implemented a temporary flow metering program during the summer of 2013, which consisted of 11 temporary flow meters and 6 temporary rain gauges. The program was initiated to support further hydraulic analyses to refine system optimization and flow balancing components of the 2012 Recommended Plan. Section 2 of this document provides details regarding the hydraulic updates to the plan. Additional updates and details regarding the progress of system diagnostics and prioritization of capital projects (including rehabilitation) are included in Section 4 of this document.

1.1.4 Unaffected Components of the May 2012 FLTCP

This document provides updates to certain components of the LTCP. All other components not addressed in this document remain current and in effect, such as the initial development of the system hydraulic model, previous field investigations and flow monitoring, previous development and evaluation of CSO control alternatives, and previous receiving water quality analyses. This document serves as a supplement and appendix document to the May 2012 FLTCP.

1.2 REGULATORY UPDATES

Historically, the U.S. Environmental Protection Agency (EPA) and Massachusetts Department of Environmental Protection (DEP) have focused on compliance with individual Clean Water Act (CWA) permits and requirements for wastewater, combined sewer, and stormwater discharges. As a result, municipalities and utility owners often struggled to balance competing CWA priorities with a limited financial capability. In 2011 and 2012, the EPA published guidance memorandums allowing for integrated planning approaches to compliance with all objectives of the CWA. In its Press Release "*Achieving Water Quality Through Municipal Stormwater and Wastewater Plans"* dated October 28, 2011, the EPA encourages States and communities to use an integrated planning approach in stormwater and wastewater management. In this memo, the EPA states "an (integrated) approach will help municipalities responsibly meet their CWA obligations by maximizing their infrastructure improvement dollars through the appropriate sequencing of work. … Integrated planning also can lead to the identification of sustainable and comprehensive solutions, such as green infrastructure, that improve water quality as well as support other quality of life attributes that enhance the vitality of communities." In addition, the EPA shows their support for green infrastructure by stating the "EPA strongly encourages the use of green infrastructure and related innovative technologies, approaches, and practices to manage stormwater as a resource, reduce sewer overflows, enhance environmental quality, and achieve other economic and community benefits."

On June 5, 2012, the EPA issued a memorandum titled "Integrated Municipal Stormwater and Wastewater Planning Approach Framework" to provide additional guidance on creating effective integrated plans, including guiding principles and implementation.

On January 18, 2013, the EPA issued a memorandum titled "Assessing Financial Capability for Municipal Clean water Act Requirements", which is discussed in greater detail in Section 1.2.3 below.

1.2.1 Guiding Principles of IPF

The EPA's Integrated Planning Framework provides the flexibility to implement the most cost-effective CWA solutions in a sequence which will prioritize projects such that the most serious water quality and system issues can be addressed sooner. The integrated planning approach does not lower compliance standards. Instead, it allows agencies to consider a municipality/utility owner's financial capability for meeting all CWA requirements and prioritizing infrastructure improvements. Effectively it facilitates planning for CWA compliance in a responsible manner, with a focus on asset management, balancing an agency's most pressing problems in a manner that addresses health and environmental protection issues first, consideration of community impacts and disproportionate financial burdens, and showed support for innovative and sustainable technologies, especially green infrastructure.

More specifically, the EPA provides the following principles that should guide an integrated plan:

- Reflect State requirements and planning efforts and incorporate State input on priority setting and other key implementation issues;
- Provide for meeting water quality standards and other CWA obligations by utilizing existing flexibilities in the CWA and its implementing regulations, policies and guidance;
- Maximize the effectiveness of funds through analysis of alternatives and the selection and sequencing of actions needed to address human health and water quality related challenges and non-compliance;
- Evaluate and incorporate, where appropriate, effective sustainable technologies, approaches and practices, particularly including green infrastructure measures, in integrated plans where they provide more sustainable solutions for municipal wet weather control;
- Evaluate and address community impacts and consider disproportionate (financial) burdens resulting from current approaches as well as proposed options;
- Ensure that existing requirements to comply with technology-based and core requirements are not delayed;
- Ensure that a financial strategy is in place, including appropriate fee structures;
- Provide appropriate opportunity for meaningful stakeholder in put throughout the development of the plan.

1.2.2 Key Elements of IPF

In accordance with the guiding principles above, the EPA also provides the following six elements that an integrated plan should address. The May 2012 FLTCP aligns with these elements as described and in some cases is supplemented with the updates to the Recommended Plan described elsewhere in this document.

Element 1: A description of the water quality, human health, and regulatory issues to be addressed in the plan.

- Sensitive areas and environmental concerns have been identified in Section 2 of the May 2012 FLTCP.

Element 2: A description of existing wastewater and stormwater systems under consideration and summary information describing the systems' current performance.

- Section 2 of the May 2012 FLTCP addresses the CSO system and Springfield Regional Wastewater Treatment Facility (SRWTF);
- Section 3 of the May 2012 FLTCP discusses field investigations and inspection of the collection system, SRWTF, and CSO Regulators;
- Section 4 of the May 2012 FLTCP discusses monitoring of rainfall and flow monitoring of the wastewater and stormwater collection systems;
- Section 5 of the May 2012 FLTCP discusses system modeling of existing conditions and flow characterization of CSO behavior and bacteria loadings.

Element 3: A process which opens and maintains channels of communication with relevant community stakeholders in order to give full consideration of the views of others in the planning process and during implementation of the plan.

- Public and regulatory participation, including public meetings, public hearings, coordination with stakeholders, regulatory coordination, and annual updates, are addressed in Chapter 12 of the May 2012 FLTCP.

Element 4: A process for identifying, evaluating, and selecting alternatives and proposing implementation schedules.

- Section 6 of the May 2012 FLTCP discusses development of criteria used to evaluate CSO control alternatives, including a range of CSO control technologies, screening level alternatives evaluation for CSO Control, improvement alternatives for the SRWTF, cost estimates; and describes the alternatives evaluation process and selection of a recommended plan.
- Section 8 of the May 2012 FLTCP discusses the recommended CSO Control Plan including description, costs, performance, implementation schedule, benefit to receiving water quality, and post-construction monitoring program;
- Section 9 of the May 2012 FLTCP discusses the wastewater capital improvements plan, developed via an extensive asset assessment program, which employed a risk model to prioritize infrastructure improvements;
- Section 10 of the May 2012 FLTCP discusses the financial capability assessment of the service area that ensures investments are sufficiently funded, operated, maintained and replaced. An updated financial capability assessment follows in this document that reflects recent priority infrastructure spending undertaken by the Commission and a greater understanding of the financial implications of the Integrated Wastewater Program on the Commission's customer base.
- Section 11 of the May 2012 FLTCP discusses the Integrated Wastewater Program implementation, including the planning framework, implementation schedule, and program summary.

Element 5: A process for evaluating the performance of projects identified in a plan as the projects identified in the plan are being implemented, which may include evaluation of monitoring data, information developed by pilot studies, and other relevant information.

- Section 1 of the May 2012 FLTCP discusses the Nine Minimum Controls (NMC) program;
- Section 2 of the May 2012 FLTCP discusses the monitoring of CSOs as part of the Commission's NMC implementation;
- Section 8 of the May 2012 FLTCP highlights post-construction monitoring practices to be implemented that address hydraulic model suitability, including performance criteria, measures of success, and reporting requirements;
- Evaluation of the performance of green infrastructure and other innovative measures is addressed in this Integrated Wastewater Plan.

Element 6: A process for identifying, evaluating and selecting proposed new projects or modifications to ongoing or planned projects and implementation schedules based on changing circumstances.

- Section 8 of the May 2012 FLTCP recommends a 5 year periodic re-evaluation of the CSO Control Plan as part of the plan's adaptive management approach. Each recommended re-evaluation is sequenced after Phases 3, 4, and 5 to maintain flexibility for the Commission in achieving CWA goals while engaging stakeholders to evaluate plan progress and the implementation schedule in light of changing economic conditions, technologies, water quality conditions, and regulatory environment.
- Section 6 of this Integrated Wastewater Plan recommends an annual re-evaluation of the Capital Plan affordability and a re-evaluation of Capital Plan performance after each CSO phase, and selected Wastewater phases, each capturing new information as that data becomes available on financial capability and system conditions.

1.2.3 FINANCIAL CAPABILITY ASSESSMENT

Special focus on an affected community's financial capability has been afforded by EPA in recent guidance. On January 18, 2013, the EPA issued a memorandum titled "Assessing Financial Capability for Municipal Clean water Act Requirements." This memorandum states that the USEPA is working with local governments "to clarify how the financial capability of a community will be considered when developing schedules for municipal projects necessary to meet Clean Water Act (CWA) obligations." The EPA states "it is essential that long-term approaches to meeting CWA objectives are sustainable and within a community's financial capability." Moreover, flexibilities under the CWA, regulations, and EPA policies allow for the continued ability to "maintain existing wastewater and stormwater systems while making progress on clean water goals in a manner that is sustainable and within a community's financial capability." This has been demonstrated in recent EPA guidance issued on October 18, 2013 by EPA Region 1 that acknowledges that 'As our valuable infrastructure begins to show its age, it becomes critically important to engaged in preventative maintenance activities and to conduct capital planning activities' and requests '…a proactive approach to addressing and improving [Springfield's] wastewater treatment system by providing adequate funding…..Viable and reliable infrastructure is also critical to the local economy.'

Determination of a community's financial capability should evaluate the effect of rates on low income households, since "uniform rate structures may place a disproportionately high financial burden on households with low incomes." In addition, the EPA's Guidance for Financial Capability Assessment provides flexibility for considering site-specific factors that impact a given community's rate base. The guidance "encourages communities to consider and present any other documentation of their unique financial circumstances, so that it may be considered as part of the analysis. Examples of information that have been used in this context include poverty rates, income distribution by quintile, late payments, disconnection notices, service terminations, uncollectable accounts and average wastewater bill as a percentage of the median household income (MHI), although any information that the community believes is relevant may be presented." However, the Guidance suggests using the percentage of MHI as only one indicator for helping determine an implementation schedule, stating "EPA expects that the full range of financial indicators as well as municipal-specific information will be considered when developing schedules. A common misconception is that the EPA requires communities to spend to a level of 2% of MHI to meet CWA obligations. Rather, the percent MHI calculation is guidance, and is considered along with a suite of other financial indicators to assess the overall burden on a community. The guidance recommends that communities with higher burdens be given longer time periods to complete the needed work."

1.3 CONTENTS OF THE INTEGRATED WASTEWATER PLAN

This IWP is organized into two volumes. Volume One contains the Executive Summary, Sections 1 through 6, Appendix A and Appendix B. Volume Two contains Appendix C.

Executive Summary

The Executive Summary provides an overview of each section in the complete IWP.

Section 1 – Introduction

An update report to components of the May 2012 FLTCP is presented in the five remaining sections of this document. The updates have been developed in accordance with the EPA's *Integrated Municipal Stormwater and Wastewater Planning Approach Framework* Memorandum. A description of the content of each section herein is summarized below:

Section 2 – Hydraulic Model Refinements/Updates

This section summarizes the 2013 temporary metering program to validate the hydraulic model's calibration and subsequent refinements to the Recommended CSO Plan.

Section 3 – Environmental Impact Report

This section includes the Environmental Impact Report; the filing of the LTCP and Notice of Project Change (NPC) through MEPA; and responses to comments from the 30 day public comment period.

Section 4 – Refinement and Detail of Improvement Program

This section provides updates to the phased CSO projects and their related costs; updates to the SRWTF and system CIP projects, as well as their related costs; project worksheets for CSO and CIP phases; and green infrastructure opportunities for proposed locations.

Section 5 – Re-evaluation of Affordability

This section will provide adaptations to Phase I and Phase II of the affordability analysis. Phase I is related to the impact on typical households, while Phase II is related to the capability of the broader community.

Section 6 – Integrated Wastewater Program Recommendations & Implementation Summary

This section includes an overview of the Integrated Wastewater Plan; a listing and description of the updated CSO control projects and costs; a listing and description of the proposed wastewater CIP improvements and costs; and a validation that the plan complies with the six elements of the EPA's IPF.

Appendices

Appendix A (material supplemental to the Introduction)

Recent LTCP-Related Correspondence between the Commission and DEP

Integrated Planning Framework Guidance Documents

Appendix B (material supplemental to the CSO and Wastewater Capital Plans)

IWP CSO Plan Performance and Project Worksheets

IWP Wastewater Plan - Additional Sites with Failing Infrastructure

EPA Green Infrastructure Literature

Appendix C (material supplemental to the EIR)

EIR Complete Integrated Wastewater Plan Zoning and Land Use Classification Maps

Historical LTCP Notices of Project Change Filings

Historical Comments and Responses on LTCP NPC Filings

Section 2
Hydraulic Model Refinements & Updates

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2.1 OBJECTIVES AND BACKGROUND

The Commission's hydraulic model has evolved over several years and is currently being used as a tool to support prioritization of projects to be implemented under the Commission's May 2012 FLTCP.

During the period of time since the May 2012 FLTCP was submitted, there have been a number of model updates, changes and new findings which have been reflected in the model. To understand the impact of these changes, additional work has been done to better understand the impacts of the model updates and in doing so revisit the model predictions; specifically relating to the ability to predict CSO results for the 1976 Typical Year.

The evolution in its configuration from the understanding as reflected in the May 2012 FLTCP to today is owed to additional knowledge gained from field surveys, review of record drawings, ongoing collection system investigations and assessment and progression of CSO abatement projects in the collection system. The following table summarizes substantive changes to the baseline network configuration since the May 2012 FLTCP document submission.

Table 2.1-1: Substantive Hydraulic Model Updates

CSO Regulator	Change to Baseline Model	Source	Result
CSO 007 / CSO 008	Baseflow from 007/049 adjusted in post-construction configuration – affects underflow magnitude and volume to CRI which affects tailwater seen at Regulator 008	007/049 post-construction hydraulic model	Increased capacity in the CRI at Regulator 008 into which the Washburn PS may discharge
CSO 007 / CSO 008	Added additional network connectivity in the 007 and 008 sewersheds to support temporary metering program analysis, which adds additional storage volume to the system. Additional storage in the 007 catchment affects underflow magnitude and volume to CRI which affects tailwater seen at Regulator 008	Field data and record drawings gathered by KLF/MWH as needed to support additional analysis of the Washburn CSO Control Project	Increase of approx. 75,000 gal of available storage capacity in the 007 catchment, Increased capacity in the CRI at Regulator 008 into which the Washburn PS may discharge Increase of approx. 75,000 gal of available storage in the 008 catchment
CSO 008	Added the under-utilized Garden Brook Sewer pipe (approx 2000LF of 66-in diameter conduit), previously outside of the original analysis	Field data and record drawings gathered by KLF/MWH as needed to support additional analysis of Washburn CSO Control Project	Increase of approx. 360,000 gal of available storage capacity in the Washburn catchment which results in greater peak flow attenuation in the upper catchment

CSO Regulator	Change to Baseline Model	Source	Result
CSO 008	Catchments in the lower Washburn sewershed (along Orchard/Newland/Lowell) were updated to be modelled as partially separated rather than fully combined sewers	Field data and record drawings gathered by KLF/MWH as needed to support design of Washburn CSO Control Project	Decreased peak flow rate and volume runoff from these catchments
CSO 012 / CSO 013 / CSO 016	Adjusted configuration of Taylor St cross connections between eventual CSO 012 and CSO 013	Field data and record drawings gathered by KLF/MWH as needed to support refinement of baseline and Recommended Plan networks	Decreased storage volume available in the Worthington St sewer and peak flow attenuation
CSO 012 / CSO 013 / CSO 016	Disconnected Taylor St from Main St and adjusted Worthington St connection to Main to high level relief.	Field data and record drawings gathered by KLF/MWH as needed to support refinement of baseline and Recommended Plan networks	Decreased relief to Main St from Taylor/Worthington. Anticipated decreased contributing flows to CSO 014. Greater pressure is placed on the CRI from 012/013 catchment due to its commanding position relative to the rest of the CRI. Due to its low overflow weir elevation, result is that CRI relieves at CSO 016 when the YSPS capacity is exceeded
CSO 014	Re-routed State St trunkline around Civic Center instead of directly to Main at State. Connection to Main for State St flows now upstream of Elm St connection to Main	Field data and record drawings gathered by KLF/MWH as needed to support refinement of baseline and Recommended Plan networks	Increased contributing flow to CSO 014 via Elm St connection to Main St. Possibly offset by change to Main-Taylor/Worthington connection modification
CSO 019 / 046	Deleted non-permitted overflow (CSO 019-SI) from the collection system model after it was removed by SWSC. Believed that additional pressure on the MIS due to changes in 019 increases tailwater at underflow connection to MIS from 046	SWSC	CSO relief for the Dickinson St sewer shifted to CSO 019. Decrease in capacity in the MIS to receive underflow from 046

The interconnected nature of the CSO regulators tributary to the Connecticut River Interceptor mean any changes to the configuration in any one regulator or regulator catchment will impact CSO performance in adjacent sewersheds. For example, a reduced flow to the CRI from the Washburn (CSO 008) catchment contribution (via the Washburn sanitary pump station) lessens the pressure on the adjacent Clinton (CSO 010) and would be anticipated to produce lesser CSO frequency and/or volume from the Clinton system as a result. Similar linkages exist throughout the CRI system. The CRI system is particularly sensitive to changes in the CSO 012 / CSO 013 sewershed due to the magnitude of peak flow rates and volume from this catchment, in tandem with the higher head (due to higher elevation of CSO relief weir crests) this regulator possesses relative to the rest of the CRI system, and produces CSO effects in regulators up and down the CRI system, beyond simply local changes at CSO 012 / CSO 013. For example the changes to the hydraulic configuration at the intersection of Taylor/Worthington and Main Street result in a more fragmented system that disallows flows to equilibrate amongst CSO relief points. Since the system cannot equilibrate and attenuate flows as effectively across spatial and temporal differences in the system hydraulics, the results are generally small increases in CSO volume at each localized overflow location, excluding the changes seen at 008 since it is hydraulically disconnected via the Washburn St pump station.

Additionally, since the previous FLCTP was submitted in May 2012, some differences were noted in comparisons of 2012 annual rainfall and CSO data series between the model predictions and the ADS meter-recorded CSO regulator wet weather spill measurements. In an attempt to further understand the differences, temporary flow metering was performed by Flow Assessment (FA) between June and August 2013. The temporary metering data was observed in conjunction with the permanent ADS regulator flow meters, and used to further review the model predictions where applicable to make appropriate upgrades to the hydraulic model.

Updated model predictions of CSO frequency in the typical precipitation year (1976), reflective of updates to the revised baseline due to the evolution of the model described herein, are included in Section 2.3.3 and again in Section 4 of this report.

This Section summarizes the data collection, analyses, and findings of undertaking the model review and provides validation of the hydraulic model's suitability to serve as the basis for Integrated Wastewater Planning activities.

2.2 DATA COLLECTION AND DATA QA/QC

The temporary metering took place between 6/5/2013 and 8/19/2013, a total of ten weeks. Flow Assessment (FA) installed eleven temporary flow meters and six rain gauges in the area tributary to the Connecticut River.

The quantity and general site locations of the temporary flow meters were selected to further evaluate model predictions of upstream collection system flows in catchments that displayed deviations in predicted CSO behavior relative to observed CSO measurements. Specifically, since predicted CSO frequency in the CSO 008 catchment was less than meter measurements, and predicted CSO frequency in the adjacent CSO 010 catchment was greater than meter measurements, several temporary meters (S101, S102, S103, S104, and S105) were installed to help re-confirm predicted flow magnitudes and collection system routing through and between these two sewersheds. Temporary meter S104 was specifically installed to directly measure output from the Washburn (CSO 008) sanitary pump station, which had not been previously measured. Temporary meter S105 was sited in a location better suited for flow metering than that during the 2009-2010 calibration period.

Additionally, discrepancies in the predicted versus observed data at CSO 012 and CSO 013 led to the recommendation for meters S106 and S107 in better suited flow metering locations than during the 2009-2010 calibration period, Temporary meter S111 was installed to help re-confirm routing between the two Taylor Street combined sewers tributary to CSO 012 and CSO 013.

Discrepancies in predicted versus observed data at CSO 014 led to the seeking of routing confirmations (Elm St & Main St) in that area with the installation of temporary meters S108 and S109.

Finally, to help further refine the understanding of the behavior of the lower CRI, which directly impacts CSO 010, CSO 011, CSO 012, CSO 013, CSO 014, CSO 015B, and CSO 016, temporary meter S110 was installed on the CRI upstream of the CSO 014 regulator.

Data from these meters and gauges were used to review the previous calibration of the model and to review areas of the model where additional confidence or understanding was required.

A map of the temporary meter locations is shown in Figure 2.2-1 and a map depicting temporary (and permanent) rain gauge locations is shown in Figure 2.2-2. Permanent rain gauges (by ADS) nearby the study area are included in Figure 2.2-2 and are annotated as RG01 and RG02. The figure shows the sewer network of the Washburn, Clinton, Liberty, Worthington, Taylor, Elm, Union and York St CSO catchments and the sewers in which the meters were installed. Figure 2.2-3 shows the same information in a schematic format for clarity. The schematic figure also shows the ADS permanent flow meters and their locations that were included as part of this analysis.

Figure 2.2-1: Location Plan of the Temporary Flow Metering Program

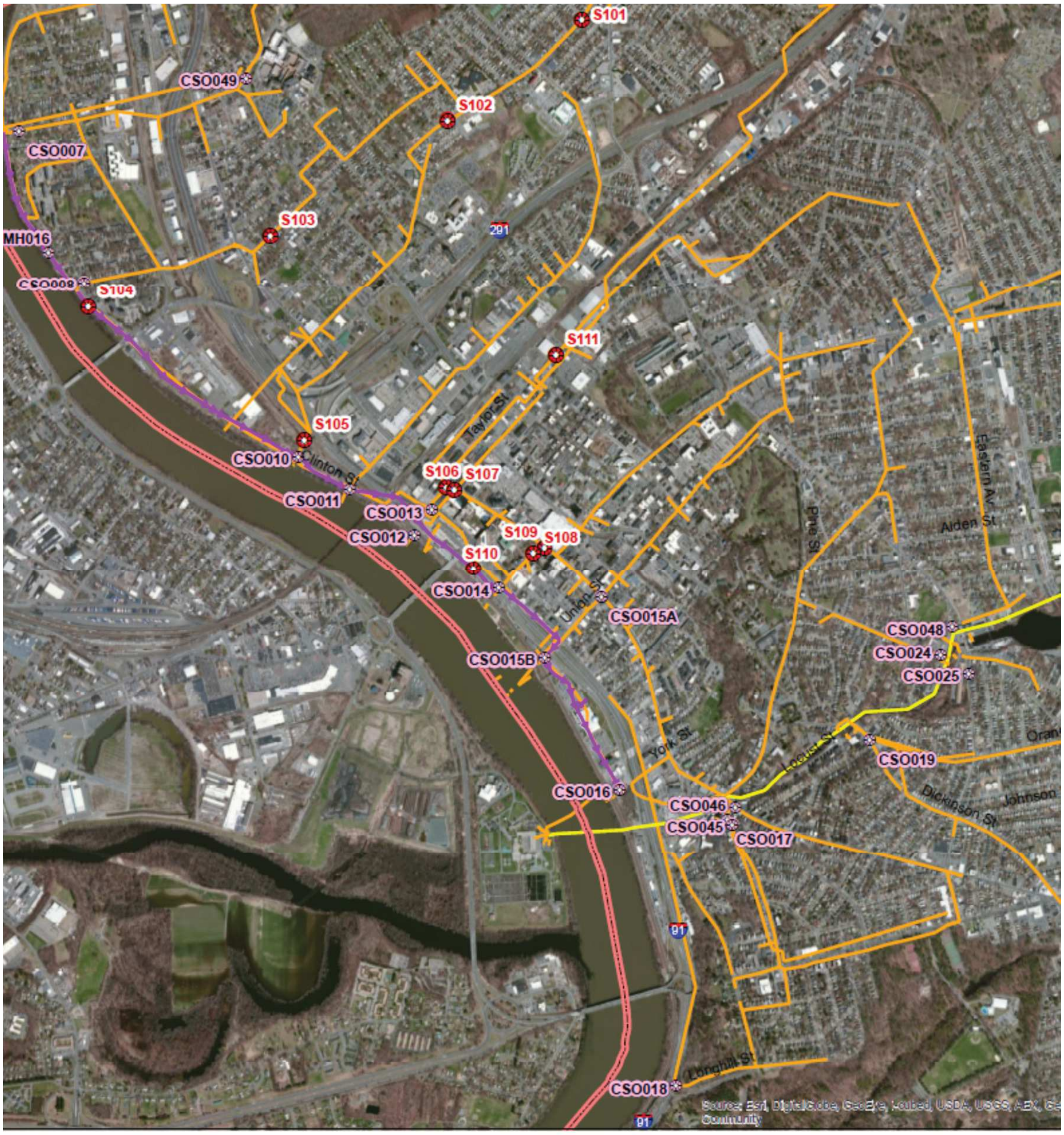
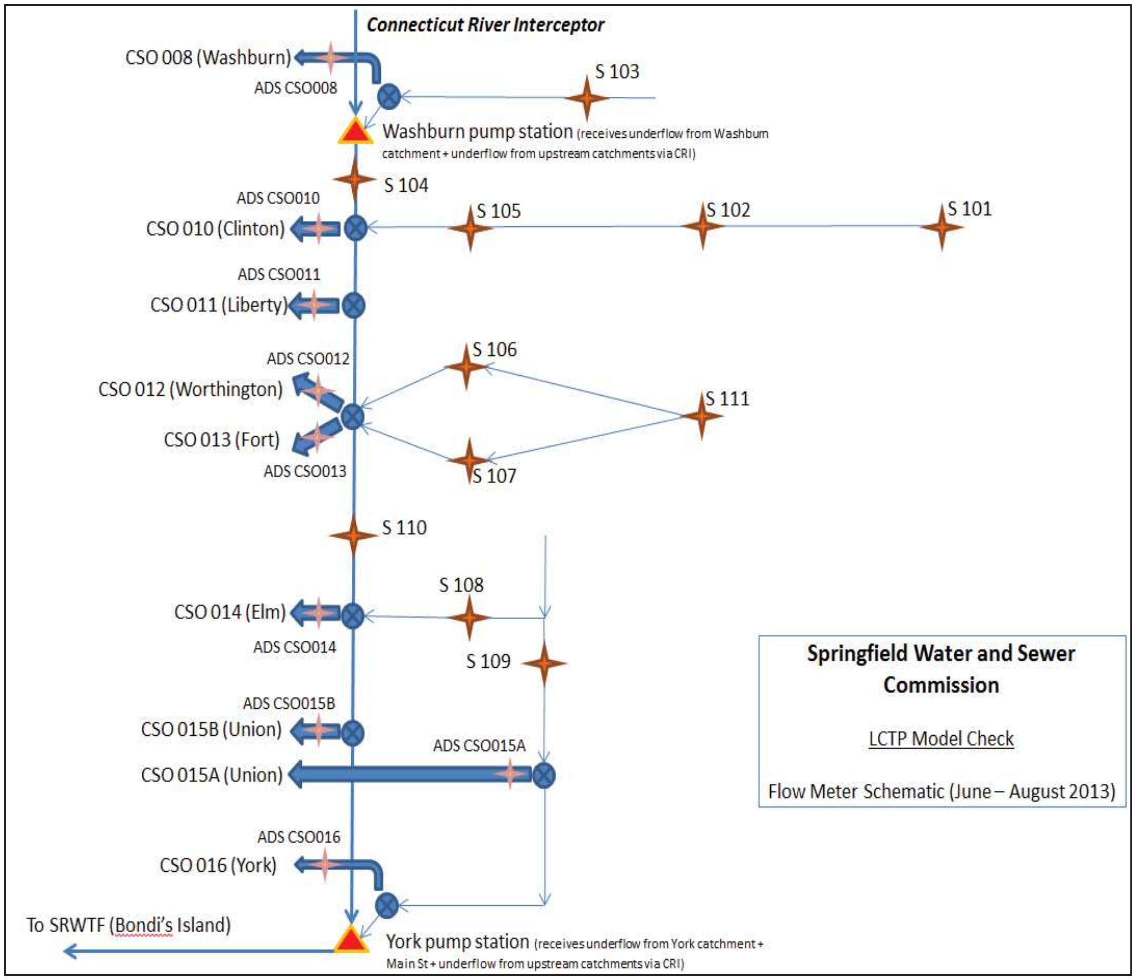


Figure 2.2-2: Location Plan of the Temporary Rain Gauge Program

Figure 2.2-3: Schematic Plan of the Temporary Flow Metering Program



2.2.1 Rainfall Analysis and Calibration Storm Event Selection

In selecting the storms for the calibration, the hyetographs created for all five gauges were reviewed to identify those storms where the total depth of rainfall and the peak intensities were deemed sufficient to warrant classification in a rainfall event. These events were ranked by total volume and peak intensity, as well as overall duration.

Consequently, there were three storms selected as the calibration events based on the characteristics, as well as the availability of recorded data at the majority of the meters. These are summarized in Table 2.2-2.

Table 2.2-2: Summary of Selected Calibration Rainfall Characteristics

		RG1	RG2	RG3	RG4	RG5
13-Jun, 1090 minutes (long duration event)	Max Int. (in/hr)	0.36	0.36	0.36	0.36	0.24
	Total depth (in)	1.46	1.45	1.62	1.54	1.36
23-Jul, 75 minutes (high intensity event)	Max Int. (in/hr)	2.88	1.44	3.84	3.36	1.56
	Total depth (in)	1.19	0.75	1.62	1.26	0.74
9-Aug, 210 minutes (intermediate intensity and duration event)	Max Int. (in/hr)	1.44	1.68	4.32	2.04	1.32
	Total depth (in)	1.62	1.33	2.40	1.74	1.31

2.3 HYDRAULIC MODEL UPDATE, SIMULATIONS, AND ANALYSIS

2.3.1 Comparison of ADS and Flow Assessment Rainfall Measurements

Rainfall data collected by the Flow Assessment and ADS gauges were compared to observe the general trends and correlation. A summary of the total rainfall measured at each of the permanent and temporary gauges is provided in Table 2.3-1, and from this summary it is evident that the variations in measured rainfall for each event are partially a function of the meter locations, which as expected follow temporal and spatial trends.

Table 2.3-1: Summary of Total Rainfall Measured by Flow Assessment and ADS gauges

Total Rainfall (in) June 4 - August 13, 2013		
Flow Assessment	RG1	14.6
	RG2	14.5
	RG3	18.1
	RG4	13.3
	RG5	13.8
ADS	ADS RG01	11.3
	ADS RG02	Offline
	ADS RG03	17.8
	ADS RG04	Offline

2.3.2 Flow Meter Calibration Comparisons

In order to compare model predictions with measured data, flow meter data from Flow Assessment were incorporated into the hydraulic model as a basis of assessment. Overall the velocity, depth, and flow data from the Flow Assessment meters correlated well to the recorded rainfall for overall response and the effects of temporal variations associated with the rainfall events.

The latest version of the Commission's hydraulic model was used in the analysis; this included all updates up to and including 2013 field investigation results. The geographic locations of the

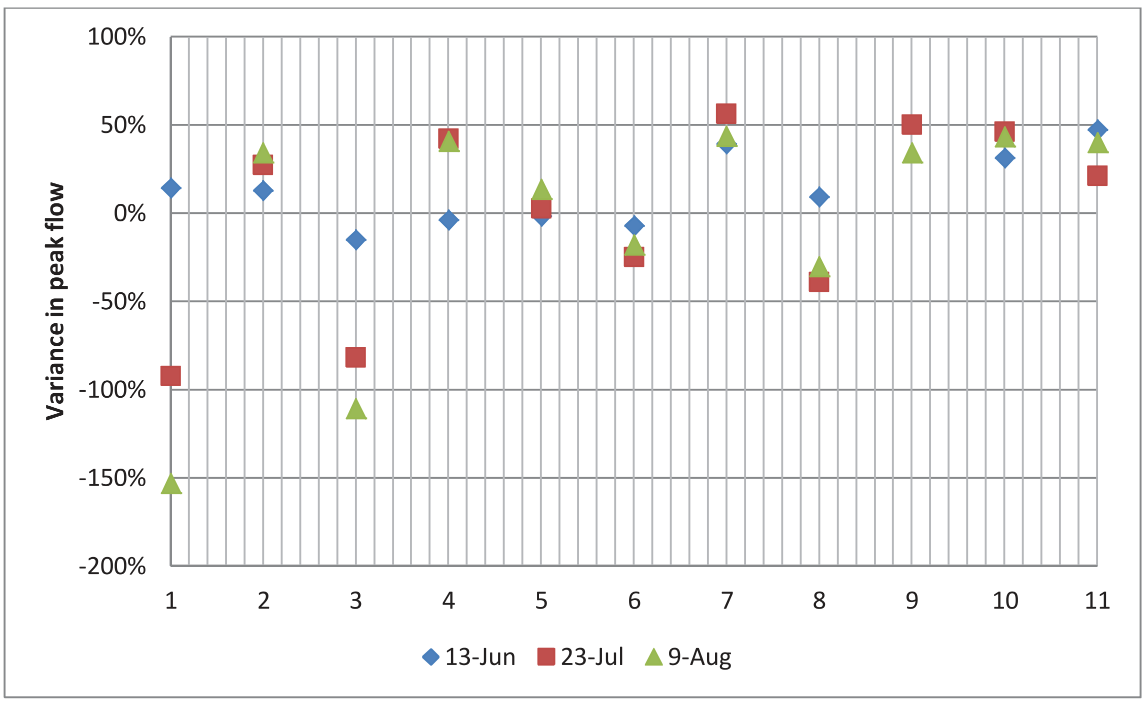
Flow Assessment rain gauges were incorporated into the model by assigning specific rain gauges to model catchments. Simulations were conducted using the three pre-selected verification events (June 13, July 23, and August 9 based on Flow Assessment rain gauge recordings).

2.3.3 General Trends from the Model Calibration

In addition to the comparative reviews of the individual meter locations, further model trends were analysed to understand the model overall performance.

In Figure 2.3.1 all three calibration storms are shown with the X axis showing the flow meters and the Y axis the percentage variance. Value 1 on the X axis is meter S101 etc. Meters S102, S105, and S106 are within the preferred +25% to -15% variations in peak flow. These locations are considered well calibrated for the purposes of long term control planning. Meters S104 and S108 were considered reasonably well calibrated because predictions either fell within the preferred variations or were bracketed around the 0% variance meaning the model over predicted or under predicted depending on the rainfall event but on average provide a good representation. Meters S107 and S109 through S111 were marginally outside the preferred variations but consistently over predicted which yields conservative results. Conversely, the greatest variations were shown at Meters S101 and S103 and these locations required more review to determine why the model is under predicting the measured flow by such a large margin. Since deviation increases with the intensity of the storm event these locations were further checked to ascertain a level of confidence for model predications.

Figure 2.3.1: Comparison between Model and Observed Peak Flow Variance



Overall, a good correlation was noted at the meters at the lower reaches of the system; with the locations exhibiting less correlation consisting of a smaller proportion of the overall flows of the system. What was evident from the analysis was that the more outlying meters, such as S101 and

S103, showed a wider discrepancy than those in the lower reaches of the system. This is considered to be a reflection of the sensitivity of the hydraulic model predictions. This analysis indicates that the model is more accurate around the CSOs and interceptor sewers; whereas the larger discrepancies consist of a smaller proportion of the overall flows within the system and these discrepancies are offset with relatively small changes to the inputs of data. An evaluation of the full calendar year 2013 CSO and rainfall data is forthcoming, and will be included in the Commission's Annual CSO Report submitted to DEP by the end of March 2014.

Two meter locations of particular significance, S103 and S104, were sited in and around the Washburn CSO sewershed (CSO 008), which is undergoing construction through the spring of 2014. These locations merited closer scrutiny, as described in the following sections.

2.3.3.1 Flow Meter S103

This meter is located along the Bancroft St mainline trunk sewer upstream of the connection from the Garden Brook Sewer and was sited in an attempt to reconfirm mid-sewershed flow magnitudes in the Washburn sewer catchment.

Overall the comparisons with this flow meter were good with the volume balance for all three storm events within acceptable limits. Both observed and predicted flows responded to rainfall in the same magnitude and where reverse flow was evident from a downstream restriction, the observed effects were replicated by the model. There were some differences in predicted and measured depths although the results showed that once the sewer becomes surcharged these minor differences are not as pronounced and therefore the overall effects of verifying this meter are that the upstream hydrology and conveyance are both acceptable. Upon review of the model invert levels and diameters all were satisfactorily represented and therefore flow predictions were deemed acceptable for inclusion in the Integrated Wastewater Plan.

2.3.3.2 Flow Meter S104

This meter is located on the CRI immediately downstream of the Washburn Pump Station. The meter was sited in an attempt to understand the flow characteristics of the pump station. Furthermore the observed flow data at this location is significantly impacted by the CSO overflows along the interceptor, in addition to the output of the pump station.

For the June calibration event, the peak measured flow rate was approximately 9 MGD, while the predicted peak flow rate was approximately 8 to 9 MGD so essentially a good correlation, however there was associated variability in the depth comparisons. It would suggest based on the observed data the model was over predicting the depth at this location. However the flow in the CRI was sluggish and since during wet weather the sewer is surcharged minor localized differences will have a magnified effect on the depth.

In summary while not an ideal location of monitoring flow conditions, there is no suggestion that changes to the model catchment characterizations would improve matters here without extensive further survey work. The main determining factor is the pump rate at the Washburn PS and this has been set at 9 MGD. This flow cap confirms the de-rating of the pump's output, which was formerly understood to be capable of 12MGD based on the original pump curves for the station and is the most significant changed condition from the hydraulic configuration described in the May 2012 FLTCP. See Section 2.3.3 and 2.3.4 for further implications of this finding.

2.3.4 Hydraulic Model and 1976 Analysis

Evolution of the understanding of the baseline network configuration, plus the findings of the short term flow metering and calibration review which resulted in a new understanding of the output from the Washburn pump station and its impacts on the overflow frequency and volume at CSO 008 under baseline conditions, together result in a revised baseline CSO frequency and volume predictions. Other findings of the short term flow metering and calibration did not result in any changes to the model catchment properties in the baseline Springfield hydraulic model for the purposes of the Integrated Wastewater Plan.

Revised baseline CSO frequency and volume model predictions for the typical precipitation year (1976) in the CRI system, reflecting current understanding of the collection system as described in Section 2.1, plus the de-rated Washburn pump station output as determined during the summer 2013 temporary metering program, are summarized in Table 2.3.3-1 below and in Section 4 of this report.

Table 2.3-2: Updated Baseline Activations and Volumes

CSO Regulator/ By-Pass	Baseline Conditions - 2012 (Typical Year -1976)		Updated Baseline Conditions - 2014 (Typical Year - 1976)	
	# Activations	Volume (MG)	# Activations	Volume (MG)
Mill River (previous CSO abatement project)				
CSO 025	7	0.8	7	0.8
CSO 048	1	0.1	1	0.1
CSO 046	3	0.1	5	0.1
CSO 024	0	0.0	0	0.0
CSO 017	1	0.03	1	0.03
CSO 045	0	0.0	0	0.0
CSO 019	0	0.0	1	0.03
CSO 019-SI	1	0.03	Removed	0.0
Mill Totals	**0-7 (Avg. 1.6)**	**1.1**	**0-7 (Avg. 2.1)**	**1.1**
Chicopee River (previous CSO abatement project)				
CSO 043	Removed	0.0	Removed	0.0
CSO 044	Removed	0.0	Removed	0.0
CSO 037	0	0.0	0	0.0
CSO 036	1	0.1	1	0.1
CSO 035	1	0.01	1	0.01

CSO Regulator/ By-Pass	Baseline Conditions - 2012 (Typical Year -1976)		Updated Baseline Conditions - 2014 (Typical Year - 1976)	
	# Activations	Volume (MG)	# Activations	Volume (MG)
CSO 034	1	0.2	1	0.2
Chicopee Totals	**0-1 (Avg. 0.75)**	**0.3**	**0-1 (Avg. 0.75)**	**0.3**
Connecticut River				
CSO 007	0	0.0	0	0.0
CSO 008	45	63.2	38	43.6
CSO 010	71	163.5	69	157.4
CSO 011	19	6.3	19	6.6
CSO 012	40	50.0	39	54.1
CSO 013	19	34.7	19	36.9
CSO 014	50	41.2	53	42.2
CSO 015A	35	24.8	42	26.8
CSO 015B	13	1.9	15	2.1
CSO 016	39	58.9	42	69.8
CSO 018	1	0.01	1	0.01
CSO 049	3	0.7	1	0.04
Outfall 042	4	1.2	4	1.3
CRI Totals	**1-71 (Avg. 26.1)**	**445**	**1-69 (Avg. 26.3)**	**441**

2.3.5 Calibration Review and Influence on the Integrated Wastewater Plan

In the May 2012 FLTCP, the H-5 alternative was selected as the Recommended Plan for implementation, which included the improvements recommended, designed, and eventually constructed under the Washburn CSO Control Project. (The H-5 recommendations are detailed in Section 4 of this text). The Washburn pump station output findings came to light during the construction of the CSO improvements to that catchment, and as expected the CSO abatement performance from this sewershed was impacted. As a result, construction changes to the final configuration of proposed hydraulic equipment to preserve CSO performance per the Recommended Plan were undertaken. These changes included the relocation of a bending weir from CSO Regulator 007 to new CSO Regulator 008A; weir crest elevation modification at 007 and 008A; and throttle settings, via modification to the underflow discharge from the hydroslide installed in the Arch Street throttle structure.

The findings of this calibration review do highlight some minor variations, but none of the differences are considered sufficiently severe to warrant changes to the latest baseline model which is being used to predict CSO level of control for the recommended plan as implementation of alternative H-5 progresses. However, there are findings which serve to highlight areas of the model that will need further localized upstream refinement, particularly in the Clinton and Worthington CSO catchments, as the model continues to be developed to support final design of projects included in the recommended plan.

2.4 SUMMARY

The current Commission hydraulic model is considered reflective of the 2014 sewer system and operational practices. Updates made since the submission of the May 2012 FLTCP have caused the model predictions for the CSO overflows to be redistributed but in all cases the changed results are directly attributable the reconfiguration of the sewer system as a result of new and updated information coming to light. The overall volume balance between the 2012 and 2014 baseline models shows only 0.7% variance, demonstrating that the latest overall model results are comparable to those reported following the 2012 analyses.

Beyond the required changes driven by a differing Washburn pump station output as described in section 2.3.4, in reviewing the latest Recommended Plan against the findings of the model calibration review, there are no further apparent adjustments required to the current baseline model calibration for the purpose of re-evaluating the Recommended Plan or other CSO control alternatives in the original May 2012 FLTCP. Overall the model calibrated against several of the temporary meters reasonably well, especially in the lower reaches; there were upper areas where localized difference in peak flow were observed but their impact on CSO performance was deemed minimal.

Section 3
Environmental Impact Report

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3.1 INTRODUCTION

This section of the Integrated Wastewater Plan presents the Final Environment Impact Report (FEIR) component of the CSO Control Program pursuant to Section 11.07 (6) (a) of the Massachusetts Environmental Policy Act (MEPA) regulations. The following project information is provided as part of the FEIR for the Springfield Water and Sewer Commission (the Commission) Integrated Wastewater Plan (IWP):

Project Name:	Integrated Wastewater Plan
Project Location:	Springfield
EOEA File Number:	11525
Type of EIR:	Final EIR
Proponent:	Springfield Water and Sewer Commission
Prepared By:	Kleinfelder; MWH
Date of Filing:	February 2014

3.2 CONTENTS OF THE EIR

On March 11, 1998, an Environmental Notification Form was filed for the Long Term CSO Control Plan with the Executive Office of Environmental Affairs (EOEA) resulting in a recommendation by EOEA that the Commission draft an Environmental Impact Report (EIR) for the project.

A Draft EIR (DEIR) was filed on March 31, 2000 and the DEIR certificate was issued on June 23, 2000. The scope of this FEIR has been developed based on EOEA comments in the DEIR certificate as well as in meetings attended by EOEA and the Commission. The DEIR required the Commission to address specific issues in the FEIR. The issues and where they have been addressed in either the FEIR or IWP are listed below.

- Methodology of the affordability analysis
    - Section 6 of FEIR, Section 10 of the May 2012 FLTCP, and Section 5 of the 2014 IWP
- Potential for greater reliance on stormwater controls and artificial wetlands
    - The Commission has committed to evaluating stormwater controls and various “green” alternatives on a project by project basis as that individual project is in the design phase. Because the specifics of these types of decisions are too dependent on many elements which are unresolved at this planning level document phase (i.e. IWP), the Commission is unprepared to discuss the details of each element herein, however, as stated above and in conformance with the requirements of the preparation of an integrated plan, sustainable and

"green" elements will be considered. Section 4.4 of the 2014 IWP includes additional information on Green Infrastructure Opportunities.

- Ongoing coordination with Connecticut Department of Energy and Environmental Protection (CTDEP)
    - Thirteen years have passed since CTDEP provided comments to the Commission regarding the 2000 FLTCP. In that time, the FLTCP has substantially changed. What was planned in 2000 does not exist in any form in this IWP. The Commission anticipates that the CTDEP will comment on this IWP and the Commission will respond as necessary

Since the submission of the DEIR (June 2000), four Notices of Project Change (NPC) have been filed and related waivers from draft Record of Decisions (ROD) have been issued. Table 3.2-1 shows a summary of filings and comments received since the filing of the DEIR in June 2000.

Table 3.2-1: Summary of Project Filings and Comments Received since June 2000 DEIR

SUBMISSION TYPE	SUBMITTED BY	PROJECT TYPE	DATE	SUBMISSION/COMMENTS SUMMARY
ENF	Springfield Water and Sewer Commission (Commission)	Long Term CSO Control Plan	3/11/1998	Sections Missing - Development, evaluation and selection of a new recommended CSO control plan for the Chicopee River tributary area in Springfield and request for Phase 1 waiver from further environmental review.
Letter	Department of Environmental Protection (DEP) - Div. of Watershed Mgmt.	Long term CSO Control Plan	3/31/1998	Review of ENF submitted by Springfield for Long Term CSO Control Plan has resulted in a recommendation for an EIR through MEPA and the EOEA.
DEIR	Springfield Water and Sewer Commission (Metcalf & Eddy)	Long term CSO Control Plan - EIR	3/31/2000	Distribution to MEPA, DEP, EPA, DEP wetlands WERO, PVPC
Comments on 2000 DEIR	EEA, DEP, DFW, CTDEP, PVPC, Connecticut River Watershed Council (CRWC), EPA	Long Term CSO Control Plan and EIR	4/5/2000	Comments on DEIR (partial responses were included in NPC from 9/2004)

DEIR Certificate	EOEA	Long Term CSO Control Plan and EIR	6/23/2000	Secretary: "the comments received on DEIR identify a number of additional issues and concerns which need to be addressed in the Final EIR, including the methodology of the affordability analysis, the potential for greater reliance on stormwater controls and artificial wetlands, and the ongoing need to coordinate with the CTDEP. I will accept them as my own and require that they be addressed in a thoughtful and thorough manner in the FEIR."
Phase I DROD	EOEA	Combined Sewer Overflow Control Plan	6/30/2000	
Phase I FROD	EOEA	Combined Sewer Overflow Control Plan	7/31/2000	Secretary of Environmental Affairs grants Phase 1 Waiver for the Draft EIR approved 6/23/2000. Waiver allows project to proceed to the state permitting agencies pending completion of an EIR for the entire project.
NPC	Springfield Water and Sewer Commission	CSO Long-Term Control Plan/EIR Chicopee River CSO Control Project	10/15/2002	Request for waiver for 3-Month relief of screening and disinfection at Indian Orchard Pump Station with Local Storage at CSO 043.
Comments on NPC	Pioneer Valley Planning Commission	Chicopee River CSO Control Project	11/8/2002	The PVPC would like to have a Stormwater utility setup as well as see more Best Management Practices (BMP) and other mitigation measures implemented as part of the project before they will sign off on it.
Withdrawal of NPC	Springfield Water and Sewer Commission	CSO Long-Term Control Plan/EIR Chicopee River CSO Control Project	12/6/2002	Springfield withdraws the NPC on the Chicopee River CSO Control Project
Comments on FEIR	Massachusetts Historical Commission	Long Term CSO Control Plan and EIR	3/10/2003	MHC would like to review plans to confirm if there will be any impact to historical sites that are located within the project area.
NPC	Springfield Water and Sewer Commission	Chicopee River CSO Control Project	9/30/2004	NPC filed to request a waiver from further environmental review for the Chicopee River CSO control project.
Comment on NPC	DEP	CSO Long-Term Control Plan/EIR Chicopee River CSO Control Project	10/29/2004	DEP Comments from BRP, BWP, BWSC. Recommend LSP retained, note 2 Tier II sites in vicinity.

NPC Certificate; Phase I DROD Waiver	EOEA	Long Term CSO Control Plan and EIR - Chicopee River	11/8/2004	
NPC Certificate; Phase I FROD Waiver	EOEA	Long Term CSO Control Plan and EIR - Chicopee River	12/10/2004	Expansion of Phase 1 waiver to include the Chicopee River CSO control Project. This includes the storage of CSO flows to achieve 6-month level of control using a box culvert in River Street and other underground storage tanks and culverts.
NPC	Springfield Water and Sewer Commission	Connecticut River CSO Control Project	7/28/2006	Change from a screening and disinfection facility at CSO outfall 010 to separation of the combined sewers tributary outfalls 007 and 049.
Comments on NPC	CWRC	Long Term CSO Control Plan	8/28/2006	Comments highlight CT River resources. Should have an FEIR and public input. Questions changes and Phase I projects (Clinton St). Tables are confusing. CTDEP comments not addressed. SWSC should have to rewrite and re-notice, update full range alternatives
Comments on NPC	DEP	Long Term CSO Control Plan	8/28/2006	Requires BRPWP 68; comments from Air, BWSC, BWP
Recommendations report for Clinton Street CSO project	Springfield Water and Sewer Commission	Clinton Street CSO Project	9/19/2006	Recommendation report stating that instead of a Screening and Disinfection Facility at Clinton Street the separation of sewers tributary to outfalls 007 and 049 will occur. This separation will eliminate CSO discharges up to the 2 year storm.
Comments on NPC	Pioneer Valley Planning Commission	Connecticut River CSO Control Project	9/27/2006	PVPC has met w/ SWSC and others, reviewed info and supports the NPC.
Comments on NPC	DEP	Connecticut River CSO Control Project	10/2/2006	similar comments as 8/26/2006
Comments on NPC - round 2	Connecticut River Watershed Council (CRWC)	Long Term CSO Control Plan	10/2/2006	Some earlier concerns have been addressed; however still concerned about Draft LTCP, no responses to some 2000 comments cost-benefit analysis, etc.

NPC Certificate; Phase 1 FROD Waiver	EOEA	Long Term CSO Control Plan- Connecticut River	11/9/2006	Cert & FROD Ph I waiver; includes history; project will require Treatment works modification & other DEP permits and wetland Order of Conditions.
Request Negative Determination NPC	Springfield Water and Sewer Commission	Connecticut River CSO Control Project- CSO 007 / 049 Sewer Separation	7/14/2008	Request concurrence from EEA that Sewer Separation work does not require filing of an NPC.
NPC	Springfield Water and Sewer Commission	CSO - Long term control plan	11/4/2008	Change from a screening and disinfection facility at CSO outfall 010 to separation of the combined sewers tributary outfalls 007 and 049. Change from 7/28/2006: Delete separation work upstream of 049, increase hydraulic capacity of connection between 049 and downstream system.
Comments on NPC	Pioneer Valley Planning Commission	CSO Long Term Control Plan	12/9/2008	The PVPC approves of the changes between the 2006 NPC and the 2008 NPC due to improved environmental conditions and reduced project costs and disturbances.
Comments on NPC	DEP - Western Regional Office	CSO Long Term Control Plan	12/10/2008	States that the changes between the 2006 NPC and the 2008 NPC still meet the project goals. Mentions that the changes between the two NPCs result in 25% reduction of pipe replacement and a savings of $11million but also results in an additional discharge per year.
Comments on NPC	Connecticut River Watershed Council	CSO Long Term Control Plan	12/15/2008	The CRWC states that they think the $10 million savings justifies that project changes, but would like the money go into an escrow account to be used for future CSO projects. Notes SWSC must submit workplan on Final LTCP by 5/31/2009 per AO 08-037
Final Record of Decision- Waiver	EOEA	CSO Long Term Control Plan	1/9/2009	Separation of the CSO 007 tributary area. No Separation of the CSO 049 tributary area.
Certificate NPC / DROD	EOEA	CSO Long Term Control Plan	11/24/2008	NPC Cert & DROD Waiver
NPC	Springfield Water and Sewer Commission	CSO Long Term Control Plan- Washburn	12/7/2011	Targeted sewer separation, inline storage and flow control, relocation of the 008 regulator and stormwater management

Comments on NPC	Connecticut River Watershed Council	Long Term CSO Control - Washburn CSO	1/20/2012	Questions rainfall calculations for discharge from CSO 008. Total discharge volumes do not agree between current and prior NPCs and appear to be rising instead of falling. The CRWC questions the transparency of the discharge calculation and questions the lack of data being given to the public. Connecticut DEPs comments (4-1 - 4-19) have not been addressed in the response.
Comments on NPC	MassWildlife - NHESP		1/23/2012	Emailed comments
Comment on NPC	DEP	Long Term CSO Control Plan	1/24/2012	Notes that the changes regarding CSO 008 will result in equal discharge with a lower cost.
Response to Comments	Kleinfelder for SWSC		1/25/2012	
NPC Certificate	EOEA		1/27/2012	
FROD	EOEA		2/24/2012	

In a May 22, 2012 meeting, DEP and the EOEA requested that the FEIR also address and include the following components:

- A description of changes between previous submissions and most recent submission (The changes are summarized in Section 3.3.1.2: Prior CSO Work and Summary of Changes).
- All previous NPC filed under the previous LTCP (included in Appendix C).
- Comments and responses made under NPC or MEPA filings under the previous LTCP (included in Appendix C).
- Copies of all Final Records of Decision (FRODs) under previous NPC or MEPA filings under the previous LTCP (included in Appendix C).

3.3 BACKGROUND AND SUMMARY

As stated in section 1.1.2 of the May 2012 FLTCP, the LTCP was developed in response to federal and state water quality regulations and administrative orders, including the Clean Water Act, the national policy for CSO control, and the state policy for CSO control.

In June 2004, the Environmental Protection Agency (EPA) issued an Administrative Order (AO) to the Commission pursuant to Section 390(a)(3) of the Clean Water Act based on violations of the Commission's National Pollutants Discharge Elimination Systems (NPDES) permit (No.MA0103331). The AO required the Commission to design and begin construction of the Chicopee River CSO control project by May 31, 2007. It also required that construction be completed by May 31, 2009.

The Commission's LTCP update was stipulated in 2008 by the EPA's AO No. 08-0370. The AO required CSO control for CSO 008 and a Collections Systems Management, Operation, and Maintenance (CMOM) compliance program.

As described in detail in Section 1.3.3 of the May 2012 FLTCP, the May 2012 FLTCP was developed by a series of initiatives undertaken by the Commission. These initiatives form the basis of the approach for a sustainable long-term CSO control with the goal of providing a technically feasible, affordable, and comprehensive plan consistent with the objectives of both national and state CSO control policies.

The IWP incorporates new information to address DEP, EPA, and stakeholder comments since the filing of the DEIR and NPCs.

3.3.1 Summary of the Commission and Prior CSO Work

3.3.1.1 Summary of the Commission

Established by authorization of the Springfield City Council, the Commission administers, operates, and maintains the water and wastewater systems in eight communities in the greater Springfield region, including Springfield. The Commission is currently 12 years into a 20-year contract with a private entity for operations at the wastewater treatment plant, sewer pumping stations, flood control pumping stations, metering stations, and the CSO regulators and Connecticut River Interceptor (CRI).

The Commission system consists of 458 miles of sanitary and combined sewer; 8 high flow sewage pumping stations; 15 low flow sewage pumping stations; 5 flood control pumping stations; and 2 combined flood control and sewage pumping stations. The Commission does not own and operate the storm drain system in the City of Springfield. That system is owned and operated by the City of Springfield and consists of 218 miles of storm drains; 275 storm drain outlets and 12,000 catch basins.

Wastewater collected in Springfield is conveyed under the Connecticut River to the SRWTF at Bondi Island in Agawam. The SRWTF is capable of providing full treatment for up to 134 mgd, and preliminary and primary treatment followed by disinfection for up to 180 mgd. Flows in excess of 180 mgd are discharged untreated to the Connecticut River via a 60-inch outfall (042) (Metcalf & Eddy, 1999). The Commission's recommended plan would reduce CSO volume by 89% for the Typical Year upon completion.

3.3.1.2 Prior CSO Work and Summary of Changes

Since the 2000 FLTCP/EIR, the Commission has filed four individual Notice of Project Change (NPC) documents with the EOEA to request Phase 1 Waivers. All four were issued waivers. Each is summarized below.

A NPC for the Chicopee River CSO Control Project was filed with and approved by the EOEA. The NPC was the result of the reevaluation of the means to accomplish long-term control of the Chicopee River. After reevaluation and alternatives analysis, (which include substantial input from DEP and EPA), the Commission determined that long-term control of the Chicopee River could be obtained with two construction projects that included pump station modification, interceptor modification, and sewer separation and improvements, summarized in the following bullets.

- Modification and improvement of the Indian Orchard Pumping Station (IOPS) including
  - Increased capacity and efficiency for dry and wet weather flow, new pumps, wet well hydraulic and structural improvements, inlet gates, back-up generator, and variable frequency drive units
  - Mechanical, electrical, and plumbing improvements
  - Additional wet weather protection (up to the 10-year storm in the typical year) through the use of storage of on-site overflows from the pump station
- Improvements to the Ludlow and Main interceptors including
  - Installation of 24" and 36" pipes and parallel pipes for improved conveyance capacity, new sanitary sewer and storm drain pipe and manholes necessary for sewer separation, and installation of new and redirected BMP catch basins necessary for sewer separation and stormwater water quality improvements
  - Cured in place pipe (CIPP) linings were installed in locations where pipe rehabilitation was appropriate
  - 16,650 LF of sewer separation and improvements on seven streets in the Chicopee River vicinity.
  - Elimination of CSO outfalls
  - Reconfiguration and improvements to CSO Regulators to improve level of service and CSO discharges

A second NPC was filed with the EOEA in 2006. The Commission found that separating combined sewer tributaries flowing to outfalls 007 (Rowland Street) and 049 (Springfield Street) rather than the installation of a screening and disinfection facility at Clinton Street would result in greater water quality benefits and with reduced costs. Separation would result in total elimination of outfalls at 049 and significant decrease, if not total elimination, of outfalls at 007.

In November 2008, the Commission filed a third NPC which would change the proposed work at regulators 007 and 049 (subject of the 2006 NPC). This change deleted the separation upstream of the 049 regulator and increased the hydraulic capacity between regulator 049 and the downstream collection/conveyance system. The proposed change would decrease CSOs to one per typical year at regulators 007 and 049. The modified recommended plan was more cost effective and resulted in a 62% reduction in the geographical area that was affected by construction. The change reduced the previously proposed piping by 25% with no significant environmental impacts.

A fourth NPC, focused on CSO Regulator 008 (Washburn Street), was filed with the EOEA in December 2011. The 2000 Draft LTCP/EIR proposed a screening and disinfection facility at regulator 010 and the installation of a conveyance conduit. The NPC proposed a change to targeted sewer separation in the regulator 008 tributary area, system optimization, and stormwater management. The recommended changes would provide the same level of CSO control, but would be a more cost effective solution for the Commission.

3.4 PROJECT DESCRIPTION

This IWP consists of phased construction of CSO control improvements including a storage and conveyance relief conduit and river crossing, a new York Street Pumping Station (YSPS), targeted sewer separation, flow control and throttling structures to optimize operation of the existing system, low impact design (LID) stormwater management incorporating green infrastructure features, and other non-CSO related infrastructure improvements. Detailed descriptions of the program information can be found in Section 8 of the May 2012 FLTCP and in Sections 4.1, 4.3, and 6 of the 2014 IWP. Table 3.4-1 summarizes the Phase, Components, Associated CSOs, Long Term Benefits, and anticipated required permits.

Table 3.4-1: Phase Summary

Project Description (Targeted Regulator)	Project Components	Project Long Term Benefits	CSO Volume Reduction	Permits / Approvals Anticipated to be Required (other than construction)
Phase 1 -Washburn CSO Control (008)	- Inflow Removal - Construction of 3 flow optimization structures in Washburn catchment area - Sewer Separation - Stormwater Management - Level of Service Improvements	Reduce overflow frequency to 4 CSOs per typical year at CSO 008 (Washburn), reduce CRI system overflow frequency to 334, reduce CRI system CSO volume to 390mg	12%	No reasonably foreseeable impacts
Phase 1.5 - CSO 012/013/018 Modifications	- Rehabilitation of failing structures - Potential removal of Regulator 018 for CSO relief		0%	No reasonably foreseeable impacts.
Phase 2 - York Street Pump Station & River Crossing (016)	- 62 MGD Pump Station - New 1,400 LF pipeline (~48") across CT River - Relocation of CSO 015A to West Columbus - New flow structure along Elm Street at Main - CSO weir crest modifications at CSO 010, 011, 012, 013, 014, 016 - Installation of a flap gate at Regulator 010 to prevent back flows	Provide storage & conveyance relief to CT River Interceptor (CRI) and reduce CRI system overflow frequency from 68 to 38, reduce total CRI system activations to 203, and reduce CRI system CSO volume to 217mg per typical	39%	- Army Corps Chapter 10/Section 404 Permit - USFW Section 7 Consultation - Section 106 of NHPA - 401 Water Quality Certificaitons - Chapter 91 License (Massachusetts Public Water Front Act) - Springfield Conservation Commission Notice of Intent and subsequent Order Conditions - Possible Coast Guard approval

Phase 3 - Locust Transfer Structure/Conduit & Flow Optimization in Mill System	- 1,100LF 60" Locust St sewer - 1,200LF 60" York St parallel sewer - 2 junction/ transfer structures - 4 flow control structures in the Main Interceptor system	Provide flow optimization between CRI and Main Interceptor	1%	No reasonably foreseeable impacts
Phase 4 - York to Union Box Culvert (015A and 015B)	- 3000 LF 12'x 12' Box Culvert; from Union Street structure to new York pump station	Will provide additional CRI storage and conveyance relief and reduce total CRI system activations to 147 and reduce CRI system CSO volume to 181.2 mg	7%	No reasonably foreseeable impacts
Phase 5 - Union to Clinton Relief Conduit (010)	- 4,000LF 48-inch diameter conduit from Union St to Clinton St	Will provide additional CRI storage and conveyance relief and reduce CRI system overflow frequency to 129 and reduce CRI system CSO volume to 112 mg	16%	No reasonably foreseeable impacts

Phase 6 – Worthington/Clinton Targeted Sewer Separation and Stormwater Management	- 3,000 LF of targeted sewer separation in East Columbus Avenue and South Main Street. Includes 140 acres of stormwater management near Springfield Technical College - 3,000 LF of targeted sewer separation near Locust Street and Mill Street - 40 acres of inflow removal in vicinity of Mercy Hospital - LID stormwater management	Will remove upstream inflow from the CRI to provide relief sufficient to reduce overflow frequency to less than 7 / typical yearr at all CRI system CSO regulators, reduce total CRI system overflow frequency to 64, and reduce CRI system CSO volume to 59.0 mg	8%	No reasonably foreseeable impacts

3.5 CSO CONTROL ALTERNATIVES

Section 6 of the May 2012 FLTCP discusses Development and Evaluation of CSO Control Alternatives. It notes that the performance of each integrated CSO control alternative was compared to the baseline water quality conditions to evaluate the cost-performance benefit of each alternative.

Each alternative development and analysis includes quantitative and qualitative data including, but not limited to, data regarding neighborhoods, engineering, operations, financial, and water quality improvements. The cost and water quality benefits of previous projects completed under the 2000 LTCP draft were incorporated to demonstrate overall water quality benefits gained since the implementation of components of the draft LTCP and NPCs.

The reader should refer to Section 6 in the May 2012 FLTCP for a detailed discussion of alternatives and rationale for removing certain alternatives from further consideration. In most cases, the high cost of construction outweighed relatively modest increases in capacity, general improvements, and water quality.

The Commission will conduct evaluations after the design and construction of every phase to confirm that the subsequent phases for implementation is still appropriate based on information that becomes available throughout the phased construction. If during these examinations a cause for ongoing coordination between the Commission and the Regulators is necessary, coordination will be reinitiated under the applicable state, federal, or local regulation.

3.6 FINANCIAL CAPABILITY ANALYSIS

Section 10 of the May 2012 FLTCP and Section 5 of the 2014 IWP describe the Financial Capability Assessment. The first phase of a financial capability analysis is to assess the impact of the IWP on rates and affordability in terms of Median Household Income (MHI). The second phase evaluates socio-economic factors compared to EPA benchmarks. The Commission's evaluation focuses only on Springfield retail customers, as retail customers residing outside of Springfield city limits are not responsible for implementation costs.

The Financial Capability Matrix (Table 10.2) of the LTCP indicates a High Burden due to the Permittee Financial Capability analysis as compared with the Residential Indicator. Figure 10.1 shows that the residential indicator will peak in 2042 when the average household bill will be 2.54% of the MHI.

3.7 EXISTING ENVIRONMENT

Section 2 of the May 2012 FLTCP presents existing information on Water Characterization of the waters that are the focus of the 2014 IWP. It also includes geographical and environmental features for the project areas within the IWP. These waters are part of one or more phases of the IWP implementation.

3.7.1 River Classifications and Uses

The project areas are categorized by two rivers and their riparian areas. These are the Connecticut River and the Mill River (Figure 13.7.1) The Commission will need to obtain a United States Army Corps of Engineers permit to regulate the discharge of dredged and fill materials in compliance with Section 404 of the Clean Water Act (CWA). The Commission will need to comply with regulations triggered by the issuance of a USACE Individual Permit, such as Section 106 of the National Historic Preservation Act.

The Connecticut River is classified as a R2UB river under the National Wetlands Inventory (NWI) classification system, which is a water body comprised of slowly flowing water with no tidal influence in the project area. The river is bounded by the steep banks of the channel. The substrate is unconsolidated and is comprised of mud and sand.

The Connecticut River has two federal designations: American Heritage River (named in July 1998 by President William Clinton) and Silvio O. Conte National Fish and Wildlife Refuge (designated in 1991). Abating pollution from CSOs is a part of the action plan that led to the designation of the river as one of 14 American Heritage Rivers. The designation includes the creation of a River Navigator, who is a federal agency employee that assists with attainment goals outlined in an action plan created for the river. Federal agencies will also provide other special assistance to implement those rivers' action plan items. Dan Burke, from the EPA Region 1 office, was designated the Connecticut River Navigator; however, it seems that the program has been dormant since circa 2003.

The Conte Refuge encompasses only certain areas along the Connecticut River. These areas are called Special Focus Areas. The USFWS will channel efforts to protect the lands in these Special Focus Areas through the acquisition of development rights (e.g., easements). Currently the mouth of the Chicopee River is designated as a Special Focus Area; however, it is outside of the scope of work for the IWP.

The Mill River watershed covers 31.8 square miles of mildly sloping land. The river originates from two branches which flow into Watershops Pond (formerly known as Lake Massasoit) east of Springfield's central business district. Lake Massasoit was impounded by 1809 to generate power for the Springfield Armory (PVPC, 1999). The Mill River is classified as PFO1, a water body non-tidal wetland that is usually dominated by vegetation, and is situated shoreward of a river, is a floodplain, or is an island in the river. The Watershops Pond is classified as L1UB, a wetland area with deep water habitats and less than thirty percent areal coverage of vegetation.

3.8 ENVIRONMENTAL IMPACTS

The following sub-sections describe the potential temporary and permanent impacts of implementing CSO control measures for the Connecticut River tributary area. Most of the alternatives require a below grade construction of new pipeline, conduits, and storage or pumping facilities. Temporary impacts will be intermittent disruption to adjacent property, including limited access to activities, such as recreation. This section will also outline the Commission's approach to any anticipated additional environmental compliance that may be required as the IWP is implemented - most appropriately for the Connecticut River crossing.

The discussion of anticipated impacts of the various alternatives is organized first by environmental parameter, then by phase, followed by a description of characteristics, and a discussion of potential temporary impacts. Information was gathered using MassGIS, City of Springfield public information available through the city's website, Springfield and Agawam zoning maps, as well as Massachusetts Historic Commission MACRIS database. The applicability and relevance of information found in the 2000 DEIR and the subsequent NPCs was reviewed and confirmed using the aforementioned sources.

Regarding Phase 2 - Connecticut River Crossing and York Street Pumping Station will require US Army Corps of Engineers consultation due to the need for a permit from the Corps to span the river. Of all phases, this phase is the most likely to result in some minor permanent impacts; however, the impacts are not reasonably foreseeable because the method of crossing is not decided upon. The Commission understands they will be legally obligated to continue consultation to avoid, minimize, and if necessary, mitigate impacts under federal, state, and local regulation as this phase is developed.

The Commission will commit to undergoing coordination with appropriate agencies and stakeholder groups, for example, but not limited to, US Army Corps of Engineers, US Fish and Wildlife, and Massachusetts Historic Commission, to better understand the presence or absence of protected resources, the impact of the method of crossing and construction for this phase of implementation will have on those resources, and if necessary, to avoid, minimize, and mitigate any impacts to meet regulatory requirements.

3.8.1 Land Use

3.8.1.1 General Land Use

Land use in the greater Springfield area is a mixture of commercial, residential, and industrial. The residential areas that may be impacted by implementation of the LTCP are located east of the city center. Phase 4 includes a partial undertaking in a residential area; otherwise, the phased construction takes place in commercial, industrial, or other non-residential use. Specific land use for each phase was determined from MassGIS Land Use data layers, and Springfield Zoning Maps.[1] Land use and potential impacts by phase are described below. Zoning maps and land use classification maps are included in Appendix C.

3.8.1.2 Land Use Impacts

3.8.1.2.1 Phase 1 - Washburn CSO Control Improvements

This phase would involve construction in roads and rights-of-way at a limited number of discrete locations. During construction land uses in the vicinity of the Phase Project area would not be impacted.

No long-term impacts of Phase 1 on land use and zoning are foreseen. Because most construction would take place in the roadways and public rights-of-way, with all new facilities located

[1] Created from City of Springfield and MassGIS Data, October 2012.

underground, there would be no change in existing land uses, and no zoning changes would be required.

3.8.1.2.2 Phase 1.5 - CSO 012/013/018 Modifications

This phase would involve construction in roads and rights-of-way at a limited number of discrete locations. During construction, land uses in the vicinity of the Phase Project area would not be impacted.

No long-term impacts of Phase 1.5 on land use and zoning are foreseen. Because most construction would take place in the roadways and public rights-of-way, with all new facilities located underground, there would be no change in existing land uses, and no zoning changes would be required.

3.8.1.2.3 Phase 2 - York Street Pumping Station and River Crossing

The current land use zoning for this phase is limited to commercial, brushland/successional, and recreation in Springfield and waste disposal in Agawam. The northeast terminus of the river crossing is located in an area of approximately 350 SF designated for commercial use. The terminus is anticipated to be wholly located on a small parcel owned by the Commission. The current YSPS is sited on this parcel. The river crossing will be placed under the recreation trail that runs along the east side of the Connecticut River. The area directly to the southeast of the pump station is classified as brush/land successional. The southwest terminus of the river crossing is at the Commission treatment facility, currently designated for waste disposal. The Commission does not anticipate any permanent impacts or change to the land use in the area of the YSPS and River Crossing.

The location of the new pump station necessary to facilitate the new river crossing is to be determined. The decision will be made in conjunction with consultation with the appropriate agencies to ensure that the new pump station complies with Springfield zoning ordinances. In the event the new pump station is located in Agawam, it will be within the Commission treatment plant parcel and will not necessitate a change in land use.

3.8.1.2.4 Phase 3 - Locust Transfer Structure/Conduit and Flow Optimization in Mill System

This phase is focused on two areas within Springfield. The Locust Transfer Structure will run parallel to the Interstate 91/Columbus Avenue corridor from the Mill River north to York Street. It is bounded at the west by brushland/successional land. Land use to the east is transportation. The parcels to the east of the project area are currently zoned for General Industrial and roadways are not zoned.

The project area for the conduit flow optimization in the Mill River system is located east of Interstate 91 in the general vicinity of Belmont Avenue, Fort Pleasant Avenue and Locust Street. CSO Regulators 046, 045, 017 are located in the vicinity. The optimization location is at the intersection of Mill and Locust streets and is currently classified as Commercial Land Use. The three regulators are located within an area classified as Multi-Family Residential. To the northeast and southwest of the regulators there are small pockets of Forest land use; however, it is not currently being used for forestry.

The optimization location and CSO Regulator 046 are located in a General Business zone, while regulators 045 and 017 are located in a Multi-Family, Medium/High Density Residential zone. The General Industrial Zone that the Locust Transfer Structure is located in and extends northeast into the General Business zone; it is possible that construction activity could take place in this small section, but the Commission does not anticipate any impacts or change to the land use or zoning in the areas for Phase 3 of the Long Term Control Plan.

This phase would involve construction in roads and rights-of-way at a limited number of discrete locations. During construction, land uses in the vicinity of the Mill Separation and Locust Transfer would experience temporary impacts associated with excavation in roadways or adjacent rights-of-way.

No long-term impacts of the Mill Separation and Locust Transfer on land use and zoning are foreseen. Because most construction would take place in the roadways and public rights-of-way, with all facilities located underground, there would be no change in existing land uses, and no zoning changes would be required.

3.8.1.2.5 Phase 4 - York/Union Box Culvert

The York/Union culvert is adjacent to the western edge of the Interstate 91 corridor from Union to York streets. At York Street, the culvert changes orientation to run easterly/westerly to and from the YSPS. Three land uses - brushland/successional, commercial, and participation recreation - are present in the phase project area between the Connecticut River and the transportation corridor. The commercial area occupies the same area described in the Washburn CSO Control Improvements Land Use section, which is bounded at the north by Broad Street. From Broad Street north to Union Street, the land use is brushland/successional. The railroad bisects the brushland/successional parcel before bounding the commercial land at the southwest.

Approximately one-half of the brushland area is not zoned. Roughly placed in the center is a large building located at Welker Street; this area is zoned for general industrial use as is the area between West Gardiner Street south to York Street. Temporary impacts would include those associated with excavation in roadways and or adjacent rights-of-way. The Commission does not anticipate a change in land use or zoning for this phase.

The lots at the northeast terminus are zoned for General Industrial Use; the rail trail and the Commission treatment facility are zoned for passive recreation. The Commission does not anticipate a change in zoning for these areas.

3.8.1.2.6 Phase 5 - Union to Clinton Relief Conduit

The relief conduit includes CSO regulators 010-014, and 015B. The conduit follows a north/south path on the western edge of the interstate corridor from south of the Interstate 91 and Interstate 291 junction to Union Street. As this represents one of the largest phases in terms of geographical area, there are a multitude of land uses and zones in the project area. Regulator 010 and the northern terminus of the conduit are located in an area designated as Powerline/Utility. Southeast of this area is commercial designation abutted at the south east by land classified as Forest. The majority of the land use for this phase area is Transportation and Commercial, located roughly in the center of the area. Directly south of a large parking lot is an area classified as Participation Recreation. South of the parking lot is an area of land classified as brushland/successional.

The majority of the area is un-zoned, but there are small areas, predominately in the center of the project area directly south of the eastern abutment of the Memorial Bridge that is zoned for General Business. Temporary impacts would include those associated with excavation in roadways and or adjacent rights-of-way. The Commission does not anticipate any changes to the land use or zoning for this phase.

3.8.1.2.7 Phase 6 - Worthington/Clinton Targeted Sewer Separation and Stormwater Management

This phase consists of many different activities including system optimization, stormwater management, sewer separation, and inflow removal. On Main Street, where system optimization will take place, the land use classification is commercial. An additional 3,000 LF of separation will occur in the East Columbus Avenue and South Main Street area. Stormwater management is slated for the area of Albany Street and Springfield Technical Community College (STCC) subcatchment. Near Albany Street the land use is categorized as commercial and is zoned for Limited, Central, Highway Business, Office Park used. The STCC area is categorized as forest, commercial, and urban public/institutional and is zoned for institutional use. The Commission does not anticipate any changes to the land use or zoning for this phase.

Approximately 3,000 LF of sewer separation will occur in the Liberty and Armory Streets. The Liberty/Armory area is a roughly equal mix of high density residential and multi-family residential land use zoned for 5,000-15,000 SF, multi-family low density residences. Some parcels fronting Liberty and Armory Streets are zoned for commercial use and are classified as such under Springfield's land use metrics. Additional sewer separation will occur in two areas adjacent to the east bank of the Connecticut River. The triangular area near Avocado Street is classified as Forest and Industrial; while the rectangular area between State and Union streets is classified as Commercial and Urban Public/Institutional. The areas are zoned for either General Industrial (Avocado Street) or General Business (State Street to Union Street). The Commission does not anticipate any changes to the land use or zoning for this phase.

3.8.2 Recreation and Open Space

Recreational areas and open spaces were assessed using Massachusetts GIS data layers in the fall of 2012. Additionally, the City of Springfield's Parks and Recreation website was accessed to verify the location of recreational and open spaces.

3.8.2.1 Phase 1 - Washburn CSO Control Improvements

The one new structure included in this phase is proposed near the Connecticut Riverwalk recreational trail. The new regulator and inflow removal is between Kenefick Park at the west and the Plainfield Soccer Field at the east. Any temporary impacts would be related to construction activities, but there will be no long term impacts as the new pipes and regulators will be underground.

3.8.2.2 Phase 1.5 - CSO 012/013/018 Modifications

This phase is wholly located outside of the right of way, along the shoreline of the Connecticut River. There will be mitigatable impacts to recreation as a result of this phase.

3.8.2.3 Phase 2 - York Street Pump Station and River Crossing

The river crossing will be placed under the Connecticut River walk in order to cross the Connecticut River with a new pipe. Temporary impacts may include detours for users to accommodate construction activities related the placement of the pipe. The new pump station will not be placed in an area used for recreation.

3.8.2.4 Phase 3 - Locust Transfer Structure/Conduit and Flow Optimization in Mill System

There are no recreational facilities, passive or otherwise, nor is there any significant open space in the vicinity of this phase of construction.

3.8.2.5 Phase 4 - York to Union Box Culvert

The culvert location is within 200' to 400' of the southern end of Riverfront Park and the Connecticut Riverwalk and Bikeway. These recreation areas are buffered from the project area by a large building and the northern parking lot of the Naismith Memorial Basketball Hall of Fame. Parking for the park and trail use is located northwest of the project area. The Commission does not anticipate any permanent impacts to the area. Temporary impacts associated with construction activity, such as traffic detours, may periodically disrupt traffic patterns used to access the park and trail form the south.

3.8.2.6 Phase 5 - Union to Clinton Relief Conduit

The southern end of this linear phase is located adjacent to Riverfront Park and the Connecticut Riverwalk and Bikeway. The Bikeway and park are buffered from the construction area (along W. Columbus Avenue) by a series of parking lots and the Boston & Maine Railroad corridor. The Commission does not anticipate any long-term impacts to the area. Temporary impacts associated with construction activity, such as traffic detours, may periodically disrupt traffic patterns used to access the park and trail form the south.

3.8.2.7 Phase 6 - Worthington/Clinton Targeted Sewer Separation and Stormwater Management

There are two substantial areas of recreation or open space in this stormwater management, separation, and inflow removal stage. Both are located near the former Springfield Armory. A recreational field is located at the western corner of the intersection of Walnut and Union Streets. Currently it does not have facilities such as a playground and is used as a multi-purpose open space. This area is targeted for storm water management. Any temporary impacts would be the result of intermittent construction activities and will be avoided to the furthest extent possible during final design.

3.8.3 Surface Waters and Ground Water Hydrology

3.8.3.1 Surface Waters

The implementation of the IWP will permanently improve water quality of surface waters, particularly the Connecticut River, by decreasing untreated outfalls during wet weather events. Any temporary impacts to surface water quality at the project locations of all phases of this IWP will be minimized by the implementation and use of BMPs. In the case of the river crossing and the construction of the new YSPS all necessary avoidance, minimization of harm, or mitigation measures will be developed through further agency coordination. BMPs may include sedimentation control measures such as the use of silt fence and hay bales and turbidity curtains in the River; frac tanks and other methods for the removal of sediment prior to the discharge of groundwater; silt sock inserts to protect catch basins; and temporary and permanent vegetation and natural fiber erosion control blankets to protect embankments from erosion. Erosion along the embankments will be mitigated using methods such as straw waddles, silt fence, coir fascines, proactive planting and seeding, geotextile fabrics and straw mats, and other means.

Section 2.4.3 Water Quality Investigations and Section 2.4.4 Water Quality Conclusions of the May 2012 FLTCP provide further detail regarding the approach taken to investigate permanent water quality benefits and reach conclusions. In summary, when the Commission modeled the May 2012 FLTCP, it found that the recommended plan only marginally improves water quality due to a variety of factors. First, the CSOs subject to this IWP contribute only a relative small fecal coliform as compared to upstream stormwater discharge.[2] Secondly, most of the discharge is flushed downstream and leaves the model area. Thirdly, because the fecal coliform levels are well above thresholds in dry weather due to stormwater impacts, substantial reductions resulting from wet weather outfalls do not significantly decrease threshold exceedances. Please refer to those sections for additional information.

The river crossing will present unique challenges as the Commission will install a pipe to carry storm and waste water to the treatment facility from Springfield before discharge; however, additional agency coordination will be required by the USUSACE involvement and impacts will be re-examined as the design for this phase progresses.

Construction phase impacts for the entire IWP will be mitigated by designing work plans that avoid and minimize impacts, including the implementation of BMPs, including those identified above. Stormwater Pollution Prevention Plans (SWPPs) will also be prepared and provisions of each permit will be incorporated into the final design and construction.

3.8.3.2 Stormwater

The Commission will include stormwater controls during the planning, construction, and post-construction of each phase. The improvements will be designed consistent with the goals incorporated in the Massachusetts Wetlands Protection Act (310 CMR 10.00) (Mass WPA). During construction, BMPs will be implemented. Sedimentation and erosion controls, as well as storm drain inlet protection, will also be implemented. The contractor will be required to develop a Stormwater Pollution Prevention Plan (SWPPP) as part of the NPDES permit for construction activities as required by the EPA.

3.8.3.3 Ground Water

No long term impacts to ground water are anticipated as a result of the implementation of the IWP. Any necessary dewatering made during construction will not directly discharge into wetlands or water bodies without prior treatment.

3.8.4 Wetlands and Flood Hazard Areas

3.8.4.1 Wetlands

The USACE defines wetlands as “those areas inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do

[2] This refers to upstream discharge that originates in communities not served by the SWSC.

support, a prevalence of vegetation typically adapted for life in saturated soil conditions. The Commission is required to consult with the USACE if impacts to a wetland are anticipated.

Chapter 91 of the Wetlands Protection Act allows that a notice of intent to impact wetlands will be filed with municipal conservation commissions. The State of Massachusetts has exempted the "maintenance, repair, or replacement of a lawfully located structure which is used to provide . . . sanitary sewage, storm drainage" from permit and application, as long as the work conforms to the performance standards and design specifications in regulations adopted by the Conservation Commission.

Wetlands data was compiled using the City of Springfield's Conservation Commission data layer found through the city's website and through the MassGIS online information site, OLIVER. With regard to the IWP, wetlands are limited mostly to the Connecticut River and some discriminate locations within Phase Project Areas.

3.8.4.1.1 Phase 1 - Washburn CSO Control Improvements – 2012 to 2014

Wetlands in this project area are limited to the western edge of Riverside Road from the Connecticut River. There will be no temporary or permanent impacts to wetlands.

3.8.4.1.2 Phase 1.5 - CSO 012/013/018 Modifications

There are no wetlands in the vicinity of this phase area; as such there will be no impacts to wetlands as a result of this phase.

3.8.4.1.3 Phase 2 – York Street Pump Station and River Crossing

Wetlands extend from the Connecticut River to the dead end of York Street. The river crossing will require a USACE Section 404 permit for dredging and fill of wetlands. The new river crossing and pump station will be located outside of delineated wetlands.

3.8.4.1.4 Phase 3 - Locust Transfer Structure/Conduit and Flow Optimization in Mill System

Wetlands are present south of the intersection of Locust Street and Mill Street. The wetlands are buffered by a large building and raised roadway under which flows the Mill River. There will be no temporary or permanent impacts to the wetlands.

3.8.4.1.5 Phase 4 - York to Union Box Culvert

This phase is adjacent to the Connecticut River which is considered a wetland by the Springfield Conservation Commission; however, because the undertaking will adhere to the Springfield and Agawam Conservation Commissions' work specification and design standards, the project is exempt from filing a Notice of Intent.

3.8.4.1.6 Phase 5 - Union to Clinton Relief Conduit

There are no wetlands in the vicinity of this Phase Project Area.

3.8.4.1.7 Phase 6 - Worthington/Clinton Targeted Sewer Separation and Stormwater Management

There are no wetlands in the vicinity of this Phase Project Area.

3.8.4.2 Flood Hazard Areas

Most of the project area is within the 500-year flood plain. Areas near the Connecticut River are within areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1-square mile; and areas protected by levees from 100-year flood.[3]

With the exception of the new river crossing pump station, all completed work will be underground or underwater. The river crossing, either constructed via trenchless technology or via an open trench, will be placed under the substrate of the Connecticut River. It will not result in net change of the river's permanent water level. All work will not result in a net change of the flood plain levels.

3.8.5 Rare and Endangered Species

The MA Division of Fisheries and Wildlife (MADFW), the MA Natural Heritage and Endangered Species Program (MANHESP), the US Fish and Wildlife Service (USFWS), and the National Maritime Fisheries Service (MNFS) were contacted in 2000 to determine the occurrence of significant fishery habitat and federal and state-listed rare species. The MADFW defines significant fishery habitat to include rare and endangered species, anadromous species, and native trout habitat. In 2012, the MANHESP, USFSW, and MADFW online databases of rare, existing, or threatened species were used to confirm the 2000 findings.

MADFW notes the Mill River does not contain any known significant fishery habitat. However, rare or endangered species may potentially occur in the Connecticut River in the vicinity of the project. The river crossing and its new pump station will be located in and adjacent to the Connecticut River. Further consultation will be required by the US Army Corps before the agency issues a permit. Consultation will include the development of avoidance, minimization of harm, and, if necessary, mitigation measures.

The aforementioned sources show that the habitats for the Rare and Endangered Species are in and around the Connecticut River; therefore, the impacts discussion for this sub-section is organized by level of protection, then by species rather than phase of implementation.

No endangered or rare plants have been identified in the vicinity of this project.

[3] Federal Emergency Management Administration. "Flood Insurance Rate Map (FIRM) Springfield MA" accessed January 13, 2013.

3.8.5.1 Federal or State Endangered Species

Dwarf Wedge mussel (*alasmidonta heterodon*)

The Dwarf Wedge mussel is a federally and state endangered species. It is imperative that animals are not harmed or removed from the water. Because the Dwarf Wedge mussel is commonly confused with other species, an expert will be consulted if its presence is suspected. It is found in a variety of substrate types including clay, sand, gravel, and pebble, and often in areas of rivers with large amounts of silt. The Dwarf Wedge mussel inhabits very shallow water along stream banks and can move laterally or horizontally in the substrate as water levels fluctuate, but they have also been found at depths of 25' in the Connecticut River. An increasing number of published studies and field observations suggest that stable flow and substrate are critical for this species.

The Dwarf Wedge mussel is sedentary; however, the larvae on the fins or gills of vertebrate are hosts to developing juveniles. The tessellated darter is considered the primary host in the Connecticut River watershed and its range is most congruent with that of the Dwarf Wedge mussel. The fish do not move very far in their short lives; usually less than 100 yards, which lessens the dispersal ability of the mussel. The USFWS believes the Dwarf Wedge mussel has extirpated from all but four water bodies in the Connecticut River watershed; therefore, it is doubtful the species is in the mainstem Connecticut River. However, with no definitive proof that the mussel has been extirpated from the mainstem, a consultant will be brought in if there is suspicion that the mussel is present in the project area.

Shortnose Sturgeon (*Acipenser brevirostrum)*

The Shortnose Sturgeon is a federally and state listed endangered benthic species found in the Connecticut River. Estimated habitat for the Shortnose Sturgeon includes the riverfront area of Springfield and the existing CSO outfalls along the Connecticut River. According to MANHESP there are three populations in Massachusetts: one the in the Merrimack River and two in the Connecticut River. The Connecticut River populations are defined as those above the Holyoke Dam and those below. Shortnose Sturgeon are an anadromous species, spawning in freshwater habitats, but entering saltwater during their life. They spawn in fast-flowing, rocky rivers areas and use areas with river aquatic vegetation to feed. Adults reach maturity between 5 and 10 years of age. While spawning runs occur every year, individuals spawn in 2-3 year cycles. Very little is known about the spawning cycle and further research is ongoing.

Habitat degradation or loss and mortality are the main threats to this species. These threats can be through dams, bridge construction, channel dredging, impingement on water-in take screens and pollution. They are particularly vulnerable to these threats because of their late spawning age and because they undergo large movements to get to critical habitats. The NMFS recovery plan estimates there was a mean value of 875 adult sturgeon below the dam. Generally, the Shortnose

Sturgeon has a much smaller range of movement in the winter than in the summer, though some individuals have been documented making longer trips.

3.8.5.2 Species of Concern

The NMFS also noted the potential presences of species of concern. These include blueback herring, alewife, striped bass (*morone saxatilis*), and American eel (*Anguilla rostrata*). In November 2011, the National Oceanic and Atmospheric Administration petitioned to have the alewife and blueback herring listed as threatened species. A 90-day finding was approved by USFWS while NOAA gathered new information.

Triangle Floater Mussel (*Alasmindonta undulate)*

MANHESP has also indicated the potential presence of the Triangle Floater Mussel, a state listed species of Special Concern. The Triangle Floater Mussel lives in and along the Connecticut River in the vicinity of Springfield. The Triangle Floater Mussel is a freshwater mussel, which lives burrowed in to the substrate. The mussels commonly live in the same location in their entire lives, up to 100 years. Vertical adjustments are made by the mussel to accommodate for a change in environment and sometimes for migration as well. The mussel has been known to migrate a short distance in order to avoid an unsuitable habitat.

Blueback Herring (*Alosa aestivalis*)

The blueback herring are triggered to return upstream from the ocean by a change in temperature. Herring spawn in areas with adequate velocity and rock, sand, and gravel substrates. The larvae are particularly sensitive to temperature. Juvenile herring begin to move downstream by late summer, or as late as November in the Connecticut River. The juveniles in the Connecticut River feed on tendipedid larvae and cladocerans. The adults tend to eat fish and small crustaceans.

The CSO outfalls along the Connecticut River are located in the migratory path of the herring. Since the 2000 LTCP, there is been a decrease of 10,682 blueback herring returns. In 2000, the Connecticut River Coordinator's Office recorded a return count of 11,000; in 2011 they recorded a return of 138. The eleven year low was 21, recorded in 2006. The blueback herring decline is attributed to the installation of the Holyoke Dam which has restricted the species access to historic spawning habitat.

3.8.5.3 Avian Concerns

Bald Eagle and Peregrine Falcon

Both the Bald Eagle (*Haliaeetus leucocephalus*) and Peregrine Falcon (*Falco peregrinus*) have been removed from the federal endangered or threatened species list due to the recovery of the species; however, the MANHESP lists the Bald Eagle as a threatened species and the Peregrine Falcon as an endangered species. In 2008 MA NSHEP observed 26 pairs of Bald Eagles throughout Massachusetts; seven of which were on the Connecticut River. As recently as 2007, a Peregrine Falcon has been sighted in Springfield. In 1997 the MANSHEP noted a nesting pair under the Memorial Bridge. The MANHESP notes that Peregrine Falcon nesting pairs have returned to pre-DDT numbers.

As most of the above species are found in and around the Connecticut River, the Commission will continue consultation with the appropriate agencies on ways to avoid, minimize, and mitigate any impact to endangered and threatened species as part of the river crossing phase.

3.8.6 Historical and Archaeological Resources

A substantial portion of the construction will occur in roadways and other previously disturbed areas, which will reduce the potential for encountering archaeological resources. MHC has indicated that they will need to review proposed site and alignment plans as they become available as required under Section 106 of the NHPA and MGL Chapter 9. The Commission will coordinate with MHC and the Springfield Historic Commission (SHC) as preliminary design proceeds in each phase. Maps with the known locations of historic resources are included in Appendix C.

3.8.6.1 Phase 1 - Washburn CSO Control Improvements - 2012 to 2014

No known historic properties are located in the areas where work will be undertaken.

3.8.6.2 Phase 1.5 – CSO 012/013/018 Modifications

No known historic properties are located in the areas where work will be undertaken.

3.8.6.3 Phase 2 - York Street Pump Station and River Crossing

This phase will require Section 106 of the NHPA compliance based on the anticipated need for USACE involvement in turn triggering a federal action. The river crossing and new pumping station are not reliant on the other phases for implementation or utilization.

3.8.6.4 Phase 3 - Locust Transfer Structure/Conduit and Flow Optimization in Mill System

No additional known historic properties are located in the areas where work will be undertaken in this area. A New York, New Haven and Hartford Rail Road Bridge is located approximately 250’ west of the southern terminus of the 96-Inch Locust Transfer Structure. The bridge was determined not eligible for listing on the National Register of Historic Places by MHC on September 1, 2010.

3.8.6.5 Phase 4 – York to Union Box Culvert

No known historic properties are located in the areas where work will be undertaken.

3.8.6.6 Phase 5 - Union to Clinton Relief Conduit

The Downtown Springfield Municipal Resource Area, a historic district listed on the National Register of Historic Places, is located on the northwest side of Interstate 91. The scope of work for this phase will be located on the southwest side of Interstate 91, which will act as buffer between historic resources and construction activity.

3.8.6.7 Phase 6 - Worthington/Clinton Targeted Sewer Separation and Stormwater Management

The Springfield Armory National Historical Site is located near the Springfield Technical Community College. The stormwater management for this area includes work in the right of way to improve surface drainage. The Commission does not anticipate any effect to this property.
This phase includes activity within the Downtown Springfield Municipal Resource Area. One location for optimization is near a cluster of resources listed on the National Register of Historic Places or properties that have preservation restrictions. The Commission will continue consultation with MHC as the project design for this phase progresses.

3.8.7 Traffic, Air, and Noise

Each Phase Project Area will experience similar temporary traffic, air, and noise impacts and as such the impacts are discussed holistically rather than by individual phase. Adjacent properties will experience temporary impacts associated with excavation in roadways or adjacent rights-of-way. These impacts will be of concern in the downtown area, where traffic congestion is already high. Impacts will include potential temporary disruption in access, elevated noise levels, and increased dust emissions.

3.8.7.1 Traffic

Springfield's transportation network is comprised of interstate highways, state highways, local roads, railroad routes, and public transportation. Interstate 91, which is a well-traveled north/south corridor in western New England, traverses Springfield adjacent to the Connecticut River. The interstate has six lanes in the vicinity of Springfield, with numerous ramps providing access and egress to downtown Springfield. Interstate 291 serves as an alternate connection between Interstate 91 and Interstate 90 (the Massachusetts Turnpike). Routes 20 and 20A provide east/west access through Springfield, while Route 5 provides a southern entrance and exit to the city. Impacts to the interstate system and Route 5 will be limited to potential impacts at the bottom of on and off ramps. Potential impacts will be minimized and mitigated during each project's design and construction phases.

The Boston and Maine Railroad and Conrail are two important rail routes in Springfield. The Boston and Maine route travels north and south, while the Conrail route travels east and west.

The Pioneer Valley Transit Authority (PVTA) provides public transportation for the region, including Springfield. An intermodal facility to connect public transportation, intercity buses, rail, and taxi services has been in development for over a decade and the current $78 million plan is to redevelop Union Station for use as an intermodal transportation facility.

Temporary impacts will include decrease in the number of lanes, flagging, and possible detours. There will be no permanent traffic impacts as a result of the implementation of the IWP.

3.8.7.2 Air

Construction during the implementation of the IWP will not require a significant presence of heavy construction equipment and related vehicles; as such implementation will not impact air quality within the project area confines. Projects which are funded through the State's Revolving Fund (SRF) low interest loan program will be further subject to the provisions of the State's Diesel Retrofit Program which is intended to mitigate impacts of diesel construction equipment on air quality.

3.8.7.3 Noise

In 2001, the City Council of the City of Springfield adopted changes to the city's noise ordinance to include construction at Section 259-6. Construction can occur between 7 a.m. and 7 p.m. on weekdays, except in the interest of public safety or welfare, upon the issuance of and pursuant to a permit from the Code Enforcement Commissioner. This permit may be renewed for one or more periods not exceeding one week. Other special exceptions may be only authorized by the Code Enforcement Officer in a written format.

DEP's *Supplemental Form for Survey Noise Potential* limits increases in ambient sound levels from all facilities to 10 dBA or the production a "pure tone" condition – when any octave band center frequency sound pressure level exceeds the two adjacent center frequency sound pressure levels by 3 decibels or more. Criteria are measured at the property line and the nearest inhabited residence. These limits do not apply to construction and are only at a facility property boundary.

DEP has qualified noise limits that apply to construction activity, stating construction and demolition equipment which characteristically emit sound may be fitted and accommodated with equipment such as enclosures to suppress sound or may be operated in a manner so as to suppress sound, suppressible and preventable industrial and commercial sources of sound, and other man-made sounds that cause noise.

3.9 MITIGATION MEASURES

3.9.1 Temporary Construction Impact

The Commission will mitigate any temporary impact by implementing BMP during construction including sedimentation control measures such as the use of silt fence and hay bales and turbidity curtains in the River; frac tanks and other methods for the removal of sediment prior to the discharge of groundwater; silt sock inserts to protect catch basins; and temporary and permanent vegetation and natural fiber erosion control blankets to protect embankments from erosion. Construction will proceed as rapidly as possible and the contractor will be responsible for delays Other measures have been included in each subject area section, including the following:

- All appropriate works will be fenced and secured to prevent unauthorized access
- The undertaking will adhere to the Springfield and Agawam Conservation Commissions' work specification and design standards
- The contractor will be responsible for implementing standard dust control mitigation measures
- The contractor will be responsible for conforming to Springfield and Agawam noise ordinances
- Construction related traffic is anticipated to be minimal. A traffic management plan will be developed prior to any phase implementation to minimize impacts. MassDOT approval will be sought for activities that will take place in state roads.

3.10 PROPOSED SECTION 61 FINDINGS

MEPA regulations require that Proposed Section 61 Findings are included as part of the EIR. These Section 61 Findings for the Commission's IWP have been prepared to comply with MGL Chapter 30, Section 61. Under this regulation, before any agency can approve a project that required an EIR, the agency must first evaluate and determine the impacts on the natural environment and confirm that all feasible measures have been taken to avoid and minimize those impacts.

The implementation of the IWP will reduce the frequency of untreated discharges into the Connecticut River resulting in long term improved water quality. There will be some temporary, short term impacts related to construction, such as dust and noise, but these impacts will be minimized by the implementations of BMPs by the Commission and its contractors.

3.10.1 Overview of Project Impacts and Mitigation Measures

The following sub sections provide a brief overview on the approach to minimizing and mitigating the temporary impacts associated with implementation of the IWP. These impacts do not warrant special mitigation other than BMPs discussed below.

3.10.1.1 Wetlands

With regard to all phases except the river crossing there are no wetlands within the project limits. Avoidance, minimization of harm, and any subsequently required mitigation measures will be developed during consultation specific to the river crossing.

3.10.1.2 Floodplain

The 100-year and 500-year floodplains will not be increased as a result of the implementation of the IWP.

3.10.1.3 Rare and Endangered Species

Based on information accessed from USFWS, MASHEP, MADFW, and NMFS, it is possible that the river crossing could impact the habitat of the protected Shortnose Sturgeon and Dwarf Wedgemussel. At this time it is not known how the crossing will be made. The Commission will enter into additional consultation with the USACE and MASHEP on BMPs and approaches to mitigate any potential impact that could result from the river crossing as part of the issuance of any USACE or USCG permit required for the river crossing.

3.10.1.4 Traffic

A traffic plan will be developed prior to construction for construction activities that may disrupt traffic patterns. Contractors will be required to coordinate with MassDOT and local authorities to determine precautions so as to not disrupt traffic patterns and public safety.

3.10.1.5 Noise

Contractors will be required to comply with local noise ordinances and use noise reduction measures on equipment when available and when appropriate. The contractor will be responsible to coordinate with City of Springfield officials in complying with noise ordinances.

3.10.1.6 Fugitive Dust Emissions

Construction activities will create temporary fugitive dust emissions. The contractor will be required to provide street sweeping and regular watering of construction sites as air quality controls during construction.

3.10.1.7 Historical and Archaeological Resources

With the exception of the Springfield Armory, there are no documented historic sites within any of the Phase Project Areas. At this time the presence or absence of resources in the Connecticut River With the implementation of each Phase, the Commission and the USACE will submit plans of each Phase to the MHC and SHC for continued Section 106 and MGL Chapter 9 consultation.

3.10.2 Implementation Schedule

Each of the mitigation measures, reviewed in these Section 61 findings, involve different time frames directly related to the type of impact during each phase. As each phase will be reviewed for appropriateness following completion of the previous phase so will impacts and mitigation. Each mitigation measure will be implemented during pre-construction and will continue through the phase project completion include the following:

- Coordination with the City of Springfield, City of Agawam, and other municipalities, as necessary for all street work, including traffic plans;
- Coordination with MassDOT for traffic plans, if necessary;
- Coordination with Springfield Conservation Commission including compliance on any Order of Conditions, if necessary;
- Performance standards for erosion and sediment control measures where construction is near wetland resources.

After construction, the Commission will ensure restoration of temporarily impacted area to pre-construction conditions or provide mitigation if there are areas that cannot be restored. Examples would include:

- Removal of any temporary structures erected during construction;
- Re-grading and re-vegetation of areas disrupted during construction.

3.10.3 Section 61 Findings

The Commission finds that all feasible and prudent measures will have been taken to avoid or minimize adverse impacts to the environment relating to the implementation and construction of recommended IWP. Additional mitigation measures may be required as a result of implementation of each phase will be addressed and developed prior to the start of construction of that phase.

Section 4
Recommended CSO & WW Plans

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4.1 UPDATES TO CSO PROJECTS & COSTS

In the May 2012 FLTCP, the H-5 CSO abatement alternative was selected for implementation as the Recommended CSO Control Plan. The Recommended Plan in the May 2012 FLTCP provided a level of CSO control of one to eight overflows per year, and conforms to the implementation schedule guidelines included in *EPA's Guidance for Financial Capability Assessment and Schedule Development (EPA, 1997)*. Minor updates have been made to the Recommended Plan as described below; however, these updates are considered refinements to the Recommended Plan previously recommended.

4.1.1 Summary of Updated Recommended CSO Control Plan

The Commission continues to invest significant time and effort to refine and further evaluate the recommended alternative H-5 as its most cost effective and Recommended Plan. As stated in the May 2012 FLTCP, the Recommended Plan meets and exceeds State and federal CSO guidelines for minimum performance measurements of long term control plans (LTCPs) (based on Typical Year rainfall conditions), including 88.6% CSO volume reduction on a system-wide annual basis. The Recommended Plan consists of several projects to be completed in phases over 20 years. The updated capital cost of the Recommended Plan is estimated at $183.3 Million. Including monies previously expended (refer to Section 6), the total cost of the CSO Control program is upwards of $283 million.

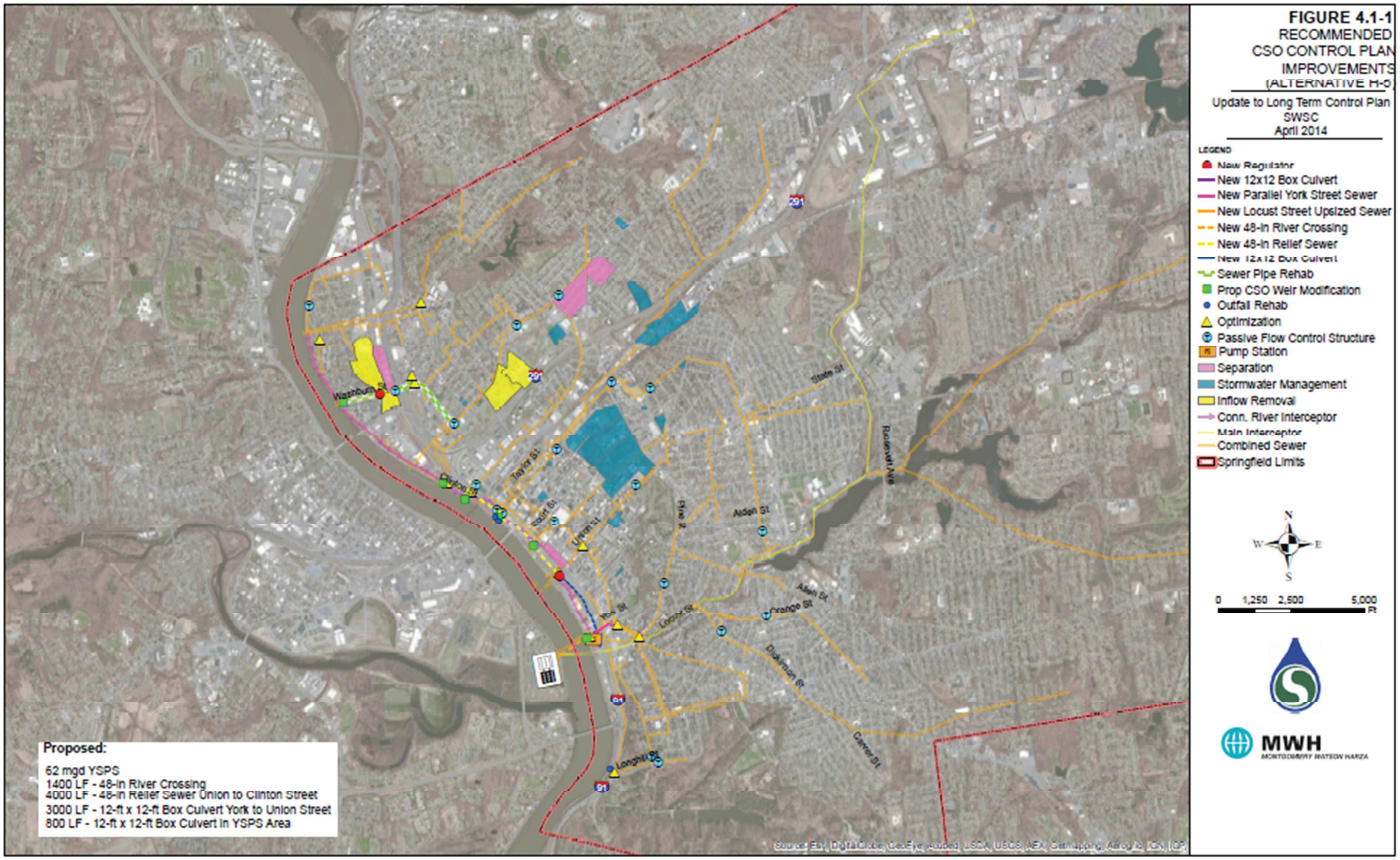
4.1.2 Description of Updated Recommended Plan

Updates to the alternative H-5 (the Recommended Plan) were undertaken upon results of the 2013 temporary metering program and for the purpose of optimizing its CSO abatement performance, while minimizing risk to the collection system and its impacted users during efforts to produce the Commission's Integrated Wastewater Plan.

Broadly, the Recommended Plan continues to provide a new 62mgd York Street pump station (YSPS), new 48-in diameter river crossing from the collection system to the SRWTF (1,400LF), new storage and conveyance conduits (3,800LF of 12-ft x 12-ft box culvert and 4,000LF of 48-in pipe) for relief of the Connecticut River Interceptor, targeted sewer separation and inflow removal, widespread system optimization measures via flow control structures, and stormwater management features that incorporate green infrastructure. The updated Recommended Plan provides more details on the Mill River – Connecticut River CSO system connection via the junction at Locust Street, and has been updated to include an upsized Locust Street sewer and parallel sewer on York Street, in addition to junction/diversion structures, to enable Main Interceptor river crossing isolation for maintenance or repairs. These improvements are illustrated in Figure 4.1-1.

Specific features within each phase of the Recommended Plan are as follows. Depictions of each phase of the improvements can be found in individual worksheets in Section 4.4.1 of this text.

Figure 4.1-1: Recommended CSO Control Plan Improvements (Alternative H-5) – Updated



Phase 1 of the Recommended Plan, the Washburn CSO Control Project, is currently being constructed. Phase 1 includes relocation of CS0 Regulator 008 (the new regulator is to be known as CSO008A); separation of Washburn Street and Birnie Avenue; inflow removal along Plainfield Street; optimization of the existing system storage capacity in the CRI, the CSO Regulator 007 catchment, the CSO Regulator 049 catchment, and the CSO Regulator 008A catchment; flow optimization between Regulator 008A and the Garden Brook sewer; and renewal of key sewer and water infrastructure. A stormwater management feature along Chapin Terrace was approved and included in the construction documents but subsequently removed from the contract due to stakeholder resistance. The de-scoping of the stormwater management feature caused a small detrimental CSO effect; however, the CSO abatement goals per the Recommended Plan are still accomplished.

Phase 1.5 contains improvements that have been newly identified as priority projects and added to the Recommended Plan. This phase includes rehabilitation of failing CSO outfall structures discharging overflows from CSO 012, CSO 013, and CSO 018, including restoration of collection system flood protection on the CSO 012 outfall system. Pending results of hydraulic analysis, the potential exists for elimination of Regulator 018 for CSO relief.

Phase 2 continues to include a new pump station that will increase the total peak pumping capacity to 62mgd; construction of a 1,400 LF 48-inch river crossing from the YSPS to the influent structure at SRWTF. New Phase 2 project components include relocation of the CSO Regulator 015A structure along Union Street from its current Main Street location to West Columbus Avenue; installation of a flow control structure along Elm Street at Main Street, installation of flow control structures along Worthington Street near both Spring Street and Bowdoin Street, installation of a flow control structure along Carew Street near Melha Avenue; modifications to CSO weir crest elevations at Regulators 010, 011, 012, 013, 014, and 016; and installation of a flap gate on the Regulator 010 underflow connection to the Connecticut River Interceptor to prevent backflows from the Interceptor relieving out via the CSO 010 outfall.

Phase 3 continues to provide means for optimizing Main Interceptor flows via installation of 4 flow control throttles in the tributary collection system. It also continues to provide better linkage between the MIS system and the CRI system via the junction at Mill St and Locust St through upgraded and new sewer infrastructure along Locust Street and York Street. This new infrastructure will be sized to convey the full capacity of the Main Interceptor toward the YSPS (upgraded in Phase 2) for delivery to the SRWTF and will therefore enable isolation of the Main Interceptor river crossing for maintenance and/or repairs.

Phase 4 continues to include the construction of a new 12-foot x 12-foot reinforced concrete box culvert along West Columbus Avenue from the existing Union Street CSO Regulator 015B to the existing York Street CSO Regulator 016 (3,000LF) and an additional 800LF in the YSPS area for supplementary storage. This box culvert will provide additional conveyance and storage capacity of combined sewer for the CRI system. In addition, existing Regulators 015A (at its new location on West Columbus), 015B, and 016 will be connected to the new box culvert, and the underflow/overflow control settings at Regulator 015A (at its Main Street location) will be optimized.

Phase 5 continues to include a 48-inch relief sewer parallel to the existing CRI from the existing Clinton Street CSO Regulator 010 to the existing Union Street CSO Regulator 015B (4,000LF). Existing Regulators 010, 011, and 012 will be connected to this relief sewer. These improvements will provide additional conveyance and storage capacity of combined sewer for the CRI system.

Phase 6 continues to consist of approximately 6,000LF of targeted sewer separation, 40 Acres of inflow removal, and LID stormwater management improvements covering areas totaling approximately 180 Acres. In addition, 7 flow control throttles will be distributed among the CSO Regulator 010, 011, 012/013, and 015 catchments.

The phased Recommended Plan components listed above are to be implemented over a period of 20 years as described in section 4.1.6 in this text. The project sequencing continues to provide substantial CSO abatement in the first two project phases, accounting for greater than 52% reduction in CSO volume, within the first 5-10 years of Recommended Plan implementation.

4.1.3 Costs of Updated Recommended Plan

Unless otherwise noted, all costs presented in the section have been escalated to November 2013 dollars. Previous cost projections in the May 2012 FLTCP were based on an Engineering News Record (ENR) Construction Cost Index (CCI) of 9080 (July 2011). The updated estimated capital cost for the Recommended Plan is $183,323,000 for the CSO program. A breakdown of the capital cost by project is listed in **Table 4.1-1**. Non-CSO Capital Costs are summarized in Section 6.

Table 4.1-1: Estimated Capital Cost of Updated Recommended Plan

Recommended Improvement	Capital Cost (Nov 2013 Dollars)
Washburn CSO Control	$20,927,000
CSO 012/013/018 Modifications	$5,640,000
York Street Pump Station and River Crossing	$58,043,000
Locust Transfer Structure/Conduit and Flow Optimization in Mill System	$17,100,000
York to Union Box Culvert	$32,131,000
Union to Clinton Relief Conduit	$18,720,000
Worthington/Clinton Targeted Sewer Separation and Stormwater Management	$30,761,000
Plan Total	**$183,323,000**

Costs have increased due to the addition of a new priority project, the additional detail and refinement added to the Recommended Plan, and the escalation to November 2013 dollars.

4.1.4 Performance of Updated Recommended CSO Control Plan

Section 5 of the May 2012 FLTCP previously defined the design storm series for evaluation of CSO improvement recommendations. After incorporating additional knowledge of the existing collection system configuration, including integration of the model configuration of post-construction CSO Regulator 007 and 049 catchments (post-construction modeling of these catchments by others) and baseline conditions (the configuration of the collection system prior to Phase 1 of the Recommended CSO Control Plan), the baseline conditions and the Updated Recommended Plan under the typical precipitation year (1976) were simulated. Results are presented in Table 4.1-2 below.

In baseline conditions, the total annual CSO volume from the CRI system is predicted to be 441 million gallons (MG). The updated Recommended CSO Plan is projected to result in an annual (1976) overflow volume of 59.0 MG from the CRI system, which is an 87% reduction in volume upon completion. The Recommended Plan projects overflow frequencies of 1 to 7 overflows per regulator per typical precipitation year (1976) in the CRI system. No change in overflow activity is predicted to occur as a result of the Recommended Plan in neither the Mill River nor Chicopee River CSO Systems. No work is proposed in the Recommended Plan in the Chicopee River CSO System, where the Commission has already implemented CSO control improvements under an administrative order.

Table 4.1-2: Updated Recommended Plan CSO Activations and Volumes

CSO Regulator/ By-Pass	Baseline Conditions (Typical Year)		Updated Recommended Plan (Typical Year)	
	# Activations	Volume (MG)	# Activations	Volume (MG)
Mill River (previous CSO abatement project)				
CSO 025	7	0.8	7	0.8
CSO 048	1	0.1	1	0.1
CSO 046	5	0.1	5	0.1
CSO 024	0	0.0	0	0.0
CSO 017	1	0.03	1	0.03
CSO 045	0	0.0	0	0.0
CSO 019	1	0.03	1	0.03
Mill Totals	0-7 (Avg. 2.1)	1.1	0-7 (Avg. 2.1)	1.1
Chicopee River (previous CSO abatement project)				
CSO 043	Removed	0.0	Removed	0.0
CSO 044	Removed	0.0	Removed	0.0
CSO 037	0	0.0	0	0.0
CSO 036	1	0.1	1	0.1
CSO 035	1	0.01	1	0.01

CSO Regulator/ By-Pass	Baseline Conditions (Typical Year)		Updated Recommended Plan (Typical Year)	
	# Activations	Volume (MG)	# Activations	Volume (MG)
CSO 034	1	0.2	1	0.2
Chicopee Totals	0-1 (Avg. 0.75)	0.3	0-1 (Avg. 0.75)	0.3
Connecticut River				
CSO 007	0	0.0	2	0.1
CSO 008	38	43.6	4	1.5
CSO 010	69	157.4	6	6.9
CSO 011	19	6.6	6	1.2
CSO 012	39	54.1	4	0.5
CSO 013	19	36.9	7	12.0
CSO 014	53	42.2	6	2.0
CSO 015A	42	26.8	6	6.1
CSO 015B	15	2.1	6	3.1
CSO 016	42	69.8	7	16.8
CSO 018	1	0.01	1	0.01
CSO 049	1	0.04	4	0.4
Outfall 042	4	1.3	5	8.4
CRI Totals	1-69 (Avg. 26.3)	441	1-7 (Avg. 4.9)	59.0

The updated performance statistics represent a modest reduction in the average activation frequency across the CRI system (4.9 activations currently versus 5.3 activations previously, each per regulator in the typical precipitation year (1976)), while again producing a modest decrease in total CSO volume (59.0 MG currently versus 59.2 MG previously, each in the typical precipitation year (1976)).

With the updated Recommended CSO Plan predictions above for the CRI system, and considering the CSO reductions achieved from the previous Chicopee River CSO System and Mill River CSO system the total CSO volume reduction since 2000 will be 89% as indicated in Table 4.1-3 below.

Table 4.1-3: Integrated Wastewater Plan CSO Volume Reduction at Plan Completion

Receiving Water	Summary (Typical Year)	
	Total Annual CSO Volume (MG)	% Reduction of Total CSO Volume
Mill River	1.2	**11.2%**
Chicopee River	0.2	**3.0%**
Connecticut River	59.2	**74.8%**
Totals	61.0	**89%**

The Recommended Plan's robustness was previously demonstrated when subjected to 'peakier' storms (lower volume, higher intensity storms) via the 2009 storm series, in which the plan effectively controls CSOs. The Integrated Wastewater Plan's Recommended CSO Control Plan is considered equivalent to the previously selected Recommended CSO Control Plan in the May 2012 FLTCP.

4.1.5 Receiving Water Quality Benefit

During the preparation of the May 2012 FLTCP, the Commission updated its water quality model for existing conditions (2011 conditions) in order to assess the water quality impacts to receiving waters for the selected CSO control alternatives and the final Recommended Plan. The water quality model simulation of the May 2012 FLTCP Recommended Plan is considered applicable to the Integrated Wastewater Plan's Recommended Plan due to the close similarity in CSO activity (frequency and volume). Refer to Section 7 of the May 2012 FLTCP for a description of the water quality model update and receiving water conditions and impacts. Refer to Section 8.2.4 of the May 2012 FLTCP for E. coli concentration in stormwater and cost-performance considerations.

4.1.6 Updated Implementation Schedule

The 20-year implementation schedule for the Recommended Plan is consistent between the May 2012 FLTCP and the Integrated Wastewater Plan and is comprised of projects to be sequenced to achieve accelerated CSO control benefit during the first 10 years with higher volume reduction earlier in the schedule.

The implementation schedule is achievable based on current Springfield economic conditions and current state and federal clean water laws and regulations. However, in order for the Recommended Plan to be flexible enough to adapt to changing economic conditions, technological advances, water quality conditions, and regulations, the Commission is continuing to take an adaptive management approach to the plan implementation as indicated in Table 4.1-4. The adaptive management approach provides a re-evaluation of the Recommended Plan at the completion of each program phase to review progress, update cost-performance estimates, update affordability, and prioritize all Commission Clean Water Act commitments to maximize the benefit to the receiving waters. A breakdown of predicted CSO performance throughout the Recommended Plan, with details by regulator and by phase, can be found in Appendix B.

Table 4.1-4: Project Implementation with Adaptive Management Review Cycles

Project	Date	CSO Volume Reduction By Project (%)	Cumulative CSO Volume Reduction (%)
Phase 1: Washburn CSO Control	2012 - 2014	12%	12%
Phase 1.5: CSO 012/013/018 Modifications	2014-2016	0%	12%
Re-evaluate/Adjust Plan and Implementation Schedule after Phase 1.5			
Phase 2: York Street Pump Station and River Crossing	2015 - 2020	39%	51%
Re-evaluate/Adjust Plan and Implementation Schedule Phase 2			
Phase 3: Locust Transfer Structure/Conduit and Flow Optimization in Mill System	2020-2022	1%	52%
Re-evaluate/Adjust Plan and Implementation Schedule after Phase 3			
Phase 4: York to Union Box Culvert	2022 - 2029	7%	59%
Re-evaluate/Adjust Plan and Implementation Schedule Phase 4			
Phase 5: Union to Clinton Relief Conduit	2025 - 2030	16%	75%
Re-evaluate/Adjust Plan and Implementation Schedule Phase 5			
Phase 6: Targeted Sewer Separation, Stormwater Management, and Misc Flow Control & System Optimization	2027 - 2031	12%	87%
Plan Total	**20 years**	**87%**	**87%**

4.1.7 Post-Construction Monitoring Program Updates

The components of Section 8.3 Post-Construction Monitoring Program included in the May 2012 FLTCP remain valid and in effect. Supplementary to Section 8.3.2, the Commission has continued to invest in temporary flow metering and rain gauge monitoring activities in an effort to gain more confidence in the accuracy of the hydraulic model of its collection system. Two programs were recently conducted in the Connecticut River CSO sewershed:

- 11 temporary flow meters and 6 rain gauges installed in spring/summer 2013 for a period of 10 weeks in support of the preparation of the Integrated Wastewater Plan (results summarized in Section 2 of this text)
- 3 temporary flow meters and 2 rain gages installed in fall 2013for a period of 10 weeks in support of the planning and design of a newly identified priority CSO project (described in Phase 1.5 of Section 4.4.1 in this update).

4.2 UPDATES TO WASTEWATER AND SEWER CIP PROJECTS

Since the submission of the May 2012 FLTCP, the Commission has continued to improve its existing collection system infrastructure through a program of targeted and prioritized infrastructure improvements. These improvements have included a continued plan of diagnostics and system assessment; improvements to the Commission Asset Management Program which is used to prioritize the improvements and also improve Operations and Maintenance response; continued cleaning of the existing infrastructure including the removal of grit, roots, and Fats, Oils and Grease (FOG) issues throughout the collection system; and improvements to structurally failing and aged collection system infrastructure.

In addition to updates to the May 2012 FLTCP which have already been or are currently being completed, the Commission continues to update its Wastewater and Sewer Capital Improvements Plan to balance its spending to put some focus on addressing on-going non-CSO related needs. Several enhancements to the Plan are included herein and are summarized in Table 4.2-1 below:

Table 4.2-1: Substantive Wastewater and Sewer Capital Improvements Plan Updates

Completed / On-going / Planned	Wastewater and Sewer CIP Update	Source	Result/Benefit
Completed	Ashley and Pine Streets Sewer Rehabilitation Project	Asset Management – Risk Based Prioritization	Structural Improvements and Extended Service Life for Large Diameter Critical Infrastructure
Completed	Allen/Bradley/Spruce Streets Sewer Rehabilitation Project	Asset Management – Risk Based Prioritization	Structural Improvements and Extended Service Life for Existing Infrastructure
On-Going	Pine/Thompson/Ingersoll Grove Streets Sewer Rehabilitation Project	Asset Management – Risk Based Prioritization	Structural Improvements and Extended Service Life for Existing Infrastructure and Protection for Adjacent Critical Infrastructure
On-Going	“21 Streets” Rehabilitation Project	Asset Management – Risk Based Prioritization	Structural Improvements and Extended Service Life for Existing Infrastructure
On-Going	Main Interceptor, Dickinson Siphon, CSO 018, and CSO 012/013 Outfalls Improvements Project	Asset Management – Risk Based Prioritization	Structural Improvements and Extended Service Life for One of the Commission’s Top 3 Most Critical Infrastructure; Reduction in SSOs near Dickinson St; Improvements to Failing Outfalls
Planned	67 Additional Sites w/ Structurally Failing Infrastructure	Asset Management – Risk Based Prioritization	Structural Improvements and Extended Service Life for Existing Infrastructure

Completed / On-going / Planned	Wastewater and Sewer CIP Update	Source	Result/Benefit
Completed / On-going / Planned	Continued Pipeline Cleaning and Diagnostics	Asset Management – Risk Based Prioritization	Improved Hydraulic Capacity Through Cleaning Program; Improved Operations and Maintenance Performance; Better Information Necessary for Decision Making When Prioritizing Additional Improvements
Planned	SRWTF Bar Screen Upgrades	SRWTF Operations and Condition Assessment	Reduction in Floatables to SRWTF Which Will Result in Better Operational Performance
Planned	SRWTF Electrical Distribution System Rehabilitation	SRWTF Operations and Condition Assessment	Improved Reliability and Risk Reduction Associated With Failures to the SRWTF Electrical Distribution System
Planned	Grit and Screening Facility at SRWTF	SRWTF Operations and Condition Assessment	Reduction in Grit and Debris to the SRWTF. Results in Increased Treatment Performance, Reliability, and Improvements to Operations and Maintenance

4.3 DATA COLLECTION, SEWER ASSESSMENT, AND ASSET MANAGEMENT RISK MODELING

In 2009, the Commission began a substantial effort to clean and assess its entire collection system inventory; to improve its document management system; to improve its collection system GIS; and to use Asset Management to prioritize necessary CSO and Non-CSO related work. The program was originally conceived and executed through the same effort being undertaken to develop the May 2012 FLTCP. The original goals of these first phases of the program included:

- Improve access to existing records to provide an accurate idea of the collection system and its complexities. This was used to improve the hydraulic model development and also sets up for improved GIS use in terms of managing data which is used in the Risk Model;

- Improved GIS data helps to more accurately baseline and calibrate the hydraulic model and helps in the accurate storage and use of data such as age, condition, and performance data as it relates to the Risk Model;

- Cleaned trunk lines would provide a more accurate reflection on how the system performs during the metering and modelling phases;

- Cleaned trunk lines would provide additional performance benefits in terms of flow capacity and velocities;

Assessed critical infrastructure would provide a more quantifiable need in terms of necessary non-CSO related improvements which would then be added to the Capital Improvements Plan in an effort to realize wastewater and sewer benefits not associated with CSO improvements.

4.3.1 Improvements to the Document Management System

From 2009 through 2012 the Commission scanned all paper copies of all records in its archives including but not limited to plans, maps, sketches, details, construction documents, photographs, and other historical data. These plans were then added to the Commission's GIS and are now accessible through a GIS query function (e.g. "find all records on Mill Street"); by selecting an area of the City (though georeferenced polygons representing each plan/document, selecting an area will result in location of all records which overlap that street, property, asset, etc.); as well as by simply selecting an asset through GIS which will result in a list of all documents which are "attached" to that asset. This new document management system has been and is currently being used to improve the Commission's planning. The GIS geometry has been improved, the asset attributes have been updated and are more reflective of actual records, the hydraulic model is improved, and the prioritization of areas to be assessed has been greatly improved. Further, improvements to the immediate access of important records has led to efficiencies in the Commission's response to emergencies; its on-going system operations and maintenance / work order program and to its CMOM reporting obligations.

4.3.2 Improvements to the GIS

Also starting in 2009 the Commission has undertaken the goal of calibrating and improving its collection system GIS. The GIS is the backbone for the various models which are used in the planning and decision making processes such as the Hydraulic Model and the Risk Model. The accuracy of the GIS is key to making the proper decisions with respect to the magnitude and the sequencing of planned CSO and Non-CSO related improvements. As referenced above, the first step in the GIS improvements was to incorporate the information from the Documents Management System task. In addition, during the Commission's Continued Pipeline Cleaning and Diagnostics Projects, and since 2009, the Commission has performed GPS locations of 47.7% of their collection system. This GPS task has resulted in x, y, and z data (i.e. location and elevations) with sub-centimeter accuracy. The GIS pipeline elevations and pipeline geometry are then revised/improved based on accurate data. This in turn has resulted in improved Hydraulic Modelling and a better understanding as to how the Commission's very complex collection system behaves and reacts under dry weather and various wet weather conditions.

4.3.3 Sewer Cleaning and Assessment

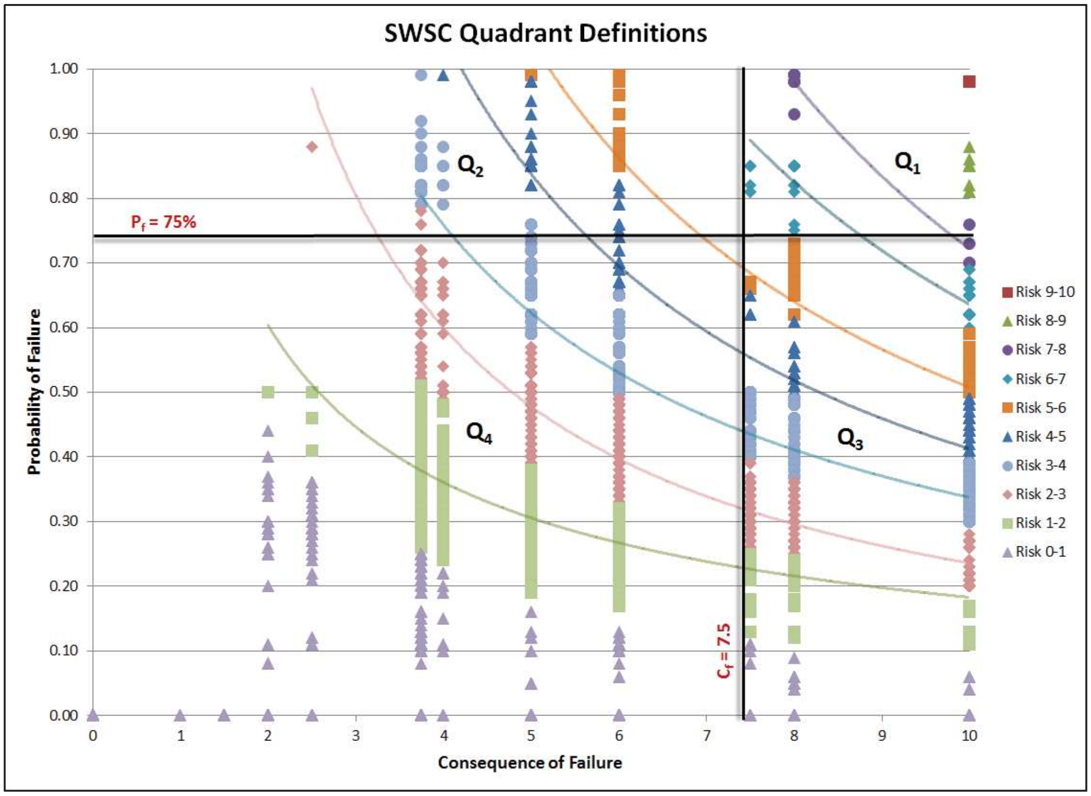
After three initial phases of a Sewer Cleaning and Assessment Program were completed under the development of the May 2012 FLTCP between 2009 and 2011, the Commission added a Program of Continued Pipeline Cleaning and Diagnostics to its on-going Wastewater and Sewer Capital Improvements Program. Since July 2011, this yearly, on-going and renewable Project has resulted in the cleaning and assessment of 1,161,000 linear feet (LF) (approximately 220 miles) of sanitary and combined sewer in the Commission's asset inventory. This 1,161,000 LF represents approximately 47.7% of the existing collection systems assets. During the three phases completed under the development of the May 2012 FLTCP and under this Continued Pipeline Cleaning and Diagnostics Project since 2011, the contract has collected structural and operations and maintenance data for use in its Risk Model. The data is collected using industry standard Pipeline Certification and Assessment Program (PACP) defect coding. The coding and ratings for each pipe segment completed are added to the Commission's collection system GIS which is then input to the Commission's Risk Model executed through the asset management software program VUEWorks. The benefit of this approach is that it gives irrefutable and quantifiable structural and operations and maintenance ratings for every asset and is substantiated as the standardized approach to asset management. This allows the Commission to more accurately identify its needs beyond the simple approach of using industry literature for life remaining based on age for each of its assets. This approach has led to a high degree of certainty that projects being prioritized are necessary and critical and that spending is appropriate for the needs.

4.3.4 Asset Management and Risk Based Prioritization

During the initial development of the May 2012 FLTCP, the Commission used a Risk Model, executed through the asset management software program VUEWorks© operated through its consultants. In 2013, the Commission has purchased the full build out, for its continued asset management use, its own VUEWorks©. The Risk Model in VUEWorks© used and uses standard industry formulas for the calculations of Risk Scores. The calculation is the product of the Consequence of Failure (F_c) and the Probability of Failure (F_p). The Consequence of Failure includes, but is not limited to, such consequences as High Cost of Repair; Proximity/Impact to Sensitive Population (i.e. nursing homes, schools, hospitals, and day care); Environmental Impact; Regulatory Impact (i.e. fines due to CSOs or SSOs, etc.); and others. The Failure Modes selected for consideration in Probabilities of Failure include, but are not limited to Structural Failure (taken from the assessment program described above); Operations and Maintenance Failure (also taken from the assessment program and including FOG, root intrusion, I/I, etc.); Life Remaining; Capacity; Velocity; and others.

Each asset within the Commission system now has its own individual Risk Factor (RF) that falls within the range of 0 - 10. By plotting the Probability of Failure versus the Consequence of Failure that defines each asset's risk score, it becomes evident that there are also qualitative differences between two assets that may have the same risk score.

Figure 4.3-1: Commission Quadrant Definitions



As can be seen in Figure 4.3-1, an asset's risk score can be grouped into quadrants on the Probability of Failure vs. Consequence of Failure graph:

- Quadrant 1 – The Risky Quadrant – Assets with both a high probability of failure as well as a high consequence of failure. This quadrant contains the most critical assets in the worst condition.

- Quadrant 2 – The Failing Assets Quadrant – Assets with a high probability of failure, but a lower consequence of failure. These assets are typically less critical to day-to-day operations, but are either in major disrepair or are already failing to meet their design intent.

- Quadrant 3 – The Monitoring Quadrant – Assets with higher consequences of failure, but lower probabilities of failure. It is typical to conduct further monitoring and assessment of assets in this quadrant to prevent them from moving up into the "Risky" quadrant.

- Quadrant 4 – The Base Quadrant – Assets with low probability of failure and low consequence of failure. These assets are less critical to the overall system performance, and as such can be put on a more longer-term assessment program to monitor their movement toward the "Failing Assets" quadrant.

During the development of recommendations for prioritized improvements, pipe assets within the Commission system have been categorized using these quadrant definitions. Once categorized, pipes that fall within either the Risky Quadrant or the Failing Asset quadrant are further analyzed and grouped into the following categories:

- Candidates for consideration for Updated Infrastructure Improvements. This group includes the following sub-groups:
    - Pipes that can be grouped with other similar pipes into a defined project
    - Pipes that may require a form of point repair, including potential candidates for short sectional liners or small dig and replace segments.
    - Pipes that require maintenance to repair either severe root issues or intruding taps that caused abandonment of CCTV operations. The passage of the CCTV camera was selected as the basis for the selection to this list since defects that prevent the passage of the camera could cause a capacity issue that may lead to an SSO.
- Candidates for consideration for larger, more complex improvements.
- Candidates for further ongoing diagnostics and assessment.
- Assets that do not require immediate improvements

Using the Commission GIS data as well as the geometric network that was created by the Commission's consultants, projects, consisting of many different assets were defined/developed based on geographical, attribute and systematic similarities. In general, the project definitions consist of a grouping of 1,000 to 2,000 linear feet of pipeline assets that have similar attribute (pipe size, material, age), systematic (local collector, trunk, overflow) and geographical characteristics. In addition, where available, projects were also grouped to consider pipeline assets of similar conditions based on the data obtained during the ongoing system assessment program.

In an effort to prioritize the list of projects, a weighted average project risk factor (PRF) based on asset length was calculated to summarize the risk associated with each project as follows.

$$\mathrm{PRF_p} = \frac{\Sigma\{(\mathrm{RiskFactor_1} * \mathrm{Length_1}), \ldots (\mathrm{RF_n} * \mathrm{L_n})\}}{\Sigma(\mathrm{L_1}, \ldots \mathrm{L_n})}$$

The projects were then sorted from highest to lowest using this PRF.

A detailed project analysis is then conducted using a two-tiered process starting with these highest scoring projects. The first tier of the analysis is used to calibrate the recommendations and get a better understanding of why each project had risen to the top of the PRF list. To determine this, the Consequences of Failure and Probabilities of Failure for each asset within the projects were analyzed. In this tier, projects that had PRF values that were driven mainly by the consequences of failure of their assets were rated lower than projects that had PRF values that were driven more by the probabilities of failure of their assets. In addition to this "risk driver" analysis, the first tier analysis included a review of the predominant type of defect within each project, the maximum depth of all assets within each project and the overall project traffic impact. The scoring system for the Tier I analysis is as follows:

Table 4.3-1: Tier I Criteria

TIER I					
Criteria	**5**	**4**	**3**	**2**	**1**
Risk Driver	Probability of Failure > Consequence AND Probability of Failure >90%	Consequence > Probability of Failure AND Probability of Failure > 80%		Probability of Failure = Consequence	Probability of Failure < Consequence AND Probability of Failure < 70%
Predominant Defect	Collapse	Breaks or Fractures Hinge	Longitudinal or Circumferential Fractures	Longitudinal or Circumferential Cracks	Surface Aggregate Missing/Visible or Brick Missing
Depth	> 15 feet	10 - 15 feet	6 -10 feet	< 6 feet	
Traffic Impact	High	High Medium	Medium	Low Medium	Low

Using the Tier I results, a list of projects is generated that warranted further analysis as well as a list of individual locations that may require small spot repairs as opposed to full rehabilitation or replacement. For those projects that warranted further analysis for prioritization purposes, a review of the number of potential customers affected by a failure, the potential impacts to adjacent large utilities and the operational criticality of the assets within the project were then reviewed as part of the Tier II analysis. The scoring system for the Tier II analysis is as follows:

Table 4.3-2: Tier II Criteria

TIER II					
Criteria	**5**	**4**	**3**	**2**	**1**
Customers Affected	81+	61 - 80	41 - 60	21 - 40	0 - 20
Impacts to Existing Utilities	Other Utility in same street is > 30"		Other Utility in same street is 15"-30"		Other Utility in same street is < 15"
Operational Criticality	High Operational Criticality to the Sewer System				Low Operational Criticality to the Sewer System

Based on all the efforts described herein and using the process described above in 4.3-2 the Commission has begun and will continue to execute a Wastewater and Sewer System Capital Improvements Program as submitted herein. The major updates to the Plan since the May 2012 FLTCP was initially presented, as outlined in Table 4.2-1 are described below.

4.4 ADDITIONAL CSO AND WASTEWATER PROJECT DETAILS

4.4.1 CSO Worksheets by Phase

CSO project worksheets are provided in Appendix B. Each worksheet contains the phase, programmed amount, design year, construction year, project description with figure, project objective, and project outcomes.

4.4.2 Wastewater Capital Plan Refinement Details

4.4.2.1 Ashley and Pine Streets Sewer Rehabilitation Project

This Project which included infrastructure improvements on Pine Street, Ashley Street, Lebanon Street, Bay Street and Sherman Street (SWSC Contract CA-1216-12) was completed between the Summer 2012 and Spring 2013. This project was driven by roadway sinkholes and surcharged pipe due to pipe failure. The Pine Street pipe is a large diameter brick pipe which was seeing a large amount of missing bricks and mortar. This pipe is considered critical infrastructure due to its size, capacity, conveyance hydraulic rates, proximity to the Mill River, and proximity to important roadways in the City of Springfield. The other streets included in this project were smaller diameter unreinforced concrete pipe which were in total structural failure and which were added to the Pine Street Project due to their proximity to Pine Street and cost/logistics benefits in executing these elements as part of a larger contract. The Project was completed for a total Project Cost of approximately $2,750,000. The Project consisted of:

- *Pine Street*: Rehabilitated 1,340 l.f. of 42-in x 63-in brick combined sewer with a cured-in-place (CIPP) liner between Central Street and Maple Street
- *Ashley Street*: Replaced 1,350 l.f. of 15-in and 12-in unreinforced Concrete Pipe (CP) sewer with new PVC within Ashley Street from Cedar Street to Walnut Street.
- *Lebanon Street*: Replaced 150 l.f. of 18-in and 15-in CP sewer with new 15-in PVC within Lebanon Street from Hancock Street heading east.
- *Bay Street*: Replaced 150 l.f. of 8-in CP sewer with new 8-in PVC within Bay Street from Clarendon Street to Sherman Street
- *Sherman Street*: Replaced 160 l.f. of 12-in CP sewer with new 15-in PVC within Sherman Street from Bay Street to Clarendon Street
- *Maple Street*: Replaced 690LF of 15-in and 12-in CP sewer with new PVC within Maple Street from Pine Street to Maple Court.

4.4.2.2 Allen/Bradley/Spruce Streets Sewer Rehabilitation Project

The Project which included sewer system improvements on Allen Street, Bradley Road, and Spruce Street (SWSC Contract CA-1315-3) was started in June 2013 and was completed in August 2013. The work was prioritized because the Vitrified Clay Pipe (VCP) and CP had significant structural damage including holes in the pipe. The pipes have a large service population, are located under a highly trafficked roadways, were resulting in pipe surcharging and loss of level of service, and the holes were resulting in sinkholes at the roadway surface and was threatening to undermine a critical adjacent 16-in water main. Further, this project was put on a fast track because of a MassDOT streetscape project. The MassDOT project was scheduled to be completed by end of Summer 2013, and the conditions on these streets necessitate a rapid response prior to a "No Dig" moratorium was instituted at the completion of the streetscape project. The Project was completed for a total Project Cost of approximately $380,000. The Project consisted of:

- *Allen Street*: Replacement of 240 l.f. of 10-in VCP sewer with new PVC sewer within Allen Street from Bradley Road to Wachusett Street

- *Bradley Rd*: Replacement of 320 l.f. of 10-in VCP sewer with 10-inch new PVC within Bradley Road from Allen Street to Chalfonte Drive

- *Spruce Street*: Replacement of 330 l.f. of 12-in CP sewer with new PVC within Spruce Street from Central Street heading west.

- *Chalfonte Drive:* Replacement of 250 l.f. of 10-in CP sewer with new PVC within Chalfonte Drive from Bradley Road heading east.

4.4.2.3 Pine/Thompson/Ingersoll Grove Streets Sewer Rehabilitation Project

The Pine Street, Thompson Street, and Ingersoll Grove Sewer Replacements Project (SWSC Contract CA-1405-14) started in October 2013 and will be completed in Spring 2014. The work was prioritized because the CP had significant structural damage including holes in the pipe and was on the verge of collapse. The pipes were resulting in pipe surcharging and loss of level of service, and the holes were resulting in sinkholes at the roadway surface and were putting the adjacent and highly critical 16-in diameter water main at risk. The depth of the existing pipe also made the repair beyond the capabilities of the Commission's own sewer crews. The Project Cost is currently estimated at approximately $2,600,000. The Project consisted of:

- *Pine Street:* Replacement of 1,500 l.f. of 12-in and 15-in CP sewer with new PVC within Pine Street from Cedar Street to Walnut Street.

- *Thompson Street:* Replacement of 2,150 l.f. of 12-in and 15-in CP sewer with new PVC within Thompson Street from the intersection of State Street and Hancock Street to Worthington Street.

- *Ingersoll Grove:* Replacement of 500 l.f. of 12-inch CP sewer with new PVC sewer within Ingersoll Grove from Worthington Street to #50 Ingersoll Grove.

4.4.2.4 "21 Streets" Sewer Rehabilitation Project

Design of the "21 Streets" Project began in late 2013. Construction is anticipated to begin in the Spring 2014. The work includes the rehabilitation and/or replacement of various infrastructure on the following streets:

Table 4.4-1: "21 Streets" Project Summary

2013 Prioritization Number	Street	Pipe Size and Material	LF
2	Allen Street (additional areas)	10-in VC	150
3	Sumner Avenue	10-in VC	510
4	Wellington Street	15-in VC	140
5	Walnut Street	12-in and 18-in CP	540
7	Belmont Avenue	20-in VC	870
9	Andrew Street	20-in VC	250
11	Sumner Avenue (additional areas)	18-in VC	1,150
13	Central Street	12-in and 18-in VC	1,255
14	Sumner Chalmers Avenue	10-in VC and CP	1,270
17	St. James Avenue	10-in, 12-in, and 18-in VC and CP	1,410
23	Bay St./Sherman Street/McKnight Street	8-in, 10-in, 12-in and 15-in CP	1,210
24	Middlesex Street	10-in VC	380
27	Allen Street (additional areas)	10-in VC	310
33	Charter Avenue	12-in VC	590
36	Armory Street	15-in CP	560

The Project generally consists of the replacement or rehabilitation of approximately 10,600 l.f. of sewer pipe ranging in diameter from 10-in to 20-in and consisting of failing VCP and unreinforced CP. The primary structural failure modes include holes, some with voids visible; spalling in the concrete pipe; fractures and breaks; sections of missing wall in some of the CP; and some deformation. These defects are resulting in decreased capacity and poor level of service with frequent surcharging. These streets are made critical due to the potential customer impact (nearly 1,100 customers are affected by these defects and their resultant loss of level of service); the nature of the defects are creating sinkholes requiring frequent maintenance and are putting other adjacent Commission and other infrastructure at risk. The Project's estimated cost is $8.7 million.

4.4.2.5 Main Interceptor, Dickinson Siphon, CSO 018, and CSO 012/013 Outfalls Improvements Project

This Project is in design and is expected to begin Construction in the Winter 2015 and will be complete by the Spring 2016. The Project consists of four elements:

- *Main Interceptor Improvements:* The Main Interceptor Pipe (MIP) is the most critical pipeline asset in the Commission's collection system, serving greater than 100,000 sewer users. Constructed in 1972 of 60/66-inch Reinforced Concrete Pipe, the MIP runs more than 5 miles beginning in the northeast corner of the City of Springfield at the Indian Orchard Pump Station (IOPS). The MIP continues to flow by means of gravity ultimately crossing the Connecticut River, discharging into the Springfield Regional Wastewater Treatment Facility (SRWTF) at Bondi's Island.

  Approximately 5,500 linear feet of the MIP, adjacent to the Mill River, within the Project area, was initially assessed in the fall of 2009. The existing conditions of the MIP include high velocity flows and many drop manholes to accommodate substantial grade changes. These factors result in extreme turbulent flows within the pipeline. The MIP routinely carries upwards of 25 Million Gallons per Day (MGD) of Sanitary Sewer Flow under peak Dry-Weather Flow (DWF) conditions and also sees 198 MGD under peak 5-year Wet Weather Combined Sewer flow. These high flows, high velocities, and existing horizontal bends and dramatic drop manholes (in some cases upwards of 8-ft drops) within the MIP cause hydrogen sulfide corrosion. The dramatic turbulence at the existing manhole structures allows for the buildup and release of hydrogen sulfide gasses. These gasses are a known contributor to concrete deterioration.

  It was projected in 2009, as a result of the initial structural assessment that, the timeline until structural failure of the MIP should be considered (+/-) 5 years, due to the significance of the concrete deterioration within the crown of the pipeline. At the time of structural failure, the cross sectional area of the pipeline is projected to be 100% blocked, allowing zero flow to pass through this critical asset. If this pipe were to result in 100% blockage, then it could be expected that there would be a continuous spill of about 25 MGD of sanitary sewer flow out the upstream manhole(s) and the area of failure, increasing if a wet weather event occurred before the failure was mitigated. The spillage of raw sewage out the manholes would relieve into the adjacent community and eventually the Mill River resulting in a significant Sanitary Sewer Overflow (SSO) event. At the time of a wet weather event, the magnitude of the overflow would increase significantly, resulting in a significant Combined Sewer Overflow (CSO) event into the Mill River. In addition to the environmental impacts, the health and safety impacts and damage to the surrounding community and the existing sewer consumers would also be irreversible. Failure of this pipe will also likely result in significant loss and or damage to private property, collateral damage to other critical utilities, and potential damage to roadways, federally controlled flood structures along the Mill River, and possible damage to interstate highways depending on the point of failure. Any failure will likely continue for a substantial period of time before it can be adequately controlled based on the volume and velocities of the flow. This could result in an average daily flow of 20-25 MGD discharging into the Mill River or onto public roadways for potentially weeks before it could be controlled.

- *Dickinson Siphon Improvements*: The area of the Dickinson Siphon has been a location for several reoccurring SSO events. Photographs taken from the SSO event on August 28, 2012 are shown below. The Dickinson Street Siphon runs beneath the Mill River at the intersection of Mill Street and Cherry Street, and feeds a large catchment's worth of flow into the Main Interceptor. This connection is made adjacent to the Mill River. DWF has been routinely measured upwards of 5 MGD nearby the Mill River, upstream of confluence with the MIP. The regulator structure CSO 019 (Mill, Orange, & Locust Street) is located upstream of the Dickinson Street Siphon and discharges combined sewer overflows into the Mill River during heavy rainfall events. Failure or dry weather capacity related issues at the Dickinson Street Siphon result in overflows to the Mill River at the CSO 019 outfall and are damaging to the Mill River and tributary areas. There is the potential of releasing upwards of 5 MGD of wastewater DWF when a capacity related failure does occur.

  In July and August of 2012 on three separate occasions, the siphon could not handle the capacity of the wet-weather flows coming from the Dickinson Street catchment area. Surcharge pressure in the combined sewer system at the siphon caused a nearby sewer manhole cover to unseat, causing a release to the street and Mill River. This location is not a pre-designed CSO and therefore any release of sewer or combined flows at this location due to capacity, air binding, or other issues needs to be eliminated.

  This project involves the elimination of the Dickinson Street Siphon by means of redirecting flow from the Dickinson Street catchment to an existing 30-inch diameter RCP sewer connection which was installed at the time of the Main Interceptor construction. This pipeline was constructed as a location for future potential connection, such as the one proposed herein from the Dickinson Street sewer. Elimination of the Dickinson Street Siphon will substantially mitigate the cause of the recent SSO and CSO events into the Mill River at this location.

Photo 4.4-1: Dickinson Siphon SSO – August 28, 2012

Photo 4.4-2: Dickinson Siphon SSO – August 28, 2012

- *CSO 018 Improvements:* The existing condition of the CSO 018 Outfall Pipe was discovered by the Commission during a recent Site Walk in the Fall of 2013. The condition was found to be in a state of complete failure along the Connecticut River. Access is very limited to the CSO 018 Regulator Structure due to its location within Interstate-91.

  This project involves the potential elimination of CSO Outfall Pipe 018 and the related CSO activation counts and discharge volumes. Up-system improvements will be explored in the area of the Longhill Street catchment involving the construction of two throttle structures which will be used to maximize the use of upsystem capacity.. The elimination of any CSO Outfall Pipe from the Commission's system is aligned with the long term goal of MassDEP CSO Policy, and has long term water quality benefits along with public health and safety benefits. See below for a photo of the existing outfall's condition.

Photo 4.4-3: CSO 018 Existing Condition

- *CSO 012/013 Outfall Improvements*: CSO Outfall 012 is located at the end of Worthington Street along the east side of the Connecticut River, while CSO Outfall 013 is located at the end of Bridge Street, also along the east side of the Connecticut River, approximately 300 feet south of CSO Outfall 012. CSO 012 and 013 share a regulator structure adjacent to the I-91 access ramp and the Connecticut River. A double-door flap-type backwater gate chamber is located on the outfall for CSO 012 at the outlet to the Connecticut River. These flood control gates are part of the federal flood control program administered by the United States Army Corps of Engineers (USACE) and are intended to prevent backflow from the river into the combined sewer system during periods of high river stage.

As a result of the recent tornado, hurricane, River icing and high River levels, trees along the embankment have been damaged and are falling into the River, and have significantly damaged the outfalls. The structural condition of these important assets is precarious enough that a structural failure is a grave concern. A structural failure would include components of the flood control system, of vital importance to the flood control strategy mandated and permitted through the USACE and which is critical to the function of the combined sewer system in low lying regions near downtown Springfield. Further a failure at this location would jeopardize the river bank and recreational facilities at this location. This project addresses the need to rehabilitate the existing failing CSO Outfall Pipes, therefore substantially mitigating the flood control concerns of the Commission's combined sewer system, in addition to mitigating dangers to public safety and the nearby Amtrak Railroad.

The four Project elements are critical to the Commission's goal of minimizing risk. It can be seen that a failure of the Main Interceptor would be a major environmental and political disaster. The Commission in its ongoing program of addressing Projects with high risk will undertake these projects, prioritizing them over other needs to their high Probability of Failure and High Consequence of Failure. The four elements of this Project are expected to result in approximately $16.5 million in capital construction costs.

4.4.2.6 Additional Site with Structural Failing Infrastructure

With the completion of the Ashley and Pine Streets Sewer Rehabilitation Project and the Allen/Bradley/Spruce Streets Sewer Rehabilitation Project, and the on-going Pine/Thompson/Ingersoll Grove Streets Sewer Improvements Project and the "21 Streets" Sewer Rehabilitation Project, the Commission has already successfully addressed many of its high priority existing wastewater and sewer collection system needs but there continues to be many additional priorities which have been and will continue to be developed as a result of the on-going Continued Pipeline Cleaning and Diagnostics Project and using the Commission's Asset Management and Risk Based Prioritization Program. As of the end of 2013, in addition to the Projects listed above, 67 additional discrete sites have been identified which have failing infrastructure which fall within the Risky and Failing Assets Quadrants described elsewhere in this Chapter. The details of these additional sites can be found in Appendix B of this document. This list will be modified each year as new condition information comes in, as projects are completed, as priorities change, and/or as rankings change. At this time, the cost estimated to address the highest remaining 67 sites is approximately $25M, allocated over 15 annual $1.67 million installments between 2017 and 2031.

4.5 GREEN INFRASTRUCTURE OPPORTUNITIES

As stated in Section 1, the EPA issued guidance on the integrated planning approach entitled, *Integrated Municipal Stormwater and Wastewater Planning Approach Framework* in June 2012.

This guidance recommends the use of green infrastructure, a best management practice (BMP), as an alternative to provide a sustainable solution for wet weather control. In October 2013, the EPA issued *Green Infrastructure Strategic Agenda 2013* to further promote the use of green infrastructure, in addition to six factsheets on issues and opportunities related to integrating green infrastructure with CSOs, SSOs, Stormwater, TMDLs, and Water Quality Standards. Additionally, in March 2014, EPA issued *Greening CSO Plans: Planning and Modeling Green Infrastructure for Combined Sewer Overflow (CSO) Control* to provide municipalities and sewer authorities with tools to help quantify green infrastructure contributions to an overall CSO control plan, The *Strategic Agenda*, a CSO-related factsheet, and the *Greening CSO Plans* documents are included in Appendix B.

The term "best management practice" is a general term that is frequently used inconsistently and with varying meanings. For purposes of this document, BMP is considered to be eco-friendly concepts in land use related to developmental activities implemented to reduce the impact to the natural environment, improve water quality, maintain healthy soils, reduce energy use, and reduce construction costs and operational expenses.

The May 2012 FLTCP offered three potential green infrastructure sites for stormwater management in the Recommended CSO Control Plan – one along the Albany Street area, another in the vicinity of Springfield Technical Community College, and a third along Chapin Terrace – however, potential BMP technologies were not specifically addressed. A stormwater management feature along Chapin Terrace was recommended and then subsequently designed and approved in the Washburn CSO control project, which was the first design contract advanced as a product of the May 2012 FLTCP. Regrettably, the improvements were not constructed due to neighborhood stakeholder resistance. However, the technical design approach can serve as a template for other applications in Springfield in future program phases.

To further supplement the identification of potential sites previously undertaken as part of the May 2012 FLTCP, this section of the Integrated Wastewater Plan summarizes where BMPs, in addition to those identified in the Recommended CSO Control Plan, could be sited for additional benefits to solve issues relating to combined sewer overflows, sanitary sewer overflows, and stormwater quality. Additionally, potential BMP technologies have been identified and preliminarily screened for applicability to each candidate site.

Potential sites were identified where land acquisition would not likely be required and where BMPs would be acceptable to the community (e.g. publicly owned land areas and institutional green spaces). These sites are located throughout Springfield and are identified in Table 4.5-1 and Table 4.5-2 below. For purposes of programming Capital project costs, approximately 10 percent of additional acreage has been budgeted beyond what is depicted in Table 4.5-1.

Table 4.5-1: Potential Sites for Green Infrastructure within Construction Area

Street	Nearby Cross Street	Area (Acres)	Land Owner	Land Use	Topography
Carew Street	Alvin Street	2.7	Municipal	Liberty Elementary School	Flat

Street	Nearby Cross Street	Area (Acres)	Land Owner	Land Use	Topography
Freeman Terrace	Utica Street	4.9	Municipal	Closed Park	Flat with localized hills in woods
Magazine Street	Lincoln Street	3.1	Municipal	Magazine Park	Flat
Stafford Street	Leslie Street	5.6	Municipal	Armory Street Park & Parking Lot	Localized Hills (20')
Worthington Street	Clarendon Street	0.8	Municipal	Island	Flat
Saratoga Street	Dwight Street Extension	0.7	Springfield Redevelopment Authority	Vacant	Flat
Maple Street	Mulberry Street	4.5	Municipal	Metro Center	Gradual 10' slope
Worthington St	Chesetnut St	0.8	Municipal	Metro Center Parking	Flat
Dwight Street	Grosvenor Street	0.3	Municipal	Open Area	Flat
Dwight Street	Harrison Ave	1.9	Springfield Redevelopment Authority	Parking Lot	Flat
Edwards Street	Chestnut St	0.2	Springfield Library & Museums	Open Area	Flat
Magazine Street	Grant Street	0.4	Municipal	Open Area	Flat
Dwight Street	Grosvenor Street	0.5	Municipal	Open Area	Flat
State Street	Federal Street	110	Various	Various	Localized Hills
Albany Street	Saint James Ave	29	Various	Warehouse/Storage/ Parking Lots	Localized Hills
Total Acreage:		**165.4**			

Table 4.5-2: Potential Sites for Green Infrastructure outside Construction Area

Street	Nearby Cross Street	Area (Acres)	Land Owner	Land Use	Topography
Berkshire Avenue	Fiberloid Street	25.7	Municipal	JFK Middle School & Berkshire Park	Localized Hills (10')
Buckingham Street	Bay Street	0.4	Municipal	Island	Flat
Carew Street	Glencoe Street	7.5	Municipal	Van Sickle Middle School	Flat
Central Street	Beech Street	0.3	New Hope Pentecostal Church	Parking Lot	Flat
Cherokee Drive	Greenaway Drive	6.8	Municipal	Frank Freedman Elem. School	Localized Hills (10')
Clough Street	Gilman Street	6.9	YWCA	Private Hospital	Flat

Street	Nearby Cross Street	Area (Acres)	Land Owner	Land Use	Topography
Berkshire Avenue	Fiberloid Street	25.7	Municipal	JFK Middle School & Berkshire Park	Localized Hills (10')
Buckingham Street	Bay Street	0.4	Municipal	Island	Flat
Carew Street	Glencoe Street	7.5	Municipal	Van Sickle Middle School	Flat
Central Street	Beech Street	0.3	New Hope Pentecostal Church	Parking Lot	Flat
Cherokee Drive	Greenaway Drive	6.8	Municipal	Frank Freedman Elem. School	Localized Hills (10')
Colton Street	Union Street	3.4	SWSC	Parking Lot	Flat
Cooley Street	Bicentennial Highway	26.8	Municipal	M. Marcus Kiley Middle School	Localized Hills (20')
Cottage Street	Industry Avenue	52.2	-	Peter Carando Conservation Area	Localized hills
Dartmouth Street	Bay Street	0.1	Municipal	Island	Flat
Dorset Street	Barnum Street	4.7	Friends of MLK JR Charter	Private Hospital	Flat
Florentine Gardens	Cherryvale Avenue	0.2	Municipal	Peninsula	Flat
Gillette Avenue	Gillette Circle	0.01	Municipal	Island	Flat
Magnolia Terrace	Pineywoods Avenue	0.9	Municipal	Median	Flat
Marengo Pk	Laverne Street	0.5	Municipal	Median	Flat
Parker Street	Frank Street	12.6	Municipal	Greenleaf Community Center	Flat
Pine Street	Central Street	0.7	Macduffie School, Inc	Private School	Flat
Puritan Road	Plumtree Road	1.4	Municipal	Median	Flat
Tiffany Street	W. Weymouth Street	9.4	Municipal	Alice B. Beal School	Flat
Walnut Street	Ashley Street	1.1	Municipal	Open Area	Flat
Walnut Street	Hickory Street	5.9	Municipal	Ruth Elizabeth Playground	Localized Hills
Whittier Street	Belmont Avenue	0.6	Municipal	Island	Flat
Whittum Avenue	Arvilla Street	3.9	Municipal	Federick Harris School	Flat
Wilbraham Road	Bradley Road	22.2	Municipal	John J Duggan Middle School	Flat

Street	Nearby Cross Street	Area (Acres)	Land Owner	Land Use	Topography
Berkshire Avenue	Fiberloid Street	25.7	Municipal	JFK Middle School & Berkshire Park	Localized Hills (10')
Buckingham Street	Bay Street	0.4	Municipal	Island	Flat
Carew Street	Glencoe Street	7.5	Municipal	Van Sickle Middle School	Flat
Central Street	Beech Street	0.3	New Hope Pentecostal Church	Parking Lot	Flat
Cherokee Drive	Greenaway Drive	6.8	Municipal	Frank Freedman Elem. School	Localized Hills (10')
Plainfield Street [1]	Clyde Street	2.1	Municipal	Plainfield Street Soccer Field	Flat
Plainfield Street [1]	Clyde Street	8.4	Municipal	Kenefick Park	Flat
Total Acreage:		**204.7**			

BMPs can be designed to both treat and slow runoff from impervious areas including roadways, sidewalks, and building surfaces. In urban areas, natural drainage patterns have changed over time due to the incremental increase of impervious surface areas. Hardscape replacement with BMPs offers the opportunity to effectively manage wet weather runoff. The list below identifies the functions each of the BMP techniques that could provide solutions to managing the first inch of rainfall.

- **Bioretention Basins (Rain Garden)** – a planting bed or landscaped area used to hold runoff, filter rainwater and to allow it to infiltrate;
- **Dry Wells and Infiltration Trenches** – areas backfilled with granular material that promote infiltration;
- **Level Spreader** – an aggregate filled trench designed to convert concentrated flow to sheet flow to promote infiltration and reduce soil erosion.
- **Grassed Swales** – channels designed to collect and convey flow. They offer treatment and retain runoff from storm events. Swales can be designed to be dry or wet. Wet swales are designed to contain water tolerant vegetation and use natural processes to remove pollutants.
- **Cisterns and Rain Barrels** – containers connected to the end of roof downspouts to provide storage to roof runoff. Collected runoff can be used for non-potable purposes such as watering of vegetation.
- **Permeable Pavements** – a type of road surface material (porous asphalt, pervious concrete, etc) commonly used in parking lots that encourage infiltration of precipitation to ground water.
- **Planter Boxes** – a landscaped area similar to a rain garden but with a vertical wall. They are used to collect runoff from sidewalks, parking lots, and streets, thereby reducing stormwater runoff flow rate, volume, and pollutants.

[1] Plainfield Street drains to a drain pipe instead of to the sanitary/combined system. This stormwater management feature may benefit stormwater quality, but does not assist with SSOs or CSOs.

The green-infrastructure BMPs that will be evaluated further for future design and implementation at the locations identified in Table 4.5-1 and Table 4.5-2 are presented below in Table 4.5-3 and Table 4.5-4.

Table 4.5-3: Applicable BMPs at Potential Sites within Construction Area

Street	Nearby Cross Street	Applicable BMPs	Benefits
Carew Street	Alvin Street	Porous Pavement, Rain Barrels, Bioretention Basin, Green Roof, Planter Boxes	Peak flow reduction, runoff retention, reduction in water usage, education
Freeman Street	Utica Street	Bioretention Basin	Peak flow reduction, runoff retention
Magazine Street	Lincoln Street	Porous Pavement, Planter Boxes, Bioretention Basin	Runoff retention, Peak flow reduction
Stafford Street	Leslie Street	Porous Pavement, Planter Boxes, Grassed Swale, Bioretention Basin	Peak flow reduction, runoff retention, pollutant removal
Worthington Street	Clarendon Street	Grassed Swale, Bioretention Basin, Porous Pavement	Runoff retention, peak flow reduction, pollutant removal
Saratoga Street	Dwight Street Extension	Detention Basin	Peak flow reduction, runoff detention
Maple Street	Mulberry Street	Porous pavement, Rain Barrels	Peak flow reduction, reduction in water usage
Worthington St	Chestnut St	Porous pavement, Detention Basin	Peak flow reduction, runoff detention
Dwight Street	Grosvenor Street	Detention Basin	Peak flow reduction, runoff detention
Dwight Street	Harrison Ave	Porous Pavement	Peak flow reduction
Edwards Street	Chestnut St	Detention Basin	Peak flow reduction, runoff detention
Magazine Street	Grant Street	Detention Basin	Peak flow reduction, runoff detention
Dwight Street	Grosvenor Street	Detention Basin	Peak flow reduction, runoff detention
State Street	Federal Street	Porous Pavement, Rain Barrels, Bioretention Basin, Level Spreader	Peak flow reduction, runoff retention, reduction in water usage, education
Albany Street	Saint James Ave	Porous Pavement	Peak flow reduction

Table 4.5-4: Applicable BMPs at Potential Sites outside Construction Area

Street	Nearby Cross Street	Applicable BMPs	Benefits
Berkshire Avenue	Fiberloid Street	Porous Pavement, Rain Barrels, Bioretention Basin, Green Roof, Planter Boxes	Peak flow reduction, runoff retention, reduction in water usage, education
Buckingham Street	Bay Street	Grassed Swale, Bioretention Basin	Runoff retention, peak flow reduction, pollutant removal
Carew Street	Glencoe Street	Porous Pavement, Rain Barrels, Bioretention Basin, Green Roof, Planter Boxes	Peak flow reduction, runoff retention, reduction in water usage, education
Central Street	Beech Street	Porous Pavement	Peak flow reduction
Cherokee Drive	Greenaway Drive	Porous Pavement, Rain Barrels, Bioretention Basin, Green Roof,	Peak flow reduction, runoff retention, reduction in water usage, education

		Planter Boxes	
Clough Street	Gilman Street	Porous Pavement, Rain Barrels, Bioretention Basin	Peak flow reduction, runoff retention, reduction in water usage
Colton Street	Union Street	Porous Pavement	Peak flow reduction
Cooley Street	Bicentennial Highway	Porous Pavement, Rain Barrels, Bioretention Basin, Green Roof, Planter Boxes	Peak flow reduction, runoff retention, reduction in water usage, education
Cottage Street	Industry Avenue	Grassed Swales, Bioretention Basins	Peak flow reduction, runoff retention, biodiversity, amenity, education
Dartmouth Street	Bay Street	Grassed Swale, Bioretention Basin	Runoff retention, peak flow reduction, pollutant removal
Dorset Street	Barnum Street	Porous Pavement, Rain Barrels, Bioretention Basin, Green Roof	Peak flow reduction, runoff retention, reduction in water usage
Florentine Gardens	Cherryvale Avenue	Porous Pavement, Bioretention Basin, Grassed Swales, Planter Boxes	Runoff retention, peak flow reduction, pollutant removal
Gillette Avenue	Gillette Circle	Grassed Swale	Runoff retention, peak flow reduction, pollutant removal
Magnolia Terrace	Pineywoods Avenue	Grassed Swale	Runoff retention, peak flow reduction, pollutant removal
Marengo Pk	Laverne Street	Grassed Swale, Bioretention Basin	Runoff retention, peak flow reduction, pollutant removal
Parker Street	Frank Street	Porous Pavement, Rain Barrels, Bioretention Basin, Green Roof, Planter Boxes	Peak flow reduction, runoff retention, reduction in water usage, education
Pine Street	Central Street	Bioretention Basin	Education, Peak flow reduction, runoff retention
Puritan Road	Plumtree Road	Grassed Swale	Runoff retention, peak flow reduction, pollutant removal
Tiffany Street	W. Weymouth Street	Porous Pavement, Rain Barrels, Bioretention Basin, Green Roof, Planter Boxes	Peak flow reduction, runoff retention, reduction in water usage, education
Walnut Street	Ashley Street	Porous Pavement, Planter Boxes, Bioretention Basin	Runoff retention, Peak flow reduction
Walnut Street	Hickory Street	Bioretention Basin, Porous Pavement, Rain Barrels, Grassed Swales, Level Spreader	Runoff retention, peak flow reduction, pollutant removal, reduction in water usage, education
Whittier Street	Belmont Avenue	Porous Pavement, Grassed Swale	Runoff retention, peak flow reduction, pollutant removal
Whittum Avenue	Arvilla Street	Porous Pavement, Rain Barrels, Bioretention Basin, Green Roof, Planter Boxes	Peak flow reduction, runoff retention, reduction in water usage, education
Wilbraham Road	Bradley Road	Porous Pavement, Rain Barrels, Bioretention Basin, Green Roof, Planter Boxes	Peak flow reduction, runoff retention, reduction in water usage, education
Plainfield Street	Clyde Street	Porous pavement, planter boxes, grassed swale	Peak flow reduction, runoff retention, pollutant removal
Plainfield Street	Clyde Street	Porous pavement, Bioretention Basin, Planter Boxes	Runoff retention, Peak flow reduction

In addition to the potential locations mentioned in the above tables, abandoned/vacant lots existing in Springfield can be potential sites for green infrastructure by re-grading the site to capture stormwater via berms and/or swales that collect and infiltrate rainfall and runoff and adding vegetation that promotes evapotranspiration.

Philadelphia, Pennsylvania has taken this initiative with the Pennsylvania Horticultural Society (PHS) Philadelphia LandCare Program, developed under contract with the Philadelphia Office of Housing and Community Development[2]. The Philadelphia Water Department (Philadelphia, PA) has partnered with PHS to use transformed vacant parcels as stormwater management educational opportunities. In addition to environmental benefits, this initiative has resulted in economic benefits by converting vacant land covered with trash and debris into attractive community assets that are a selling point to retain existing residents and business and attract new ones. This approach can be emulated in other economically depressed communities and neighborhoods.

Other References:
(http://water.epa.gov/infrastructure/greeninfrastructure/gi_regulatory.cfm#permittingseries)
(http://water.epa.gov/infrastructure/greeninfrastructure/upload/2013_GI_FINAL_Agenda_101713.pdf)
(http://water.epa.gov/infrastructure/greeninfrastructure/upload/gi_munichandbook_green_streets.pdf)
BaltIPF_GI white paper_draft v1_4 – MWH

[2] "Reinvesting in Philadelphia Neighborhoods." *PHS Online*. Pennsylvania Horticultural Society. 2013. Web. 06 Jan. 2014. <http://phsonline.org/media/resources/2013_PHS_VacantLand_CaseStudy_RELEASE.pdf>

Section 5
Financial Capability Assessment

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5.1 INTRODUCTION

This chapter of the Integrated Wastewater Plan presents discussion and measurements of the Commission community's financial capability to undertake water quality related capital improvements, both to comply with regulatory requirements of U.S. Environmental Protection Agency (EPA) and Massachusetts Department of Environmental Protection (DEP) and for advance financial planning purposes for the Commission. The Financial Capability Assessment follows the EPA's 1997 Guidance Methodology then continues with an enhanced approach evaluating affordability impacts on a micro-community level by utilizing both billing data and census tract data. The combination of these two affordability assessment approaches demonstrates an immediate financial burden on the citizens of Springfield, MA.

5.1.1 CSO Control History and Prospective Capital Costs

The Commission has a long history of investing in combined sewer overflow control facilities, both to comply with federal and state policy and regulations and to satisfy its own commitment to public health and environmental protection. Springfield is one of 772 communities in the United States which have combined sewer systems with CSOs. In Massachusetts, other CSO communities along the Connecticut River include Chicopee, Holyoke, and Montague. CSO discharges are regulated by DEP EPA in accordance with state and federal CSO policies and the State Water Quality Standards (WQS). The EPA issues permits to water and sewer utilities with conditions intended to control discharges to water bodies and establish water quality standards. If the permit conditions are exceeded, an Administrative Order is issued for corrective action. The Commission is currently under an Administrative Order to reduce its CSO discharges by updating and implementing its Long Term CSO Control Plan. Failure to meet the AO requirements may subject the Commission to further enforcement action and fines. Many communities across the United States that have combined sewer systems and CSO discharges are under similar Administrative Orders.

The CSO Program Goals include:

- CSO Compliance
- Maximize Infrastructure Renewal
- Reduce Risk
- Increase Level of Service
- Implement Cost Effective Projects
- Improve Water Quality

Since 2000, the Commission has invested $100 million (including $12 million in debt service interest payments) in CSO control projects to reduce CSO discharges to receiving waters.

The Commission's plan was developed by analyzing and comparing multiple project alternatives to select the most cost-effective solution. The plan consists of numerous CSO and wastewater projects to be completed in phases over the next 20 to 40 years to achieve more than 85% reduction in CSO discharge volume and better than 95% water quality compliance with state

WQS. Moving forward the Commission will, to the extent of its financial capability, continue to strive to meet state and federally mandated goals and requirements. As such, the Commission estimates it will invest approximately $447.2 million (un-escalated) in capital projects, including CSO control, wastewater collection and treatment system, and shared utilities projects through FY 2035, as shown in Table 5.1-1.

Table 5.1-1: Long-Term Capital Improvement Costs

CSO Projects	$ 183,321,559
Wastewater Projects	249,038,835
Shared Cross Utility Projects	14,803,242
Total	$ 447,163,636

With a service area population of approximately 152,000[1], the Commission capital requirement present worth (un-escalated cost level) of $447.2 million equates to about $2,940 per person[2]. Put another way, with a household total of approximately 63,000, this capital requirement equates to about $7,100 per household.

The base year values included in Table 5.1-1, and throughout this report, are expressed in 2014 dollars, with few exceptions.

The values for CSO Control, wastewater, and utility projects shown in Table 5.1-1 are sums of over thirty individual but related projects. These projects are described in previous chapters of the Integrated Wastewater Plan.

5.1.2 Fiscal Burdens of an Economically Stressed Community

To achieve the CSO control and other water quality objectives, the Commission community will need to accommodate the increased financial burden of $447.2 million, plus the annual O&M costs of those new assets. This all adds up to a substantial fiscal responsibility for Commission customers and businesses. The Commission can only accommodate the additional burden if it does so over a time schedule that allows customer-allocated costs to increase gradually, at or under the threshold that EPA documents characterize as *"Significant and Widespread Social and Economic Impact,"*[3] which is evaluated in part by determining whether such costs exceed two percent of Median Household Income ("MHI").

The Commission requests a lengthy implementation period in order to accommodate the capital and operational requirements within the economic bounds of the community. Financial-based

[1] The City of Springfield, MA population over the three year period of 2010-2012 was estimated by the U.S. Census Bureau to be 151,708. [Census, American Community Survey, Table B07003].

[2] Boston's sewer system (BWSC) serves a population of about 640,000 [2012 CAFR, Table 11]. A similar cost per capita would equate to about $1.9 billion of present worth project value.

[3] See, for example, http://water.epa.gov/scitech/swguidance/standards/economics/chaptr1.cfm

causes for subsequent extension of the implementation schedule may occur as well. For example, if the median household income of the Commission's service area significantly decreases in the future, if the population decreases substantially, if construction costs increase, if unemployment swells, or if the City's industrial base substantially shrinks, then the residential rates and charges necessary to pay for the projects proposed in the Integrated Wastewater Plan may become overly burdensome due to the increased financial responsibility associated with implementing the Integrated Wastewater Plan.

5.1.3 Commission Socio-Economic Setting

By any reasonable measure, the economic wherewithal of the Commission is financially stressed. Following are some salient data concerning the Commission's economic conditions:

- High unemployment in the Commission's service area has been a major source of concern. The published U.S. Census estimate of Springfield unemployment for 2012 is 16.3 percent.[4] Sixteen percent amounts to nearly 7.0 percent greater unemployment in Springfield than the State of Massachusetts (9.3%) and 6.2 percent greater unemployment in Springfield than the national average (10.1%). In December 2013, S&P RatingsDirect reported more favorable employment numbers for the City[5]. According to their research, unemployment in Springfield for 2013 is 11.6 percent, while the city and state were reported at 6.8 percent and 7.3 percent, respectively. In our discussion on unemployment in section 5.4.2.1, the numbers outlined by S&P were used.
- In recent years, the City of Springfield has suffered from limitations on property tax revenues. From 1996 to 2000 Springfield's tax levy was up against its 2.5 percent levy ceiling, limiting the City's ability to increase property taxes. Since 2004, the City increased its room between the tax levy and the tax ceiling through additional economic development and higher assessed values. In 2011, Springfield's assessed values decreased by 2.1 percent and, in 2012, decreased by an additional 1.1 percent. Although a lesser decline than originally expected was encountered in FY12, the City made an effort to reduce property taxes for the majority of businesses and residents[6]. Details of Springfield's levy calculation and lost revenues are shown in the Table 5.1-2 below.

Table 5.1-2: Property Tax Limitations

	FY11	FY12	FY13	FY14	FY15	FY16	FY17
	Levy Calculation	Levy Calculation	Levy Calculation	Levy Calculation	Levy Calculation	Levy Calculation	Levy Calculation
Tax Levy	170,824,032	171,233,218	169,400,199	167,408,833	165,734,744	164,077,397	164,077,397
Increase Levy 2.5%	4,292,701	4,318,594	4,452,106	4,185,221	4,143,369	4,101,935	4,101,935
Subtotal	**175,116,733**	**175,551,812**	**173,852,305**	**171,594,054**	**169,878,113**	**168,179,332**	**168,179,332**
New Growth	3,482,214	4,526,534	5,868,281	4,000,000	4,000,000	4,000,000	32,000,000
Subtotal of Gross Tax Levy	**178,598,947**	**180,078,346**	**179,720,586**	**175,594,054**	**173,878,113**	**172,179,332**	**200,179,332**
Levy Ceiling	**171,233,218**	**169,400,199**	**167,408,833**	**165,734,744**	**164,077,397**	**164,077,397**	**181,577,397**
LOST REVENUE To Support Operations	**7,365,729**	**10,678,147**	**12,311,753**	**9,859,310**	**9,800,716**	**8,101,935**	**18,601,935**
		Total lost to date FY11-FY13:	30,355,629			*Total estimated lost FY11-FY17:*	76,719,525

[4] U.S. Census Bureau Table DP03, Selected Economic Characteristics, 2010-2012 American Community Survey 3-Year Estimates, City of Springfield, MA.
[5] S&P RatingsDirect, December 24, 2013
[6] City of Springfield, MA, 2013 CAFR

- The Commonwealth of Massachusetts reduced state aid (Unrestricted General Government Aid) to Springfield by 30% since FY08. Chapter 70 Aid continues to grow, however, so do their education expenses including the City's required contribution and the non-School eligible spending cost for transportation. Because the City's budget is reliant on State Aid for 60% of revenues, the budget follows the same economic cycles experienced by the State[7].
- According to the U.S. Census, the population of Springfield in 2012 was estimated to be 151,708. Significant population declines are not favorable to the economic health of communities. A 2007 study, *"Uses of Population and Income Statistics in Federal Funds Distribution –With a Focus on Census Bureau Data"* found that140 federal grant and direct grant and assistance programs totaling $435.7 billion use U.S. Census Bureau population data as part of the funding formulae. In 2008, Springfield successfully challenged the 2007 Census data bringing it back above the critical 150,000 threshold. The July 2007 estimate of 149,938 was increased by 1,404 to account for college students, nursing-home residents and group housing tenants. Officials said it is critical for a city's population to be above 150,000 in order to qualify for federal grants and aid. Mayor Domenic J. Sarno was quoted "It keeps Springfield in the ball game for vital federal funds." In the future, the population in Springfield is expected to steadily decline. A recent projection published by the UMass Donahue Institute estimated that the population of Springfield would drop below 146,000 by the year 2030, a decrease of almost 5%[8]. Any population decline below 150,000 will be a federal funding loss to the community and the state.
- In addition to population, employment and household income are also indicated to be declining in the City of Springfield. MHI in Springfield in 2012 was estimated by the U.S. Census to be $34,175. In contrast, the 2012 MHI in the State of Massachusetts was $65,029, and nationwide, MHI was $51,771. "Median" means the value at which the number of data points greater than the value equals the number of data points less than the value. Thus, half of Springfield's households earned less than the roughly $34,000 MHI value mentioned above.
- Poverty in the City of Springfield has become staggering. The U.S. Census in 2012 defined the poverty threshold as $27,827 for a family of five. In 2012, 29.5 percent of Springfield's population, including 43.4 percent of children under age 18, was estimated to have income below the poverty level.[9] By contrast, the percentage of people in the United States below the poverty level was 15.7 percent, including 22.2 percent of children.[10]

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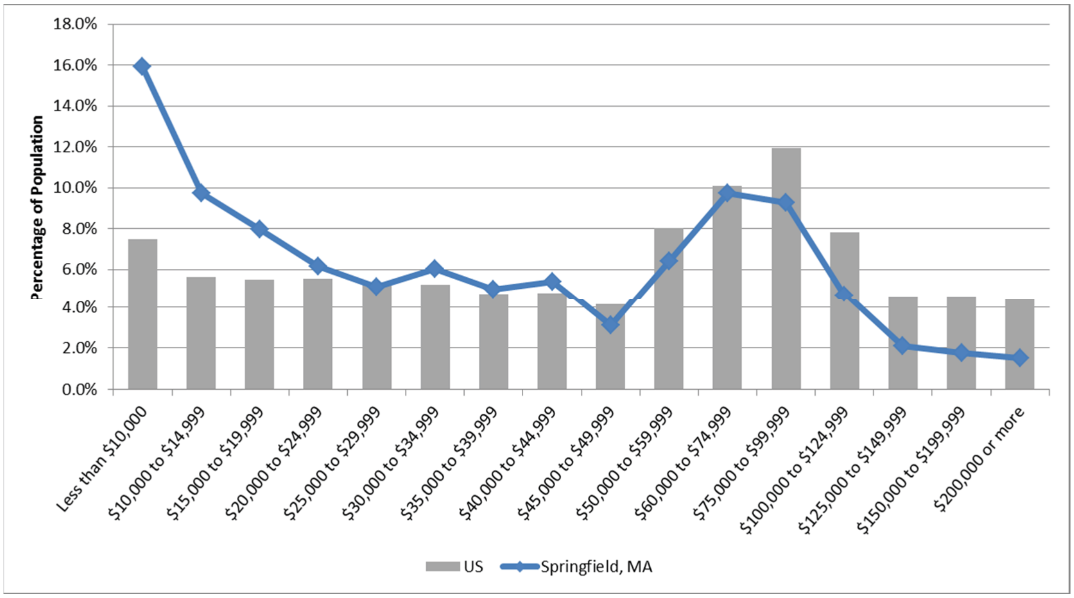
[7] City of Springfield, MA, 2013 CAFR
[8] Massachusetts Populations Projections, developed and published by the UMass Donahue Institute, http://pep.donahue-institute.org/
[9] U.S. Census Bureau Table DP03, Selected Economic Characteristics, 2010-2012 American Community Survey 3-Year Estimates, City of Springfield, MA.
[10] U.S. Census Bureau Table DP03, Selected Economic Characteristics, 2010-2012 American Community Survey 3-Year Estimates, United States.

- Household income levels in the City of Springfield are less favorable than those at the national level. Income distribution in Springfield is much more concentrated in lower income levels and less concentrated in higher income levels. A comparison of income distribution in Springfield and US is shown below in Figure 5.1-1.

Figure 5.1-1: Household Income Distribution



- Market values of real property are down by nearly $1 billion. Real property tax value assessed and reported for Springfield in 2013 was 1.2 percent less than that of the previous year. The City's property values have experienced over $1 billion in decline since FY08 which has not fully stabilized. Because of this significant decline, the City's levy ceiling has been significantly constrained. As such, growth to the levy, even the annual 2.5% or the benefit of economic development known as "new growth" has not been able to be captured. Springfield is the only community in the Commonwealth that, to date is having this experience, however other communities are close and will soon face the same issues. Without being able to grow local revenues and without increases in State Aid, non-discretionary costs are crowding out all other budgetary needs and impacting the City's ability to provide core services.
- The City of Springfield also uses their limited funding for public health, safety, education and economic development. As population, jobs, and incomes have declined over recent years, the City of Springfield has significantly reduced its manpower to balance its budget to ensure its ability to fund its most critical needs. Every department was impacted by budget reductions in the Fiscal Year 2013 budget planning process. Including $10.2 million in reductions from personal services (salaries, benefits, elimination of vacant positions, layoffs), $4.6 million in reductions from other than personal services (OTPS), and $269,000 in reductions to capital expenditures. Overall, the budget reductions across departments impacted 108.0 requested Full Time Equivalents (FTEs) which are divided into the elimination of 96.0 FTE vacancies and the

layoff of 12.0 FTEs. The General Fund FTE complement is at its lowest to date at 1,207.3 FTEs. That is a reduction of 374 FTEs (-24%) since Fiscal Year 2008. The City is using a total of $8 million in reserves from its $40 million reserve account. This amount leaves the fund balance at 6% of the overall budget which complies with the City's financial ordinances. Utilizing reserves is necessary to fund programs and services that would otherwise be decimated by that level of reductions[11]. A summary of FTEs by year is shown in table 5.1-3 below.

Table 5.1-3: City FTEs

	FY08	FY09	FY10	FY11	FY12	FY13
City GRAND TOTAL	1,581.5	1,557.9	1,433.2	1,410.3	1,302.8	1,207.3

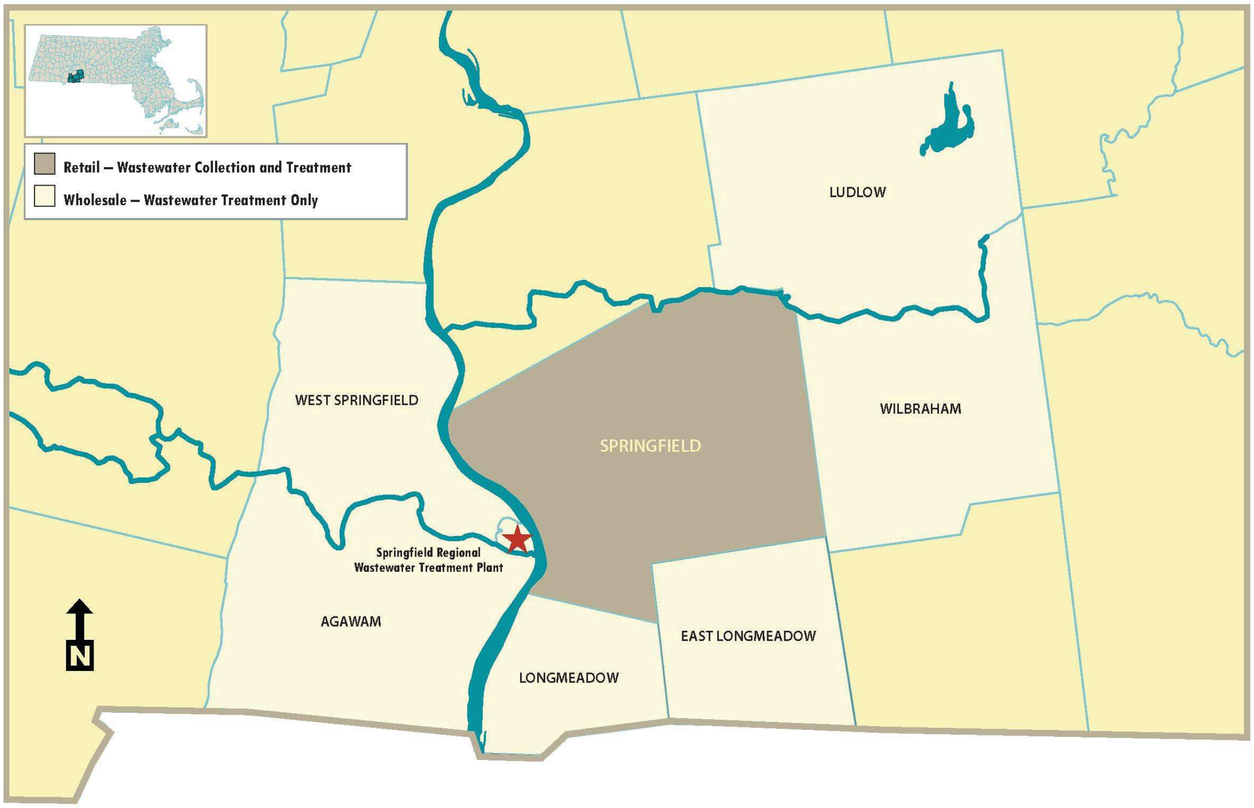
- Notwithstanding the above indications of economic difficulty for the community, the Commission has never been in default on bond payments nor significantly downgraded on its outstanding financial obligations. On the contrary, the Commission has demonstrated strong political will in passing sewer rate increases when necessary. But the Commission cannot continually take on financial burdens that severely impact the City of Springfield's citizens and municipal tax base.

5.1.4 Wastewater Service Area and Population

A map of the service area is shown on Figure 5.1-2.

[11] City of Springfield, MA, 2013 CAFR

Figure 5.1-2: Wastewater Service Area



The population in the City of Springfield in 2013 was estimated by the U.S. Census Bureau to be 151,708, as mentioned earlier. This assessment on financial capability focuses only on the retail customers within the city of Springfield, shaded on the map above in grey. Within the Commission's retail service area, approximately 63,000 households (accounting for single and multi-family units) are provided wastewater collection and treatment.

5.1.5 EPA Guidance Analysis Protocol

EPA has published the *CSO Guidance for Financial Capability Assessment and Schedule Development*[12] (herein referred to as "EPA Guidance"). The EPA Guidance indicates that financial capability should be assessed using two methodologies, which EPA calls "phases." One method, Phase 1, is to estimate the present value of proposed capital and operational costs of CSO control and wastewater collection and treatment improvements, coupled with costs of existing wastewater collection and treatment system facilities and procedures, and to measure the residential share of that cost against household income. This computation determines the "Residential Indicator."

The other method, Phase 2, examines six parameters intended to measure background or underlying financial capacity of the community, collectively called the "Permittee Financial

[12] USEPA, Office of Water, EPA 832-B-97-004, March 1997.

Capability Indicators." Two financial capability indicators address existing debt, two concern socio-economic conditions, and two concern property tax data. These six parameters are compared with benchmark figures (nationwide data, for example) or against specific criteria provided by USEPA. Thus, the Residential Indicator is intended to represent prospective financial burden, and the Permittee Financial Capability Indicators are intended to represent existing financial capacity to accommodate additional financial burden. This chapter of the Integrated Wastewater Plan provides computations of the Phase 1 Residential Indicator and the Phase 2 Permittee Financial Capability Indicators in accordance with the methods set forth in the EPA Guidance.

5.2 REGULATORY FRAMEWORK

Among other things, EPA regulates point-source discharges, including CSOs, into bodies of water. In 1989 EPA issued a *National CSO Control Strategy,* which was supplemented in 1994 when EPA issued its *CSO Control Policy*[13]. One of the intentions of the *CSO Control Policy* was to provide guidance to Permittees with CSOs and to federal and state water quality permitting and enforcement authorities. A key expectation of the *CSO Control Policy* is that Permittees shall produce Long Term Control Plans ("LTCPs") to address CSO discharges. According to EPA's *CSO Guidance for Long-Term Control Plan*:[14]

> *As part of LTCP development, the ability of the municipality to finance the final recommendations should be considered. The CSO Control Policy "…recognizes that financial considerations are a major factor affecting the implementation of CSO controls…[and]…allows consideration of…financial capability in connection with the [LTCP] effort…and negotiation of enforceable schedules." The CSO Control Policy also specifically states that "…schedules for implementation of the CSO controls may be phased based on…financial capability."*

EPA's *CSO Control Policy* addresses the relative importance of financial issues when developing implementation schedules for CSO controls. The Policy states that an implementation schedule "may be phased based on the relative importance of adverse impacts upon Water Quality Standards and designated uses, Priority projects identified in a long-term plan and on a Permittee's financial capability."[15] Thus, an important purpose of this chapter is to provide meaningful financial capability information concerning the Commission to Massachusetts DEP and EPA for developing an implementation schedule.

Due to the importance of financial capability in determining a municipality's capacity to construct CSO Control assets, and to undertake an affordable schedule within which construction of those assets will occur, EPA published the EPA Guidance, mentioned above.

[13] 59 Fed. Reg. 18,688.
[14] USEPA, Office of Water, EPA 832-B-95-002, September 1995, p.3-66.
[15] Cited in USEPA Guidance, p.6.

Importantly, the EPA Guidance encourages Permittees to provide additional financial and economic information beyond the analyses of the above indicators, as stated at page.7 of the EPA Guidance, to provide a better reflection of financial capability:

> *Since flexibility is an important aspect of the CSO Policy, Permittees are encouraged to submit any additional documentation that would create a more accurate and complete picture of their financial capability.*

The analyses provided in this Chapter directly reflect the EPA Guidance in form and content, but also includes additional information to more accurately and completely describe the City's financial capability.

5.3 PHASE 1 ASSESSMENT: THE RESIDENTIAL INDICATOR

EPA Guidance stipulates how the CSO control program financial capability analysis shall be undertaken. This section presents the results for Phase 1 of that analysis, the Residential Indicator, including replicas of the specific worksheet/forms contained in the EPA Guidance. The intention of the Residential Indicator is to measure "…financial impact of the current and proposed WWT ['wastewater treatment' in the broader sense of 'wastewater collection and treatment system'] and CSO controls on residential users." The EPA Guidance does not indicate why measurement of the impact on non-residential sectors of the communities, such as commercial, industrial, institutional and agricultural, is neglected in the analysis. Those sectors certainly pay wastewater rates and charges and are essential elements of the economic dynamics of any community. For example, in Springfield, the non-residential customer base provides approximately 20 percent of the annual sewer flow, per Table 5.3-4. Any loss of commercial/industrial accounts would have serious impacts on the revenue base, as well as on unemployment, wages and taxes.

Existing and future CSO and wastewater collection and treatment system costs attributable to the residential sector are identified. The cost value is divided by the number of contributing households to determine Cost per Household ("CPH"). Once this figure is determined, the CPH is divided by MHI to determine the Residential Indicator (CPH as a percentage of MHI).

Table 5.3-1 shows EPA's Residential Indicator criteria. If CPH is less than one percent of MHI then this cost related factor is assigned a *low* Financial Impact value. If CPH is between one and two percent of MHI then this factor is assigned a *mid-range* Financial Impact value. If CPH is more than two percent of MHI then this factor is assigned a *high* Financial Impact value.

Table 5.3-1: Phase 1 Criteria

Financial Impact	Cost per Household
Low	Less than 1.0 percent of MHI
Mid-Range	1.0 - 2.0 percent of MHI
High	Greater than 2.0 percent of MHI

These financial impact ratings are used in the Financial Capability Matrix presented later in this section. The Financial Capability Matrix brings together the Residential Indicator with the six Permittee Financial Capability Indicators developed in the Phase 2 Evaluation. The first step of the Phase 1 Evaluation, then, is to determine CPH.

5.3.1 Costs per Household

The CPH evaluation considers existing and projected costs of wastewater collection and treatment, including existing CSO Control facilities, and other costs directly associated with the wastewater collection and treatment system. The ratio of residential wastewater flow to total flow is used to estimate residential share of total costs. The residential share of costs divided by number of households yields the CPH, in accordance with EPA Guidance protocol. The EPA Guidance "Worksheet 1" form is shown in Table 5.3-2.

Table 5.3-2: Costs per Household Determination

Row	Item	Unit	Value
Current Costs			
100	Annual O&M Costs (Net of Non-Rate Revenues)	($s)	$ 13,024,607
101	Annual Capital and Debt Service	($s)	12,792,507
102	Subtotal	($s)	$ 25,817,114
Projected Costs			
103	Estimated Annual O&M Costs	($s)	$ 500,000
104	Estimated Annual Capital and Debt Service	($s)	21,531,932
105	Subtotal	($s)	$ 22,031,932
106	Total Current and Projected Costs	($s)	$ 47,849,046
107	Residential share of total costs	($s)	$ 37,982,246
108	Total number of Households in Service Area		62,908
109	Cost Per Household	($s)	$ 603.77

Row 100 of Table 5.3-2 includes annual costs of O&M net of non-rate revenues. The Commission's total budgeted wastewater O&M costs in 2014 for the entire utility were $21,400,463. In order to give an accurate picture of the current year costs impacting households in the community, non-rate revenues of $8,375,855 were removed. These revenues are not directly associated with the utility's retail rate customers and should not be used in the consideration of cost per household. The $8.4 million of non-retail rate revenues include revenues from wholesale customers, late fees, and other sources of miscellaneous revenue. When we remove the non-rate revenues from our total annual O&M costs, we get our net current O&M costs of $13,024,607, shown on row 100 of Table 5.3-2.

It must be noted that all of the cost data included in the CPH determination are present worth numbers. The EPA Guidance process appears to result in the determination of what engineering economists call "equivalent uniform annual costs," which is a way to convert capital costs to annual costs (typically done for comparison of project alternatives), using terms that are derived from public finance. Thus it is very important not to infer that starting next year that the commission will require $22 million in additional revenue to pay debt service on new facilities, some of which may not be built for dozens of years.

Row 101 of Table 5.3-2 includes annual costs of $6,911,147 of existing wastewater system debt service plus the $5,881,360 of capital outlay (already present value) that the Commission shall have expended in 2014. The number shown on Row 101 includes the actual sum of debt service the Commission paid on fifteen issues in 2014. Table 5.3-3 provides a summary of the outstanding debt issues and the amount of debt service paid in 2013 and 2014.

Table 5.3-3: Debt Service 2013 and 2014

Name	Type	2013	2014
Sewer Plant Loan		$ 146,280	$ 0
City - Refunding Bonds		0	0
City - SRF 91-59	SRF	90,061	92,935
City - SRF 94-24	SRF	285,309	292,450
2001A - Revenue		534,192	0
2000A - SRF 94-24	SRF	267,961	272,968
2000A - SRF 95-07	SRF	4,214	4,142
2000A - SRF 98-133	SRF	12,727	12,503
2002A - SRF CW 01-39	SRF	163,282	159,446
2003A - Revenue		72,823	72,173
2006A - Revenue		701,914	701,929
2007A - Refunding of 2001A		289,313	823,823
2007B - SRF CW-06-27	SRF	1,403,019	1,401,899
2008A - Revenue		544,182	545,795
2010A - SRF CW-08-36	SRF	604,819	595,698
2012C - SRF CW-08-36a	SRF	112,206	381,400
2010B - Revenue		1,422,978	1,392,211
2012A - SRF DWD-10-06	SRF	0	0
2012B - SRF DW-11-01	SRF	0	0
US Water Loan		161,773	161,773
SRF DW-11-22	SRF	0	0
SRF CW-12-03	SRF	0	0
Total		$ 6,817,055	$ 6,911,147

Row 103 of Table 5.3-2 includes $500,000 of projected costs for future O&M. The future O&M costs projected are comprised of costs to cover supplies, equipment, and staff associated with new assets built.

Row 104 of Table 5.3-2 includes capital outlay and projected "annual debt service" of the prospective CSO, wastewater collection and treatment system, and shared utility projects. The estimated capital costs of the CIP included in Table 5.1-1 are in present worth (2014 cost basis) dollar values. To determine "annual debt service" (meaning equivalent uniform annual cost) according to the EPA Guidance, terms of public works financing are used (representative tax exempt interest rates, length of debt maturity, etc.).

The Commission's CIP capital funding requirement is to use a combination of available cash, revenue bonds, and Massachusetts Water Pollution Abatement Trust (MWPAT) loans, also referred to as state revolving fund (SRF) loans. Because the terms of MWPAT state revolving fund loans are more attractive than revenue bonds, the Commission intends to optimize that capital resource.

Row 105 shows the $22,031,932 sum of projected O&M, capital and debt service costs.

Row 106 shows the $47,849,046 sum of existing/current O&M, capital and debt service plus the projected O&M, capital and debt service costs.

Row 107 of Table 5.3-2 shows the Residential Share of total current and future O&M, capital and debt service costs. EPA Guidance prescribes that this value be calculated by dividing the residential share of wastewater flow by the total flow. The Commission's residential flow in 2013 was 79.4 percent of total flow as shown in Table 5.3-4.

Table 5.3-4: Wastewater Flow Quantity Data

Generation (HCF/yr)	2013	
Residential	4,922,501	79.4%
Commercial	705,710	11.4%
Industrial	227,615	3.7%
Hospital	221,975	3.6%
FSE	51,406	0.8%
Municipal	72,031	1.2%
Total	6,201,239	100.0%

Row 108 of Table 5.3-2 sets forth the number of households in the service area. According to the U.S. Census, the number of households in the City of Springfield in 2011 was 55,857, down 769 households from the U.S. Census 2010 estimate of 55,088. This figure is published in the census tract data provided by the U.S. Census.

For the purposes of this financial capability assessment, the number of households was derived from billing data exported from the Commission's accounting system. This approach was used to give an exact number of households served by the Commission, rather than only the number of households that reside within Springfield. Thus 62,908 is the figure used at Row 108 of Table 5.3-2. Row 109 of Table 5.3-2 shows the final computation of CPH: the residential share of costs divided by number of households to derive CPH to be $603.77.

5.3.2 Residential Indicator

The Residential Indicator computation divides CPH, as determined above, by MHI. This is shown in Table 5.3-5.

Table 5.3-5: Residential Indicator Determination

Row	Item	Unit	Value
Median household income			
201	MHI in 2011	($)	$ 38,180
202	CPI adjustment factor - to 2014	(%)	106.3%
203	Adjusted MHI	($)	$ 40,588
204	Annual cost per household (line 109)	($)	$ 603.77
205	Residential indicator CPH as a percentage of adjusted MHI	(%)	1.49%

Row 201 of Table 5.3-5 shows the MHI to be $38,180 for the Commission in 2011. Determination of MHI for Springfield was calculated using a weighted average of detailed census tract data and billing data. As outlined in EPA Guidance documentation, a weighted average is often used to determine the MHI for a permittee's entire service area. In the case of the Commission, census tracts for the entire service area were weighted using the number of households serviced in each of those tracts. In our analysis, the number of households used to calculate the weighted average was derived directly from Commission billing data, not the number of households in census data. This value is included in Table 5.3-5 at Row 201.

The EPA Guidance requires that the MHI figure be adjusted to the baseline year of the analysis, which in this case is 2014. The adjustment is to be made by ratio using Consumer Price Index ("CPI").

Therefore, to comply with the EPA Guidance, the MHI datum from 2011 is adjusted to 2014 as shown on Row 203. Row 204 of Table 5.3-5 is the CPH as determined in Table 5.3-2. The Residential Indicator is thus determined to be 1.49% of MHI as indicated on Row 205 of Table 5.3-5. Because the CPH is between one and two percent of MHI, the Residential Indicator is judged to be of "Mid-Range" Financial Impact as indicated by the EPA Guidance criteria presented in Table 5.3-1.

5.4 PHASE 2 ASSESSMENT: PERMITTEE FINANCIAL CAPABILITY INDICATORS

As stated above in section 5.1.5, there are six Permittee Financial Capability Indicators:

- Debt Indicators
  Bond Ratings
  Overall Net Debt as a Percent of Full Market Property Value
- Socioeconomic Indicators
  Unemployment Rate
  Median Household Income ("MHI")
- Financial Management Indicators
  Property Tax Revenue Collection Rate
  Property Tax Revenues as a Percent of Full Market Property Value

Table 5.4-1 shows EPA's Financial Capability criteria used to evaluate the six Indicators. The Indicators are shown in the left-most column. Each of the Permittee's financial indicators will be assessed to be "Strong," "Mid-Range" or "Weak" depending on the Permittee's actual data compared with criteria shown in the cells of the table.

Table 5.4-1: Financial Capability Indicator Criteria and Benchmarks

Indicator	*Strong*	*Mid-Range*	*Weak*
Bond Rating	AAA-A (S&P) or Aaa-A (MIS)	BBB (S&P) or Baa (MIS)	BB-D (S&P) or Ba-C (MIS)
Net Debt/Property Value	Below 2%	2% - 5%	Above 5%
Unemployment Rate	>1% below National Ave.	±1% of National Ave.	>1% above National Ave.
Median Household Income	>25% above adj. Nat'l MHI	±25% of adj. Nat'l MHI	>25% below adj. Nat'l MHI
Prop. Tax/Property Value	Below 2%	2% - 4%	Above 4%
Prop. Tax Collection Rate	Above 98%	94% - 98%	Below 94%

5.4.1 Debt Indicators

The two Debt Indicators are Bond Ratings and Net Debt. EPA Guidance states that these indicators "…were selected to assess current debt burden conditions and ability to issue new debt." Ratings and total amount of outstanding debt are indeed important parameters associated with undertaking additional debt. However, they are not the only parameters for determination of sustainable financial affordability, and in many cases may not be the most important parameters. There are a number of alternatives for structuring long term debt for large capital projects. Typically, wastewater and wastewater related system capital projects are financed by the sale of revenue bonds or by undertaking state sponsored loans, both of which are secured by the promises that the borrower will continue to produce ample direct operating revenue (sewer user charges) in the future.

There are two principal reasons for the predominant revenue bond preference.
First, bonds that are secured by payment of ad valorem taxation (generally called general obligation bonds, or "GO bonds") and by the full faith and credit of the City would require a favorable vote of the City Council for approval / authorization to sell bonds. Secondly, the costs of providing wastewater services are more fairly allocated among the system user/customers in accordance with how much wastewater (water quality as well as quantity) is discharged to the system, rather than property value.

Because revenue production is the critical factor in the ability of an issuer to service revenue bond debt (*i.e.,* annually pay principal and interest on the bonds), the history and reasonable forecast of net revenue production is the key factor used by rating agencies to evaluate credit worthiness – that is, to assess ability to undertake additional debt and the cost of that debt. The CSO Guidance recognizes the distinction between revenue bonds and GO bonds in the discussion of the "Bond Rating" financial capability indicator. But nowhere does the CSO Guidance provide for consideration of net revenue production information.

The second of the "Debt Indicators" is "Overall Net Debt as a Percent of Full Market Property Value." The EPA Guidance provides, "Overall net debt is debt repaid by property taxes in the permittee's service area." Net debt is interesting as an indicator of the overall stress of community debt on constituents, but has little to do with the capability to issue revenue bonds for CSO Control facility financings. The parameter of import for the assessment of projected financial capability to undertake project financings, then, is how net revenues are forecast to produce sufficient revenue to service the debt, and how many and to what levels will rate increases have to be to achieve projected revenue requirements. In rare cases, debt is limited by statute or ordinance; more frequently, the issuance of bonds is limited by the political will to enact rate increases that are deemed unaffordable.

Affordability is the essence of financial capability, and nowhere in the EPA Guidance is the reasonableness of sewer rate projections addressed. As noted above, however, if the Commission determines that the rate increases necessary to support the projects proposed in this Integrated Wastewater Plan are overly burdensome, it will seek to extend the applicable implementation schedule or reevaluate the affordability of certain CSO or wastewater collection and treatment system projects. Notwithstanding the above, the remainder of this section presents the Phase 2 Financial Capability indicators in accordance with the protocol set forth in the EPA Guidance.

5.4.1.1 Bond Ratings

There are several credit rating agencies used by local governments to assess credit worthiness ratings of bonds. The Commission has used Moody's Investors Service ("Moody's" or "MIS") and Standard and Poor's Corporation ("S&P") to rate the credit of their bonds. Fitch Ratings ("Fitch") is another credit rating company that some issuers use. All three rating agencies rate long-term fixed-rate tax-exempt bonds with more ratings than appear in Table 5.4-1. Table 5.4-2 compares the ratings of the three agencies.

Table 5.4-2: Comparison of Bond Credit Ratings by Agency

<table>
<tr><th colspan="2">Moody's</th><th colspan="2">S&P</th><th colspan="2">Fitch</th><th></th></tr>
<tr><th>Long-term</th><th>Short-term</th><th>Long-term</th><th>Short-term</th><th>Long-term</th><th>Short-term</th><th></th></tr>
<tr><td>Aaa</td><td rowspan="6">P-1</td><td>AAA</td><td rowspan="4">A-1+</td><td>AAA</td><td rowspan="4">F1+</td><td>Prime</td></tr>
<tr><td>Aa1</td><td>AA+</td><td>AA+</td><td rowspan="3">High grade</td></tr>
<tr><td>Aa2</td><td>AA</td><td>AA</td></tr>
<tr><td>Aa3</td><td>AA-</td><td>AA-</td></tr>
<tr><td>A1</td><td>A+</td><td rowspan="2">A-1</td><td>A+</td><td rowspan="2">F1</td><td rowspan="3">Upper medium grade</td></tr>
<tr><td>A2</td><td>A</td><td>A</td></tr>
<tr><td>A3</td><td rowspan="2">P-2</td><td>A-</td><td rowspan="2">A-2</td><td>A-</td><td rowspan="2">F2</td></tr>
<tr><td>Baa1</td><td>BBB+</td><td>BBB+</td><td rowspan="3">Lower medium grade</td></tr>
<tr><td>Baa2</td><td rowspan="2">P-3</td><td>BBB</td><td rowspan="2">A-3</td><td>BBB</td><td rowspan="2">F3</td></tr>
<tr><td>Baa3</td><td>BBB-</td><td>BBB-</td></tr>
<tr><td>Ba1</td><td rowspan="14">Not prime</td><td>BB+</td><td rowspan="6">B</td><td>BB+</td><td rowspan="6">B</td><td rowspan="3">Non-investment grade speculative</td></tr>
<tr><td>Ba2</td><td>BB</td><td>BB</td></tr>
<tr><td>Ba3</td><td>BB-</td><td>BB-</td></tr>
<tr><td>B1</td><td>B+</td><td>B+</td><td rowspan="3">Highly speculative</td></tr>
<tr><td>B2</td><td>B</td><td>B</td></tr>
<tr><td>B3</td><td>B-</td><td>B-</td></tr>
<tr><td>Caa1</td><td>CCC+</td><td rowspan="5">C</td><td rowspan="5">CCC</td><td rowspan="5">C</td><td>Substantial risks</td></tr>
<tr><td>Caa2</td><td>CCC</td><td>Extremely speculative</td></tr>
<tr><td>Caa3</td><td>CCC-</td><td rowspan="3">In default with little prospect for recovery</td></tr>
<tr><td rowspan="2">Ca</td><td>CC</td></tr>
<tr><td>C</td></tr>
<tr><td>C</td><td rowspan="3">D</td><td rowspan="3">/</td><td>DDD</td><td rowspan="3">/</td><td rowspan="3">In default</td></tr>
<tr><td>/</td><td>DD</td></tr>
<tr><td>/</td><td>D</td></tr>
</table>

The data in Table 5.4-2 was taken from public media and may not perfectly correspond with current rating nomenclature used by the three rating agencies. In December 2013, the Commission was issued a credit report by Standard & Poor's. The Commission was given an A+, or stable, review. The credit profile issued by S&P is summarized in Table 5.4-3. While the Commission is noted with good financial management, the Springfield customer base is described as a "limited economy that has below-average wealth levels and above-average unemployment." These findings are consistent with the analysis of Financial Capability Assessment and highlights the understanding that as rates increase the growing level of unaffordable sewer bills will spread and deepen throughout the community while the prospects of economic recovery remain unseen.

Table 5.4-3: Summary of Bond Rating

Credit Profile		
Springfield Wtr & Swr Commn (ASSURED GTY)		
Unenhanced Rating	A+(SPUR)/Stable	Affirmed
Springfield Wtr and Swr Comm gen rev		
Unenhanced Rating	A+(SPUR)/Stable	Affirmed
Springfield Wtr and Swr Comm gen rev bnds		
Unenhanced Rating	A+(SPUR)/Stable	Affirmed

Rationale

Standard & Poor's Ratings Services has affirmed its 'A+' long-term rating on the Commission's general revenue bonds outstanding. The outlook is stable.

The rating reflects our view of the following credit strengths:

- Good financial operations, with historically strong annual debt service coverage (DSC) and strong liquidity, which we expect to continue; and
- A demonstrated willingness to adjust rates to maintain strong financial operations.

We believe offsetting credit weaknesses include:

- A reliance on rate increases to maintain strong DSC despite escalating debt service requirements from the commission's additional debt needs; and
- The primary service area's somewhat limited local economy that has below-average wealth levels and above-average unemployment.

The data in Table 5.4-4 was taken from the Commission's financial model demonstrating how the Commission compares to key financial metrics monitored by major credit rating agencies. The Commission's credit metrics are based on a combined water and sewer basis. This table shows the future years projection of the key metrics under the submitted rate increases, level of debt and cash on hand. The color red indicates a financial element below the benchmarked goal, yellow as a warning and green as the above the credit standing metric's objective. Financial metrics may fluctuate depending on the uses of debt and reserves to meet capital project funding requirements. Rate increases can help return or strengthen the financial stability of the Commission, however, the affordability component will only become more burdensome without widespread economic recovery.

Table 5.4-4: Financial Tracking Metrics

	Target/Benchmark			*Springfield Measurements -Projected*			
Fitch Ratings Guidelines	AAA	AA	A	2014	2015	2016	2017
Total Outstanding Long-Term Debt per Customer	$1,165	$1,812	$1,963	$2,020	$2,210	$2,973	$3,028
Annual CIP Cost per Customer	$190	$243	$159	$551	$620	$618	$412
Senior Lien ADS Coverage	3.4	2.6	2.1	1.7	1.5	1.5	1.6
Minimum Projection of Sr. Lien ADS Coverage	3.2	2.1	1.5	1.7	1.5	1.5	1.6
Operating Margin	38%	39%	48%	$0	33%	36%	40%
Days Cash on Hand	671	398	254	616	172	268	248
Days of Working Capital	621	410	275	569	130	230	217
Debt to Net Plant	24%	47%	54%	61%	58%	69%	66%
S&P Ratings Guidelines	Strong	Avg.	Low				
Per Capita Income as % of National Avg.	130%	100%	65%	63%	63%	63%	63%
Debt Service Coverage	1.5	1.4	1.0	1.7	1.5	1.5	1.6
Liquidity (Days Working Capital)	$120	$90	$30	569	130	230	217
Debt to Net Plant	40%	70%	80%	61%	58%	69%	66%
Top 10 Customers as % of Total Revenue	15%	28%	40%	36%	36%	36%	36%
Fixed Charge Coverage	1.40	1.20	1.00	1.16	1.15	1.21	1.33
Other Ratios and Benchmarks (Fitch Medians)	AAA	AA	A				
Wastewater Affordability:(Bill as %MHI)	0.50%	0.60%	0.60%	1.7%	1.9%	2.1%	2.3%
Water Affordability:(Bill as %MHI)	0.50%	0.60%	0.60%	1.0%	1.1%	1.3%	1.4%
Combined Bill Affordability:(Bill as %MHI)	1.00%	1.20%	1.20%	2.7%	3.0%	3.3%	3.7%

Color Codes	Bad	Warning	Good

The Commission has borrowed from the State of Massachusetts's state revolving loan funds as well as sold bonds. Loans provided by the Massachusetts Water Pollution Abatement Trust ("MWPAT") loans are subordinated debt and are not rated. Overall the credit of the Commission's bonds is judged to be "strong" (favorable investment attributes). This is indicated in Table 5.4-5, which replicates the form provided in the EPA Guidance.

"B3" is Moody's lowest rating above "Caa." This rating is a "Weak" financial capability rating according to Table 5.4-1. Because the A+ rating of the more recent revenue bond sale is in the "Strong" category the Summary Bond Rating is "Strong."

Table 5.4-5: Bond Ratings Worksheet

Row	Item	Value
301	Most Recent General Obligation Bond Rating	N/A
302	Most Recent Revenue Bonds	
	Springfield Wtr and Swr Comm gen rev bnds	
	No Bond Issuance	
	Standard & Poor's Rating, Dec 2013	A+
303	Summary Bond Rating	A+
	(Most recent rating, per USEPA Guidance)	

5.4.1.2 Net Debt

Net debt is the amount of outstanding tax-backed bond debt of the community. It includes debt that is generally unrelated to wastewater and environmental systems.

The City of Springfield's annual Basic Financial Statements for the 2013 year show the data included in Table 5.4-6.

Table 5.4-6: Overlapping Debt

		2013
City of Springfield		
General Obligation bonds	$	251,858,246
Revenue bonds		0
Capital leases		0
SRF loans		0
Notes payable		0
Special assessments		0
Other		0
Subtotal, Springfield	$	251,858,246
Net, not incl. rev. bonds or SRF loans	$	251,858,246
Other taxing agencies		
Pioneer Valley Regional Transit Authority	$	0
Pioneer Valley Planning Commission		0
Subtotal, Other	$	0
Total overlapping debt	$	251,858,246

Because the Net Debt indicator is a ratio of debt to property value and because property value is the basis for ad valorem taxation that is used to pay general obligation debt, the EPA Guidance requires the total debt figure to be net of revenue bond debt, as that form of debt is not paid by property taxes. The Commission's MWPAT loan debt is also paid by utility revenues, not property taxes. The total City of Springfield debt indicated above, less revenue bond debt and MWPAT loan debt is $251,858,000. No other jurisdictions which have outstanding debt partially paid by the Commission, as indicated in Table 5.4-6.

Table 5.4-7 shows the computation of Net Debt according to EPA requirements. The debt values of Table 5.4-6 are included on lines 401 and 402 in Table 5.4-7. The City reports property taxable value (assessed value) of property in Springfield in its annual *CAFR*. The value for 2013 was $6,696,353,300. Because the ratio of net debt to property value, 3.8 percent, is between 2 and 4 percent (reference criteria in Table 5.4-1), this parameter indicates "Mid-Range" financial capability.

Table 5.4-7: Net Debt Worksheet

Row	Item	Unit	Value
401	Direct net debt	($s)	251,858,246
402	Debt of overlapping entities other than City of Springfield	($s)	0
403	Overall net debt	($s)	251,858,246
404	Market value of property	($s)	6,696,353,300
405	Overall net debt as a percent of full market property value	(%)	3.8%

5.4.2 Socioeconomic Indicators

The two Socioeconomic Indicators are Unemployment and Household Income.

5.4.2.1 Unemployment

The unemployment indicator is determined as shown in Table 5.4-8.

Table 5.4-8: Unemployment Worksheet

Row	Item	Unit	Value
501	Unemployment rate of permittee	(%)	11.6%
503	Average national unemployment rate (benchmark)	(%)	7.3%
	Comparison of permittee with benchmark	(%)	+ 4.3%

The unemployment rate of the Commission community and for the USA for the year 2013 were taken from the S&P RatingsDirect report published in December 2013.

Because unemployment in the Commission community is substantially greater than one percent above the national average (*i.e.*, greater than 4.3 percent), this ratio indicates “Weak” Financial Capability, according to the criteria of Table 5.4-1.

5.4.2.2 Household Income

The Household Income Indicator is related to the Residential Indicator in that both incorporate MHI. While the Residential Indicator compares MHI to cost per household, here the Household Income Indicator compares local MHI to national MHI, as a measurement of relative wealth or poverty. Median household income is an important statistic that is tracked by the U.S. Census Bureau.

As discussed previously in section 5.3.2, the weighted Median Household Income for City of Springfield in 2011 was $38,180. This amount is weighted to incorporate the entire service area and was determined using detailed census tract data and Commission billing data. The CPI based adjustment of MHI to the 2014 year is $40,588 is shown in Table 5.4-9.

The U.S. Census Bureau reports that the Median Income of Households in the United States in 2012 was $51,771[16]. Applying the same CPI based adjustment to the national MHI to estimate 2014 MHI yields an adjusted figure of $53,926 as shown.

Because local MHI is between +/- 25 percent (*i.e.*, is between 75 percent and 125 percent of) national MHI according to the EPA criteria included on Table 5-9, this ratio indicates "Mid-Range" Financial Capability.

Table 5.4-9: Household Income Worksheet

Row	Item	Unit	Value
601	MHI of permittee, adjusted to 2014	($)	40,588
	Benchmark:		
602	National MHI, adjusted to 2014	($)	53,926
	Compare permittee with benchmark	($)	75.3%

5.4.3 Financial Management Indicators

The two "Financial Management" Indicators are Property Tax Revenues and Property Tax Collection Efficiency.

5.4.3.1 Property Tax Revenues

Property value and property tax revenue are included in Table 5.4-10.

Because the ratio of property tax revenue as a percentage of full market property value is between two and four percent (see criteria in Table 5.4-1), this Indicator indicates "Mid-Range" financial capability.

[16] U.S. Census Bureau Table DP03, Selected Economic Characteristics, 2010-2012 American Community Survey 3-Year Estimates, United States.

Table 5.4-10: Property Tax Revenues Worksheet

Row	Item	Unit	Value
701	Full market value of real property	($s)	6,696,353,300
702	Property tax revenue	($s)	159,557,644
703	Property tax rev. as a percentage of full market property value	(%)	2.38%

5.4.3.2 Tax Collection Efficiency

The last of the EPA Guidance financial capability indicators to review is property tax revenue collection rate. Computation of this indicator is shown in Table 5.4-11.

Data used for this indicator are derived from the City's CAFR, as were the data for the previous indicator as shown in Table 5.4-10. Because Springfield's collections are between 94 percent and 98 percent of the amount levied, this ratio indicates "Mid-Range" Financial Capability, according to the criteria of Table 5.4-1. This property tax collection amount at 95.31% is due to the tax ceiling limit due to a heavy loss in property values.

Table 5.4-11: Tax Collection Efficiency Worksheet

Row	Item	Unit	Value
801	Property tax revenue collected	($s)	159,557,644
802	Property taxes levied	($s)	167,403,337
803	Property tax revenue collection rate	(%)	95.31%

5.4.4 Summary of Phase 2 Financial Capability Indicators

The Indicator values and scores of the six Financial Capability Indicators are compiled in Table 5.4-12. The EPA Guidance provides that for each "Weak" financial capability indicator shall be assigned a numeric value of "1". Similarly, "Mid-Range" indicators are assigned "2" and "Strong" indicators are assigned "3." One of the Commission indicators score "1," four of the Commission indicators score "2," and one Commission indicator scores a "3." The simple arithmetic average of the six Commission indicators is 2.00.

Table 5.4-12: Summary of Financial Capability Indicators

Row	Item	Value	Score
901	Bond rating	A+	3
902	Net debt percent of property value	3.8%	2
903	Unemployment rate compared with national average	+ 4.3%	1
904	Median household income compared with national average	75.3%	2
905	Property tax revenue percent of property value	2.38%	2
906	Property tax revenue collection rate	95.31%	2
907	Permittee indicator score		2.00

This simple average following the EPA's 1997 Guidance essentially weights evenly a bond rating level to attain future debt at variable interest rate against the unemployment rate and level of median household income. This simple calculation blends the factors and ultimately hides the true impact to a utilities' customer base.

Table 5.4-13 shows the same table as is in Table 5.4-1, color coded to show the Commission scores indicated above in Table 5.4-12.

Table 5.4-13: Financial Capability Scores

Indicator	*Strong*	*Mid-Range*	*Weak*
Bond Rating	AAA-A (S&P) or Aaa-A (MIS)	BBB (S&P) or Baa (MIS)	BB-D (S&P) or Ba-C (MIS)
Net Debt/Property Value	Below 2%	2% - 5%	Above 5%
Unemployment Rate	>1% below National Ave.	±1% of National Ave.	>1% above National Ave.
Median Household Income	>25% above adj. Nat'l MHI	±25% of adj. Nat'l MHI	>25% below adj. Nat'l MHI
Prop. Tax/Property Value	Below 2%	2% - 4%	Above 4%
Prop. Tax Collection Rate	Above 98%	94% - 98%	Below 94%

"S&P" means Standard & Poors Corp. "MIS" means Moody's Investors Service

Key: [ ] = Springfield score

5.5 SUMMARY OF COMMISSION FINANCIAL CAPABILITY ASSESSMENT

Table 5.5-1 provides the "Financial Capability Matrix" pursuant to the EPA Guidance. The table shows the Phase 2 Permittee Financial Capability Indicators to be in the "Mid-Range" category, and is so color coded. This is because the average scores of the indicators (2.00 as indicated in Table 5.4-12) are between 1.5 and 2.5.

The Phase 1 Residential Indicator is determined to indicate Medium financial capability burden. The intersection of the Phase 1 and Phase 2 determinations shows that the overall assessment is "Medium Burden."

Table 5.5-1: EPA 1997 Financial Capability Matrix

Permittee Financial Capability Indicators Score (Socioeconomic, Debt & Financial Indicators)	Residential Indicator (Cost per Household as a percentage of MHI)		
	Low (below 1.0 %)	Mid-Range (between 1.0 and 2.0 %)	High (greater than 2.0 %)
Weak (Below 1.5)	Medium Burden	High Burden	High Burden
Mid-Range (Between 1.5 and 2.5)	Low Burden	Medium Burden	High Burden
Strong (Above 2.5)	Low Burden	Low Burden	Medium Burden

Key: [ ] = Springfield score

While this initial and simplified approach based on 1997 guidance materials provides for a high level financial capability assessment for SWSC, the real affordability impact on customers in the SWSC service area requires a more detailed review of actual customer bills and income distribution levels.

Residential Affordability under an Enhanced Methodology on a micro-community level demonstrates an immediate impact on low income customers.

5.6 ENHANCEMENT OF COMMISSION FINANCIAL CAPABILITY ASSESSMENT

Up until now in this assessment, the EPA's 1997 Guidance Methodology for Financial Capability Assessment has been followed. The primary method the EPA uses for measuring affordability is the Residential Indicator. As outlined in EPA Guidelines, the residential indicator calculates current costs and future costs to determine a cost per household. The EPA defines costs as high, or unaffordable, when the cost per household exceeds 2% of the median household income. This calculation is made on a city wide level without evaluating the impact at different levels of income at the specific service area of the utility.
The cost per household calculated by the EPA takes into account the total cost of the existing and future CSO and wastewater collection and treatment costs attributable to the residential sector, including any proposed debt service. However, it does not take into account debt service coverage requirements or reserve requirements that are mandatory on any revenue bond issued and have a significant impact on the rate increases associated with a utility.

The Commission has applied an enhancement to the original affordability methodology, based on recent EPA guidance. In this enhanced methodology, every year of the study period is looked at, which encompasses 22 years of integrated wastewater collection and treatment system related capital improvements. Looking at an annual basis gives a better perspective of how the affordability changes throughout time.

The enhanced methodology proposed differs from the original EPA approach by looking at the utility's service area on a census tract level. In addition, residential customer data is collected from client billing data and an average bill is calculated within each census tract. These average bills are then matched up to according to the MHI and income distribution data within each of those census tracts. The average bills are then indexed annually by the expected rate increases during the study period on a real basis where inflation is discounted. This allows one to see the average bill in 2014 dollars for every future year projected in the study period.

The proposed rate increases by year came from the financial plan developed specifically for the Commission. Those increases represent the adjustments necessary to pay for all the capital improvements, debt service coverage, and minimum reserve requirements. This methodology provides for a more accurate view of the real cost per residential customer within each of those census tracts while balancing fiscal responsibility.

5.6.1 Residential Affordability Index under the Enhanced Methodology

The EPA's 1997 guidance on residential affordability has several shortfalls. It does not address the income distribution skew nor does it utilize individual utility bills. The enhanced methodology supported by the US Conference of Mayors improves the residential affordability index calculation by correcting these two critical items. It is important to understand the methodology applied including the MHI per tract, average bill, and new color scheme used throughout images.

In the following tables, different colors are used to show how the affordability threshold increases over 2%. The EPA's 2% threshold is considered unaffordable. Under the Enhanced Methodology and a 2% scale, lower income distribution levels in nearly every census tract can have unaffordable levels up to 8%.

Table 5.6-1 below color codes the various levels of the Affordability Index.

Table 5.6-1 Projected Affordability Index per Census Tract Key

Level	Item	Index	Color
Low	Less than	1.00%	
Low-Mid	Up to	1.50%	
Mid	Up to	1.75%	
Mid-High	Up to	2.00%	
High	Up to	3.00%	
Higher	Up to	4.00%	
Highest	Up to	6.00%	
Really Really High	Up to	8.00%	
Extreme	Higher Than	8.00%	

Table 5.6-2 represents the billing data collected for each census tract and median household income by census tract to create a baseline 2014 average sewer bill. The baseline average affordability index is then calculated. This baseline is a starting point and does not include future rate increases or capital needs. The affordability index is weighted by the number of customers served in each of the census tracts.

Table 5.6-2 Projected Affordability Index per Census Tract Key

Tract	Number of Units from Billing Data	Median Household Income	Average Bill 2014	Average Affordability index 2014
8001	3,196	$35,023	$291	0.83%
8002.01	2,573	$41,496	$288	0.69%
8002.02	712	$51,121	$305	0.60%
8003	1,977	$43,071	$296	0.69%
8004	2,390	$41,737	$305	0.73%
8005	1,191	$49,455	$326	0.66%
8006	846	$17,502	$454	2.59%
8007	2,109	$15,123	$347	2.30%
8008	906	$17,109	$376	2.20%
8009	1,547	$12,451	$405	3.25%
8011.01	719	$15,655	$519	3.31%
8011.02	816	$20,449	$304	1.49%
8012	1,261	$18,651	$385	2.06%
8013	1,564	$30,564	$357	1.17%
8014.01	1,339	$33,935	$337	0.99%
8014.02	1,003	$45,498	$281	0.62%
8015.01	2,077	$49,379	$309	0.63%
8015.02	1,444	$35,626	$318	0.89%
8015.03	1,908	$45,779	$319	0.70%
8016.01	2,327	$54,181	$316	0.58%
8016.02	2,436	$51,610	$307	0.60%
8016.03	1,568	$61,951	$315	0.51%
8016.04	1,557	$81,171	$312	0.38%
8016.05	2,975	$49,859	$319	0.64%
8017	2,386	$38,084	$331	0.87%
8018	2,018	$26,154	$362	1.38%
8019	2,861	$19,525	$408	2.09%
8020	1,200	$18,357	$304	1.66%
8021	2,718	$42,045	$351	0.83%
8022	1,141	$32,284	$365	1.13%
8023	2,285	$36,673	$338	0.92%
8024	1,575	$60,670	$298	0.49%
8025	2,860	$69,331	$292	0.42%
8026.01	2,670	$43,379	$305	0.70%
8026.02	680	$66,969	$281	0.42%
8104.04	2	$68,249	$205	0.30%
8104.12	3	$62,124	$48	0.08%
8107	3	$56,109	$445	0.79%
8109.02	2	$40,210	$298	0.74%
8134.01	30	$68,385	$281	0.41%
8134.03	4	$75,805	$314	0.41%
8136.01	9	$82,777	$401	0.48%
8136.02	20	$114,281	$597	0.52%
Total	**62,908**	**$40,588**	**$329**	1.04%

Table 5.6-3 illustrates the EPA Methodology projected out through 2035 with the applied rate increases provided by the financial planning model. Under this census detailed approach, the affordability within each census tract over the review period can be analyzed. Low income census tracts demonstrate a 6% burden in 2035 with the overall affordability index at 1.98% in 2035.

Table 5.6-3 Overview of Affordability throughout the Study Period by Percentage

Tract	Average Affordability index 2014	Average Affordability index 2015	Average Affordability index 2016	Average Affordability index 2017	Average Affordability index 2018	Average Affordability index 2019	Average Affordability index 2020	Average Affordability index 2021	Average Affordability index 2022	Average Affordability index 2023	Average Affordability index 2024
8001	0.83%	0.91%	0.99%	1.08%	1.20%	1.30%	1.36%	1.42%	1.43%	1.44%	1.46%
8002.01	0.69%	0.76%	0.82%	0.90%	1.00%	1.09%	1.14%	1.19%	1.19%	1.20%	1.22%
8002.02	0.60%	0.65%	0.71%	0.77%	0.86%	0.93%	0.98%	1.02%	1.02%	1.03%	1.05%
8003	0.69%	0.75%	0.81%	0.89%	0.99%	1.08%	1.12%	1.18%	1.18%	1.19%	1.21%
8004	0.73%	0.80%	0.87%	0.95%	1.05%	1.14%	1.20%	1.25%	1.25%	1.26%	1.28%
8005	0.66%	0.72%	0.78%	0.86%	0.95%	1.03%	1.08%	1.13%	1.13%	1.14%	1.16%
8006	2.59%	2.83%	3.08%	3.37%	3.74%	4.06%	4.25%	4.44%	4.45%	4.48%	4.56%
8007	2.30%	2.50%	2.72%	2.98%	3.31%	3.60%	3.76%	3.93%	3.94%	3.96%	4.03%
8008	2.20%	2.40%	2.61%	2.86%	3.17%	3.45%	3.60%	3.76%	3.78%	3.80%	3.86%
8009	3.25%	3.54%	3.86%	4.22%	4.69%	5.09%	5.32%	5.56%	5.58%	5.61%	5.71%
8011.01	3.31%	3.61%	3.93%	4.30%	4.78%	5.19%	5.42%	5.67%	5.69%	5.72%	5.82%
8011.02	1.49%	1.62%	1.76%	1.93%	2.14%	2.33%	2.43%	2.54%	2.55%	2.57%	2.61%
8012	2.06%	2.25%	2.45%	2.68%	2.97%	3.23%	3.37%	3.53%	3.54%	3.56%	3.62%
8013	1.17%	1.27%	1.39%	1.52%	1.68%	1.83%	1.91%	2.00%	2.00%	2.02%	2.05%
8014.01	0.99%	1.08%	1.18%	1.29%	1.43%	1.56%	1.62%	1.70%	1.70%	1.71%	1.74%
8014.02	0.62%	0.67%	0.73%	0.80%	0.89%	0.97%	1.01%	1.06%	1.06%	1.07%	1.08%
8015.01	0.63%	0.68%	0.74%	0.81%	0.90%	0.98%	1.02%	1.07%	1.07%	1.08%	1.10%
8015.02	0.89%	0.97%	1.06%	1.16%	1.29%	1.40%	1.46%	1.53%	1.53%	1.54%	1.57%
8015.03	0.70%	0.76%	0.83%	0.90%	1.00%	1.09%	1.14%	1.19%	1.20%	1.20%	1.22%
8016.01	0.58%	0.64%	0.69%	0.76%	0.84%	0.91%	0.95%	1.00%	1.00%	1.01%	1.02%
8016.02	0.60%	0.65%	0.71%	0.77%	0.86%	0.93%	0.98%	1.02%	1.02%	1.03%	1.05%
8016.03	0.51%	0.55%	0.60%	0.66%	0.73%	0.80%	0.83%	0.87%	0.87%	0.88%	0.89%
8016.04	0.38%	0.42%	0.46%	0.50%	0.55%	0.60%	0.63%	0.66%	0.66%	0.66%	0.67%
8016.05	0.64%	0.70%	0.76%	0.83%	0.92%	1.00%	1.05%	1.09%	1.10%	1.10%	1.12%
8017	0.87%	0.95%	1.03%	1.13%	1.25%	1.36%	1.42%	1.49%	1.49%	1.50%	1.53%
8018	1.38%	1.51%	1.64%	1.80%	2.00%	2.17%	2.27%	2.37%	2.38%	2.39%	2.43%
8019	2.09%	2.28%	2.48%	2.71%	3.01%	3.27%	3.42%	3.58%	3.59%	3.61%	3.67%
8020	1.66%	1.81%	1.97%	2.15%	2.39%	2.60%	2.71%	2.84%	2.85%	2.86%	2.91%
8021	0.83%	0.91%	0.99%	1.08%	1.20%	1.31%	1.37%	1.43%	1.43%	1.44%	1.46%
8022	1.13%	1.23%	1.34%	1.47%	1.63%	1.77%	1.85%	1.93%	1.94%	1.95%	1.98%
8023	0.92%	1.00%	1.09%	1.20%	1.33%	1.44%	1.51%	1.58%	1.58%	1.59%	1.62%
8024	0.49%	0.53%	0.58%	0.64%	0.71%	0.77%	0.80%	0.84%	0.84%	0.85%	0.86%
8025	0.42%	0.46%	0.50%	0.55%	0.61%	0.66%	0.69%	0.72%	0.72%	0.73%	0.74%
8026.01	0.70%	0.77%	0.83%	0.91%	1.01%	1.10%	1.15%	1.20%	1.21%	1.21%	1.23%
8026.02	0.42%	0.46%	0.50%	0.54%	0.60%	0.66%	0.69%	0.72%	0.72%	0.72%	0.74%
8104.04	0.30%	0.33%	0.36%	0.39%	0.43%	0.47%	0.49%	0.51%	0.51%	0.52%	0.53%
8104.12	0.08%	0.08%	0.09%	0.10%	0.11%	0.12%	0.13%	0.13%	0.13%	0.13%	0.14%
8107	0.79%	0.86%	0.94%	1.03%	1.14%	1.24%	1.30%	1.36%	1.36%	1.37%	1.39%
8109.02	0.74%	0.81%	0.88%	0.96%	1.07%	1.16%	1.21%	1.27%	1.27%	1.28%	1.30%
8134.01	0.41%	0.45%	0.49%	0.53%	0.59%	0.64%	0.67%	0.70%	0.71%	0.71%	0.72%
8134.03	0.41%	0.45%	0.49%	0.54%	0.60%	0.65%	0.68%	0.71%	0.71%	0.72%	0.73%
8136.01	0.48%	0.53%	0.57%	0.63%	0.70%	0.76%	0.79%	0.83%	0.83%	0.84%	0.85%
8136.02	0.52%	0.57%	0.62%	0.68%	0.75%	0.82%	0.86%	0.89%	0.90%	0.90%	0.92%
Total	1.04%	1.13%	1.23%	1.35%	1.50%	1.63%	1.70%	1.78%	1.79%	1.80%	1.83%

Tract	Average Affordability index 2025	Average Affordability index 2026	Average Affordability index 2027	Average Affordability index 2028	Average Affordability index 2029	Average Affordability index 2030	Average Affordability index 2031	Average Affordability index 2032	Average Affordability index 2033	Average Affordability index 2034	Average Affordability index 2035
8001	1.48%	1.48%	1.48%	1.49%	1.49%	1.49%	1.49%	1.50%	1.50%	1.54%	1.58%
8002.01	1.24%	1.24%	1.24%	1.24%	1.24%	1.24%	1.25%	1.25%	1.25%	1.29%	1.32%
8002.02	1.06%	1.06%	1.06%	1.06%	1.06%	1.07%	1.07%	1.07%	1.08%	1.10%	1.13%
8003	1.23%	1.23%	1.23%	1.23%	1.23%	1.23%	1.23%	1.24%	1.24%	1.27%	1.30%
8004	1.30%	1.30%	1.30%	1.30%	1.31%	1.31%	1.31%	1.31%	1.32%	1.35%	1.39%
8005	1.18%	1.18%	1.18%	1.18%	1.18%	1.18%	1.18%	1.19%	1.19%	1.22%	1.25%
8006	4.63%	4.63%	4.63%	4.63%	4.64%	4.64%	4.65%	4.66%	4.68%	4.80%	4.92%
8007	4.10%	4.10%	4.10%	4.10%	4.10%	4.11%	4.11%	4.13%	4.14%	4.25%	4.36%
8008	3.93%	3.93%	3.93%	3.93%	3.93%	3.94%	3.94%	3.96%	3.97%	4.07%	4.17%
8009	5.80%	5.81%	5.80%	5.81%	5.81%	5.82%	5.83%	5.85%	5.87%	6.02%	6.17%
8011.01	5.91%	5.92%	5.92%	5.92%	5.92%	5.93%	5.94%	5.96%	5.98%	6.13%	6.29%
8011.02	2.65%	2.66%	2.66%	2.66%	2.66%	2.66%	2.66%	2.67%	2.68%	2.75%	2.82%
8012	3.68%	3.68%	3.68%	3.68%	3.69%	3.69%	3.69%	3.71%	3.72%	3.82%	3.91%
8013	2.08%	2.09%	2.09%	2.09%	2.09%	2.09%	2.09%	2.10%	2.11%	2.16%	2.22%
8014.01	1.77%	1.77%	1.77%	1.77%	1.77%	1.78%	1.78%	1.79%	1.79%	1.84%	1.88%
8014.02	1.10%	1.10%	1.10%	1.10%	1.10%	1.11%	1.11%	1.11%	1.11%	1.14%	1.17%
8015.01	1.12%	1.12%	1.12%	1.12%	1.12%	1.12%	1.12%	1.12%	1.13%	1.16%	1.19%
8015.02	1.60%	1.60%	1.60%	1.60%	1.60%	1.60%	1.60%	1.61%	1.61%	1.65%	1.70%
8015.03	1.24%	1.24%	1.24%	1.24%	1.24%	1.25%	1.25%	1.25%	1.26%	1.29%	1.32%
8016.01	1.04%	1.04%	1.04%	1.04%	1.04%	1.04%	1.05%	1.05%	1.05%	1.08%	1.11%
8016.02	1.06%	1.06%	1.06%	1.06%	1.06%	1.07%	1.07%	1.07%	1.08%	1.10%	1.13%
8016.03	0.91%	0.91%	0.91%	0.91%	0.91%	0.91%	0.91%	0.91%	0.92%	0.94%	0.96%
8016.04	0.69%	0.69%	0.69%	0.69%	0.69%	0.69%	0.69%	0.69%	0.69%	0.71%	0.73%
8016.05	1.14%	1.14%	1.14%	1.14%	1.14%	1.14%	1.15%	1.15%	1.15%	1.18%	1.21%
8017	1.55%	1.55%	1.55%	1.55%	1.55%	1.56%	1.56%	1.56%	1.57%	1.61%	1.65%
8018	2.47%	2.47%	2.47%	2.47%	2.48%	2.48%	2.48%	2.49%	2.50%	2.56%	2.63%
8019	3.73%	3.73%	3.73%	3.73%	3.74%	3.74%	3.75%	3.76%	3.77%	3.87%	3.97%
8020	2.96%	2.96%	2.96%	2.96%	2.96%	2.97%	2.97%	2.98%	2.99%	3.07%	3.15%
8021	1.49%	1.49%	1.49%	1.49%	1.49%	1.49%	1.49%	1.50%	1.50%	1.54%	1.58%
8022	2.02%	2.02%	2.02%	2.02%	2.02%	2.02%	2.02%	2.03%	2.04%	2.09%	2.14%
8023	1.64%	1.65%	1.64%	1.65%	1.65%	1.65%	1.65%	1.66%	1.66%	1.70%	1.75%
8024	0.88%	0.88%	0.88%	0.88%	0.88%	0.88%	0.88%	0.88%	0.89%	0.91%	0.93%
8025	0.75%	0.75%	0.75%	0.75%	0.75%	0.75%	0.75%	0.76%	0.76%	0.78%	0.80%
8026.01	1.25%	1.26%	1.26%	1.26%	1.26%	1.26%	1.26%	1.26%	1.27%	1.30%	1.33%
8026.02	0.75%	0.75%	0.75%	0.75%	0.75%	0.75%	0.75%	0.75%	0.76%	0.78%	0.80%
8104.04	0.53%	0.54%	0.54%	0.54%	0.54%	0.54%	0.54%	0.54%	0.54%	0.55%	0.57%
8104.12	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.15%
8107	1.42%	1.42%	1.42%	1.42%	1.42%	1.42%	1.42%	1.43%	1.43%	1.47%	1.51%
8109.02	1.32%	1.32%	1.32%	1.32%	1.32%	1.33%	1.33%	1.33%	1.34%	1.37%	1.41%
8134.01	0.73%	0.73%	0.73%	0.73%	0.73%	0.74%	0.74%	0.74%	0.74%	0.76%	0.78%
8134.03	0.74%	0.74%	0.74%	0.74%	0.74%	0.74%	0.74%	0.74%	0.75%	0.77%	0.79%
8136.01	0.86%	0.86%	0.86%	0.87%	0.87%	0.87%	0.87%	0.87%	0.87%	0.90%	0.92%
8136.02	0.93%	0.93%	0.93%	0.93%	0.93%	0.94%	0.94%	0.94%	0.94%	0.97%	0.99%
Total	1.86%	1.86%	1.86%	1.86%	1.86%	1.86%	1.87%	1.87%	1.88%	1.93%	1.98%

Table 5.6-4 illustrates the EPA Methodology projected out through the time period to 2035 by census tract color coded as Low Burden (Green), Medium Burden (Orange) and High Burden (Red) as rate increases are applied each year to meet the capital planning funding requirements.

Table 5.6-4 Overview of Affordability throughout the Study Period by Burden Level

Tract	EPA Finanacial Capability Matrix 2014	EPA Finanacial Capability Matrix 2015	EPA Finanacial Capability Matrix 2016	EPA Finanacial Capability Matrix 2017	EPA Finanacial Capability Matrix 2018	EPA Finanacial Capability Matrix 2019	EPA Finanacial Capability Matrix 2020	EPA Finanacial Capability Matrix 2021	EPA Finanacial Capability Matrix 2022	EPA Finanacial Capability Matrix 2023	EPA Finanacial Capability Matrix 2024
8001	Low Burden	Low Burden	Low Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8002.01	Low Burden	Low Burden	Low Burden	Low Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8002.02	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8003	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8004	Low Burden	Low Burden	Low Burden	Low Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8005	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8006	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8007	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8008	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8009	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8011.01	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8011.02	Medium Burden	Medium Burden	Medium Burden	Medium Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8012	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8013	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	High Burden	High Burden	High Burden
8014.01	Low Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8014.02	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8015.01	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8015.02	Low Burden	Low Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8015.03	Low Burden	Low Burden	Low Burden	Low Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8016.01	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Medium Burden	Medium Burden	Medium Burden
8016.02	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8016.03	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden
8016.04	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden
8016.05	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8017	Low Burden	Low Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8018	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8019	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8020	Medium Burden	Medium Burden	Medium Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8021	Low Burden	Low Burden	Low Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8022	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8023	Low Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8024	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden
8025	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden
8026.01	Low Burden	Low Burden	Low Burden	Low Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8026.02	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden
8104.04	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden
8104.12	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden
8107	Low Burden	Low Burden	Low Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8109.02	Low Burden	Low Burden	Low Burden	Low Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8134.01	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden
8134.03	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden
8136.01	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden
8136.02	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden
Total	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden

Tract	EPA Finanacial Capability Matrix 2025	EPA Finanacial Capability Matrix 2026	EPA Finanacial Capability Matrix 2027	EPA Finanacial Capability Matrix 2028	EPA Finanacial Capability Matrix 2029	EPA Finanacial Capability Matrix 2030	EPA Finanacial Capability Matrix 2031	EPA Finanacial Capability Matrix 2032	EPA Finanacial Capability Matrix 2033	EPA Finanacial Capability Matrix 2034	EPA Finanacial Capability Matrix 2035
8001	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8002.01	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8002.02	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8003	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8004	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8005	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8006	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8007	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8008	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8009	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8011.01	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8011.02	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8012	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8013	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8014.01	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8014.02	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8015.01	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8015.02	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8015.03	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8016.01	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8016.02	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8016.03	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden
8016.04	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden
8016.05	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8017	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8018	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8019	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8020	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8021	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8022	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8023	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8024	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden
8025	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden
8026.01	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8026.02	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden
8104.04	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden
8104.12	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden
8107	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8109.02	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8134.01	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden
8134.03	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden
8136.01	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden
8136.02	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden
Total	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden

5.6.2 Enhanced Methodology Using a Weighted Average Residential Index

The Enhanced Methodology utilizes a calculation of the weight average residential index. Census data provides the income distribution of each census tract. Table 5.6-5 lists the 16 different bins of income for each census tract. Understanding income distribution is the critical element in assessing affordability issues for utility customers. Every census tract does not contain the same number of households. Household incomes are not evenly spread within each census tract data. A weighted-average calculation is required to resolve the problem of income skew.

Table 5.6-5 Income Distribution by Census Tract

Less than $10,000	$10,000 to $14,999	$15,000 to $19,999	$20,000 to $24,999	$25,000 to $29,999	$30,000 to $34,999	$35,000 to $39,999	$40,000 to $44,999	$45,000 to $49,999	$50,000 to $59,999	$60,000 to $74,999	$75,000 to $99,999	$100,000 to $124,999	$125,000 to $149,999	$150,000 to $199,999	$200,000 or more

Household Income

The average sewer bill is calculated by census tract. This average bill has a different financial impact at each income bin and for each census tract as demonstrated in Table 5.6-6.

Table 5.6-6 Income Distribution Affordability Index per Census Tract

number of Units	Average Bill by census Tract	$5,315	$13,289	$18,604	$23,919	$29,235	$34,550	$39,866	$45,181	$50,496	$58,470	$71,758
3,196	$291.18	5.48%	2.19%	1.57%	1.22%	1.00%	0.84%	0.73%	0.64%	0.58%	0.50%	0.41%
2,573	$288.38	5.43%	2.17%	1.55%	1.21%	0.99%	0.83%	0.72%	0.64%	0.57%	0.49%	0.40%
712	$304.51	5.73%	2.29%	1.64%	1.27%	1.04%	0.88%	0.76%	0.67%	0.60%	0.52%	0.42%
1,977	$295.88	5.57%	2.23%	1.59%	1.24%	1.01%	0.86%	0.74%	0.65%	0.59%	0.51%	0.41%
2,390	$304.80	5.73%	2.29%	1.64%	1.27%	1.04%	0.88%	0.76%	0.67%	0.60%	0.52%	0.42%
1,191	$326.23	6.14%	2.45%	1.75%	1.36%	1.12%	0.94%	0.82%	0.72%	0.65%	0.56%	0.45%
846	$453.96	8.54%	3.42%	2.44%	1.90%	1.55%	1.31%	1.14%	1.00%	0.90%	0.78%	0.63%
2,109	$347.19	6.53%	2.61%	1.87%	1.45%	1.19%	1.00%	0.87%	0.77%	0.69%	0.59%	0.48%
906	$376.28	7.08%	2.83%	2.02%	1.57%	1.29%	1.09%	0.94%	0.83%	0.75%	0.64%	0.52%
1,547	$404.71	7.61%	3.05%	2.18%	1.69%	1.38%	1.17%	1.02%	0.90%	0.80%	0.69%	0.56%
719	$518.62	9.76%	3.90%	2.79%	2.17%	1.77%	1.50%	1.30%	1.15%	1.03%	0.89%	0.72%
816	$304.06	5.72%	2.29%	1.63%	1.27%	1.04%	0.88%	0.76%	0.67%	0.60%	0.52%	0.42%
1,261	$384.52	7.23%	2.89%	2.07%	1.61%	1.32%	1.11%	0.96%	0.85%	0.76%	0.66%	0.54%
1,564	$356.89	6.71%	2.69%	1.92%	1.49%	1.22%	1.03%	0.90%	0.79%	0.71%	0.61%	0.50%
1,339	$336.83	6.34%	2.53%	1.81%	1.41%	1.15%	0.97%	0.84%	0.75%	0.67%	0.58%	0.47%
1,003	$280.99	5.29%	2.11%	1.51%	1.17%	0.96%	0.81%	0.70%	0.62%	0.56%	0.48%	0.39%
2,077	$308.85	5.81%	2.32%	1.66%	1.29%	1.06%	0.89%	0.77%	0.68%	0.61%	0.53%	0.43%
1,444	$318.47	5.99%	2.40%	1.71%	1.33%	1.09%	0.92%	0.80%	0.70%	0.63%	0.54%	0.44%
1,908	$318.80	6.00%	2.40%	1.71%	1.33%	1.09%	0.92%	0.80%	0.71%	0.63%	0.55%	0.44%
2,327	$316.10	5.95%	2.38%	1.70%	1.32%	1.08%	0.91%	0.79%	0.70%	0.63%	0.54%	0.44%
2,436	$307.44	5.78%	2.31%	1.65%	1.29%	1.05%	0.89%	0.77%	0.68%	0.61%	0.53%	0.43%
1,568	$314.59	5.92%	2.37%	1.69%	1.32%	1.08%	0.91%	0.79%	0.70%	0.62%	0.54%	0.44%
1,557	$311.76	5.87%	2.35%	1.68%	1.30%	1.07%	0.90%	0.78%	0.69%	0.62%	0.53%	0.43%
2,975	$318.69	6.00%	2.40%	1.71%	1.33%	1.09%	0.92%	0.80%	0.71%	0.63%	0.55%	0.44%
2,386	$331.06	6.23%	2.49%	1.78%	1.38%	1.13%	0.96%	0.83%	0.73%	0.66%	0.57%	0.46%
2,018	$362.22	6.81%	2.73%	1.95%	1.51%	1.24%	1.05%	0.91%	0.80%	0.72%	0.62%	0.50%
2,861	$408.01	7.68%	3.07%	2.19%	1.71%	1.40%	1.18%	1.02%	0.90%	0.81%	0.70%	0.57%
1,200	$304.29	5.72%	2.29%	1.64%	1.27%	1.04%	0.88%	0.76%	0.67%	0.60%	0.52%	0.42%
2,718	$350.62	6.60%	2.64%	1.88%	1.47%	1.20%	1.01%	0.88%	0.78%	0.69%	0.60%	0.49%
1,141	$364.72	6.86%	2.74%	1.96%	1.52%	1.25%	1.06%	0.91%	0.81%	0.72%	0.62%	0.51%
2,285	$337.80	6.36%	2.54%	1.82%	1.41%	1.16%	0.98%	0.85%	0.75%	0.67%	0.58%	0.47%
1,575	$297.56	5.60%	2.24%	1.60%	1.24%	1.02%	0.86%	0.75%	0.66%	0.59%	0.51%	0.41%
2,860	$291.92	5.49%	2.20%	1.57%	1.22%	1.00%	0.84%	0.73%	0.65%	0.58%	0.50%	0.41%
2,670	$305.01	5.74%	2.30%	1.64%	1.28%	1.04%	0.88%	0.77%	0.68%	0.60%	0.52%	0.43%
680	$280.88	5.28%	2.11%	1.51%	1.17%	0.96%	0.81%	0.70%	0.62%	0.56%	0.48%	0.39%

5.6.3 Calculation of the Weighted-Average Residential Index "WARi"

The Weighted-Average Residential Index or "WARi" takes into consideration that inside of every census tract, the households are segmented into the 16 standardized income bins based on US census data. The WARi calculation takes the percent of the population in each income bin and multiplies the population by the percentage of burden for that income bin and repeats the process for all income bins for each census tract. The average WARi is calculated for the entire service area.

Table 5.6-7 compares this calculation for 2014 only next to the EPA affordability index.

Table 5.6-7 Income Distribution Affordability Index per Census Tract (Comparison)

Tract	Average Bill as a percentage of Household Income	EPA Affordability Index
8001	1.64%	0.83%
8002.01	1.23%	0.69%
8002.02	0.97%	0.60%
8003	1.33%	0.69%
8004	1.30%	0.73%
8005	1.20%	0.66%
8006	3.56%	2.59%
8007	3.16%	2.30%
8008	2.90%	2.20%
8009	4.31%	3.25%
8011.01	4.38%	3.31%
8011.02	2.29%	1.49%
8012	3.22%	2.06%
8013	2.37%	1.17%
8014.01	2.05%	0.99%
8014.02	1.38%	0.62%
8015.01	1.41%	0.63%
8015.02	1.63%	0.89%
8015.03	1.22%	0.70%
8016.01	1.21%	0.58%
8016.02	1.09%	0.60%
8016.03	0.83%	0.51%
8016.04	0.71%	0.38%
8016.05	1.37%	0.64%
8017	1.45%	0.87%
8018	2.28%	1.38%
8019	3.43%	2.09%
8020	2.38%	1.66%
8021	1.76%	0.83%
8022	2.04%	1.13%
8023	1.37%	0.92%
8024	0.71%	0.49%
8025	0.71%	0.42%
8026.01	1.16%	0.70%
8026.02	0.69%	0.42%
8104.04	0.48%	0.30%
8104.12	0.14%	0.08%
8107	1.76%	0.79%
8109.02	1.34%	0.74%
8134.01	0.66%	0.41%
8134.03	0.84%	0.41%
8136.01	1.26%	0.48%
8136.02	1.08%	0.52%
Total	**1.53%**	**1.04%**

[redacted]

5.6.4 Weighted-Average Calculations for the Entire Study Period

As the Weighted-Average is applied throughout the entire study period to 2035, Table 5.6-8 illustrates the real affordability impact across the census tracts of the entire community.

Table 5.6-8: Projected Affordability Index per Census Tract (Enhanced Methodology)

Tract	Average Affordability index 2014	Average Affordability index 2015	Average Affordability index 2016	Average Affordability index 2017	Average Affordability index 2018	Average Affordability index 2019	Average Affordability index 2020	Average Affordability index 2021	Average Affordability index 2022	Average Affordability index 2023	Average Affordability index 2024	Average Affordability index 2025	Average Affordability index 2026	Average Affordability index 2027	Average Affordability index 2028	Average Affordability index 2029	Average Affordability index 2030	Average Affordability index 2031	Average Affordability index 2032	Average Affordability index 2033	Average Affordability index 2034	Average Affordability index 2035
8001	1.64%	1.79%	1.94%	2.13%	2.36%	2.57%	2.68%	2.80%	2.81%	2.83%	2.88%	2.92%	2.93%	2.93%	2.93%	2.93%	2.93%	2.94%	2.95%	2.96%	3.03%	3.11%
8002.01	1.23%	1.34%	1.46%	1.60%	1.78%	1.93%	2.02%	2.11%	2.12%	2.13%	2.17%	2.20%	2.20%	2.20%	2.20%	2.20%	2.21%	2.21%	2.22%	2.23%	2.28%	2.34%
8002.02	0.97%	1.06%	1.15%	1.26%	1.40%	1.52%	1.59%	1.66%	1.67%	1.68%	1.71%	1.73%	1.74%	1.74%	1.74%	1.74%	1.74%	1.74%	1.75%	1.75%	1.80%	1.84%
8003	1.33%	1.45%	1.58%	1.73%	1.92%	2.09%	2.18%	2.28%	2.29%	2.30%	2.34%	2.38%	2.38%	2.38%	2.38%	2.38%	2.39%	2.39%	2.40%	2.41%	2.47%	2.53%
8004	1.30%	1.42%	1.55%	1.69%	1.88%	2.04%	2.13%	2.23%	2.24%	2.25%	2.29%	2.33%	2.33%	2.33%	2.33%	2.33%	2.33%	2.34%	2.34%	2.35%	2.41%	2.47%
8005	1.20%	1.31%	1.43%	1.56%	1.73%	1.88%	1.97%	2.06%	2.07%	2.08%	2.11%	2.15%	2.15%	2.15%	2.15%	2.15%	2.15%	2.16%	2.16%	2.17%	2.23%	2.28%
8006	3.56%	3.88%	4.22%	4.62%	5.13%	5.58%	5.83%	6.09%	6.11%	6.14%	6.25%	6.35%	6.36%	6.36%	6.36%	6.36%	6.37%	6.38%	6.40%	6.42%	6.59%	6.75%
8007	3.16%	3.45%	3.75%	4.11%	4.56%	4.96%	5.18%	5.41%	5.43%	5.46%	5.56%	5.65%	5.65%	5.65%	5.65%	5.66%	5.66%	5.67%	5.69%	5.71%	5.86%	6.01%
8008	2.90%	3.15%	3.43%	3.76%	4.18%	4.54%	4.74%	4.95%	4.97%	5.00%	5.08%	5.17%	5.17%	5.17%	5.17%	5.18%	5.18%	5.19%	5.21%	5.23%	5.36%	5.49%
8009	4.31%	4.70%	5.12%	5.60%	6.22%	6.76%	7.06%	7.38%	7.41%	7.45%	7.58%	7.70%	7.70%	7.70%	7.71%	7.71%	7.72%	7.73%	7.76%	7.79%	7.98%	8.19%
8011.01	4.38%	4.77%	5.19%	5.68%	6.31%	6.86%	7.16%	7.49%	7.52%	7.56%	7.69%	7.81%	7.82%	7.82%	7.82%	7.83%	7.84%	7.84%	7.87%	7.90%	8.10%	8.31%
8011.02	2.29%	2.50%	2.72%	2.97%	3.30%	3.59%	3.75%	3.92%	3.93%	3.95%	4.02%	4.09%	4.09%	4.09%	4.09%	4.09%	4.10%	4.10%	4.12%	4.13%	4.24%	4.35%
8012	3.22%	3.51%	3.82%	4.19%	4.65%	5.05%	5.28%	5.52%	5.53%	5.57%	5.66%	5.75%	5.76%	5.76%	5.76%	5.76%	5.77%	5.78%	5.80%	5.82%	5.97%	6.12%
8013	2.37%	2.58%	2.81%	3.07%	3.41%	3.71%	3.88%	4.05%	4.07%	4.09%	4.16%	4.23%	4.23%	4.23%	4.23%	4.23%	4.24%	4.24%	4.26%	4.27%	4.38%	4.49%
8014.01	2.05%	2.23%	2.43%	2.66%	2.96%	3.21%	3.35%	3.51%	3.52%	3.54%	3.60%	3.66%	3.66%	3.66%	3.66%	3.66%	3.67%	3.67%	3.69%	3.70%	3.79%	3.89%
8014.02	1.38%	1.50%	1.64%	1.79%	1.99%	2.16%	2.26%	2.36%	2.37%	2.38%	2.42%	2.46%	2.46%	2.46%	2.47%	2.47%	2.47%	2.47%	2.48%	2.49%	2.55%	2.62%
8015.01	1.41%	1.54%	1.68%	1.83%	2.04%	2.21%	2.31%	2.42%	2.43%	2.44%	2.48%	2.52%	2.52%	2.52%	2.52%	2.53%	2.53%	2.53%	2.54%	2.55%	2.61%	2.68%
8015.02	1.63%	1.78%	1.93%	2.12%	2.35%	2.56%	2.67%	2.79%	2.80%	2.82%	2.86%	2.91%	2.91%	2.91%	2.91%	2.92%	2.92%	2.92%	2.93%	2.94%	3.02%	3.10%
8015.03	1.22%	1.33%	1.44%	1.58%	1.75%	1.91%	1.99%	2.08%	2.09%	2.10%	2.14%	2.17%	2.17%	2.17%	2.17%	2.17%	2.18%	2.18%	2.19%	2.19%	2.25%	2.31%
8016.01	1.21%	1.32%	1.44%	1.58%	1.75%	1.90%	1.99%	2.08%	2.09%	2.10%	2.13%	2.17%	2.17%	2.17%	2.17%	2.17%	2.17%	2.18%	2.18%	2.19%	2.25%	2.31%
8016.02	1.09%	1.19%	1.29%	1.41%	1.57%	1.71%	1.78%	1.86%	1.87%	1.88%	1.91%	1.94%	1.94%	1.94%	1.94%	1.95%	1.95%	1.95%	1.96%	1.96%	2.01%	2.07%
8016.03	0.83%	0.90%	0.98%	1.07%	1.19%	1.29%	1.35%	1.41%	1.42%	1.43%	1.45%	1.47%	1.48%	1.48%	1.48%	1.48%	1.48%	1.48%	1.49%	1.49%	1.53%	1.57%
8016.04	0.71%	0.77%	0.84%	0.92%	1.02%	1.11%	1.16%	1.21%	1.21%	1.22%	1.24%	1.26%	1.26%	1.26%	1.26%	1.26%	1.27%	1.27%	1.27%	1.28%	1.31%	1.34%
8016.05	1.37%	1.49%	1.63%	1.78%	1.98%	2.15%	2.24%	2.34%	2.35%	2.37%	2.41%	2.45%	2.45%	2.45%	2.45%	2.45%	2.45%	2.46%	2.46%	2.47%	2.54%	2.60%
8017	1.45%	1.58%	1.72%	1.88%	2.09%	2.27%	2.38%	2.48%	2.49%	2.51%	2.55%	2.59%	2.59%	2.59%	2.59%	2.59%	2.60%	2.60%	2.61%	2.62%	2.69%	2.75%
8018	2.28%	2.49%	2.71%	2.97%	3.29%	3.58%	3.74%	3.91%	3.92%	3.94%	4.01%	4.08%	4.08%	4.08%	4.08%	4.08%	4.09%	4.09%	4.11%	4.12%	4.23%	4.34%
8019	3.43%	3.74%	4.07%	4.45%	4.95%	5.37%	5.61%	5.87%	5.89%	5.92%	6.02%	6.12%	6.13%	6.12%	6.13%	6.13%	6.14%	6.15%	6.17%	6.19%	6.35%	6.51%
8020	2.38%	2.59%	2.82%	3.09%	3.43%	3.73%	3.89%	4.07%	4.08%	4.11%	4.18%	4.24%	4.25%	4.25%	4.25%	4.25%	4.26%	4.26%	4.28%	4.29%	4.40%	4.51%
8021	1.76%	1.92%	2.09%	2.29%	2.54%	2.76%	2.88%	3.01%	3.02%	3.04%	3.09%	3.14%	3.14%	3.14%	3.14%	3.15%	3.15%	3.15%	3.17%	3.18%	3.26%	3.34%
8022	2.04%	2.22%	2.42%	2.64%	2.94%	3.19%	3.33%	3.48%	3.50%	3.52%	3.58%	3.63%	3.64%	3.64%	3.64%	3.64%	3.64%	3.65%	3.66%	3.67%	3.77%	3.86%
8023	1.37%	1.50%	1.63%	1.78%	1.98%	2.15%	2.25%	2.35%	2.36%	2.37%	2.41%	2.45%	2.45%	2.45%	2.45%	2.46%	2.46%	2.46%	2.47%	2.48%	2.54%	2.61%
8024	0.71%	0.78%	0.85%	0.93%	1.03%	1.12%	1.17%	1.22%	1.23%	1.23%	1.26%	1.28%	1.28%	1.28%	1.28%	1.28%	1.28%	1.28%	1.29%	1.29%	1.32%	1.36%
8025	0.71%	0.78%	0.85%	0.93%	1.03%	1.12%	1.17%	1.22%	1.22%	1.23%	1.25%	1.27%	1.27%	1.27%	1.27%	1.28%	1.28%	1.28%	1.28%	1.29%	1.32%	1.35%
8026.01	1.16%	1.26%	1.37%	1.50%	1.67%	1.82%	1.90%	1.98%	1.99%	2.00%	2.03%	2.07%	2.07%	2.07%	2.07%	2.07%	2.07%	2.08%	2.08%	2.09%	2.14%	2.20%
8026.02	0.69%	0.76%	0.82%	0.90%	1.00%	1.09%	1.14%	1.19%	1.19%	1.20%	1.22%	1.24%	1.24%	1.24%	1.24%	1.24%	1.24%	1.24%	1.25%	1.25%	1.28%	1.32%
8104.04	0.48%	0.52%	0.57%	0.62%	0.69%	0.75%	0.78%	0.82%	0.82%	0.82%	0.84%	0.85%	0.85%	0.85%	0.85%	0.85%	0.85%	0.86%	0.86%	0.86%	0.88%	0.91%
8104.12	0.14%	0.15%	0.16%	0.18%	0.20%	0.21%	0.22%	0.23%	0.23%	0.23%	0.24%	0.24%	0.24%	0.24%	0.24%	0.24%	0.24%	0.24%	0.24%	0.25%	0.25%	0.26%
8107	1.76%	1.92%	2.09%	2.29%	2.54%	2.76%	2.89%	3.02%	3.03%	3.05%	3.10%	3.15%	3.15%	3.15%	3.15%	3.15%	3.16%	3.16%	3.17%	3.18%	3.27%	3.35%
8109.02	1.34%	1.46%	1.59%	1.74%	1.94%	2.11%	2.20%	2.30%	2.31%	2.32%	2.36%	2.40%	2.40%	2.40%	2.40%	2.40%	2.41%	2.41%	2.42%	2.42%	2.49%	2.55%
8134.01	0.66%	0.72%	0.78%	0.85%	0.95%	1.03%	1.08%	1.13%	1.13%	1.14%	1.16%	1.17%	1.18%	1.18%	1.18%	1.18%	1.18%	1.18%	1.18%	1.19%	1.22%	1.25%
8134.03	0.84%	0.92%	1.00%	1.09%	1.21%	1.32%	1.38%	1.44%	1.44%	1.45%	1.48%	1.50%	1.50%	1.50%	1.50%	1.50%	1.51%	1.51%	1.51%	1.52%	1.56%	1.60%
8136.01	1.26%	1.37%	1.49%	1.63%	1.81%	1.97%	2.06%	2.15%	2.16%	2.17%	2.21%	2.24%	2.25%	2.25%	2.25%	2.25%	2.25%	2.25%	2.26%	2.27%	2.33%	2.39%
8136.02	1.08%	1.18%	1.28%	1.40%	1.56%	1.69%	1.77%	1.85%	1.85%	1.86%	1.90%	1.93%	1.93%	1.93%	1.93%	1.93%	1.93%	1.93%	1.94%	1.95%	2.00%	2.05%
Total	1.53%	1.67%	1.82%	1.99%	2.21%	2.40%	2.51%	2.62%	2.63%	2.65%	2.69%	2.74%	2.74%	2.74%	2.74%	2.74%	2.74%	2.75%	2.76%	2.77%	2.84%	2.91%

Analysis of the projections from Table 5.6-8 would indicate that in 2018 the average weighted sewer bill affordability level would surpass the EPA's affordability threshold of 2% estimated at 2.12%. By 2035, the entire community's average sewer bill would reach a weighted average 2.79% ranging from 0.26% in high income areas to 8.31% in low income areas of the City of Springfield.

Table 5.6-9 codes Table 5.6-8 using Green for Low Burden, Orange for Medium Burden and Red for High Burden based on the EPA's use of percentage points.

Table 5.6-9: Financial Capability Matrix Projected Affordability (Enhanced Methodology)

Tract	EPA Finanacial Capability Matrix 2014	EPA Finanacial Capability Matrix 2015	EPA Finanacial Capability Matrix 2016	EPA Finanacial Capability Matrix 2017	EPA Finanacial Capability Matrix 2018	EPA Finanacial Capability Matrix 2019	EPA Finanacial Capability Matrix 2020	EPA Finanacial Capability Matrix 2021	EPA Finanacial Capability Matrix 2022	EPA Finanacial Capability Matrix 2023	EPA Finanacial Capability Matrix 2024	EPA Finanacial Capability Matrix 2025	EPA Finanacial Capability Matrix 2026	EPA Finanacial Capability Matrix 2027	EPA Finanacial Capability Matrix 2028	EPA Finanacial Capability Matrix 2029	EPA Finanacial Capability Matrix 2030	EPA Finanacial Capability Matrix 2031	EPA Finanacial Capability Matrix 2032	EPA Finanacial Capability Matrix 2033	EPA Finanacial Capability Matrix 2034	EPA Finanacial Capability Matrix 2035
8001	Medium Burden	Medium Burden	Medium Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8002.01	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8002.02	Low Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8003	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8004	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8005	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8006	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8007	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8008	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8009	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8011.01	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8011.02	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8012	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8013	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8014.01	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8014.02	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8015.01	Medium Burden	Medium Burden	Medium Burden	Medium Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8015.02	Medium Burden	Medium Burden	Medium Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8015.03	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8016.01	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8016.02	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	High Burden	High Burden
8016.03	Low Burden	Low Burden	Low Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8016.04	Low Burden	Low Burden	Low Burden	Low Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8016.05	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8017	Medium Burden	Medium Burden	Medium Burden	Medium Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8018	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8019	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8020	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8021	Medium Burden	Medium Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8022	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8023	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8024	Low Burden	Low Burden	Low Burden	Low Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8025	Low Burden	Low Burden	Low Burden	Low Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8026.01	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8026.02	Low Burden	Low Burden	Low Burden	Low Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8104.04	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden
8104.12	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden
8107	Medium Burden	Medium Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8109.02	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8134.01	Low Burden	Low Burden	Low Burden	Low Burden	Low Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8134.03	Low Burden	Low Burden	Low Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden
8136.01	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden
8136.02	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	Medium Burden	High Burden
Total	Medium Burden	Medium Burden	Medium Burden	Medium Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden	High Burden

Table 5.6-10 provides the "Financial Capability Matrix" based upon an Enhanced Methodology by taking into effect the weighted average of income distribution of households by census tract. The table shows the Phase 2 Permittee Financial Capability Indicators to be in the "Mid-Range" category, and is so color coded. This is because the average scores of the indicators (2.00 as indicated in Table 5.4-12) are between a factor of 1.5 and 2.5.

The Enhanced Phase 1 Residential Indicator under the new Weighted-Average methodology while using the EPA's scoring template shifts the EPA's simplified calculation of the level of MHI burden from Medium Burden (Table 5.5-1) to a Weighted Average calculated High Burden (Table 5.6-10).

Table 5.6-10 Weighted Average Financial Capability Matrix under Enhanced Methodology

PHASE 2: Economic Indicators	PHASE 1 : Residential Indicator		
	Low (below 1.0 %)	Mid-Range (between 1.0 and 2.0 %)	High (greater than 2.0 %)
Weak (Below 1.5)	Medium Burden	High Burden	High Burden
Mid-Range (Between 1.5 and 2.5)	Low Burden	Medium Burden	High Burden
Strong (Above 2.5)	Low Burden	Low Burden	Medium Burden

The new "High Burden" level combined with the demonstration of ever increasing unaffordable sewer bills as represented in Table 5.6-8 and Table 5.6-9 would suggest that SWSC would require a re-evaluation of both the cost of prescribed capital projects and the imposed timing of the capital projects.

The Commission service area customers before applying the additional financial burden of future capital investments of approximately $447 million (un-escalated) for CSO control, wastewater collection and treatment system, are already overwhelmed economically.

The City of Springfield faces de-population dropping below a critical 150,000 population number for federal funding opportunities. Commission customers face high unemployment with reduced municipal services. These types of economic hardships are not resolved quickly, but require decades to improve, and currently all indicators still show a steady decline. Nearly 30% of customers are below the poverty level which is double as compared to the U.S. poverty rates. Half of the households earned less than the adjusted MHI level of $40,588 which is still on the low side of even the U.S. median household income amount of $53,926 (adjusted for 2014).

Given such an income distribution skew in the Commission service area, the EPA's 1997 guidance and calculation of a 2% MHI against the entire area lacks accuracy and perspective of the impacts of CSO and wastewater collection and treatment system projects on rates and increased sewer bills on the affordability of services and sustainability of financial resources for the utility. The affordability impact is reviewed in different ways, utilizing a weighted average residential indicator, but the result is the same. The Commission customer base financial capacity is stressed, resulting in failing market financial metrics and weakening the financial stability of the Commission as a whole.

The Commission is able to meet some current funding requirements; however this still results in the bills of lower income level customers extending well above the 2% MHI in every census track across the service area. A MHI measurement ignores the impact on low income customers and the greater burden of project costs as a percentage of income. Under a Weighted Average calculation, the impacts at every income level for every census tract is known. Under the current control plan schedule and without any future reduction in capital project requirements, by 2035, the entire community's sewer bill would reach weighted average factor of 2.79%. When analyzing rates on a micro-community perspective sewer bills would range from 0.26% in high income areas to 8.31% in low income areas in the City of Springfield. These hard facts are calculated for households only. Commission business customers are also at risk, creating an additional financial uncertainty and stressing the already poor financial capacity indictors.

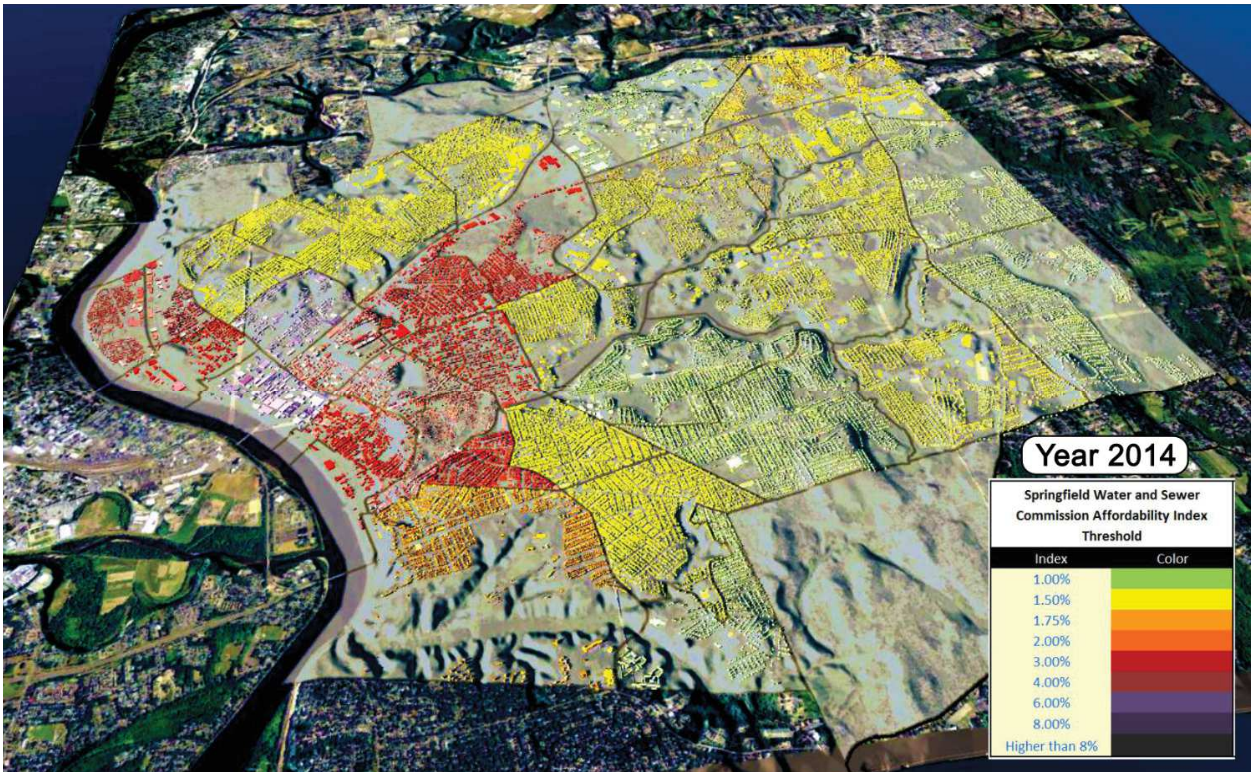
5.7 GIS 3-D MAPPING AND CENSUS TRACT DATA TIME SERIES

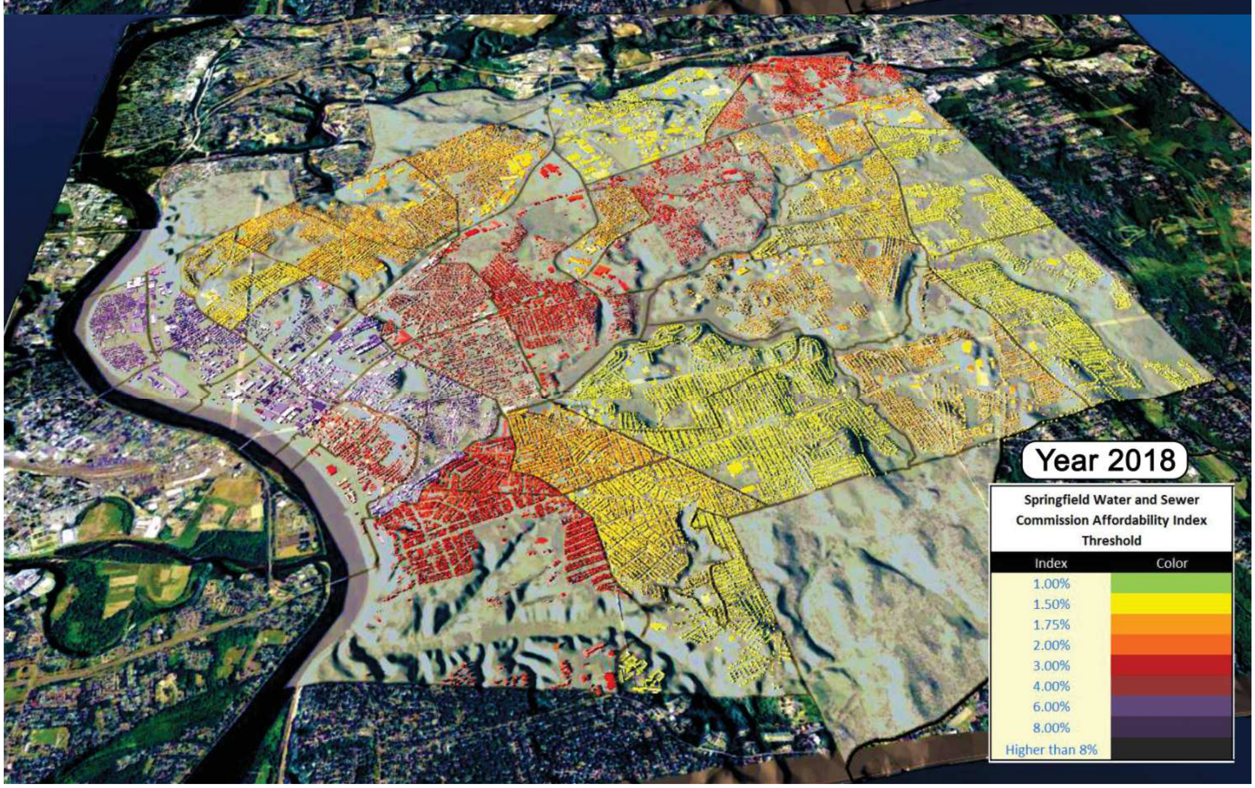
This section of the Financial Capability Assessment demonstrates the changes of the Affordability Index utilizing a time series approach on GIS 3-D maps of the City of Springfield.

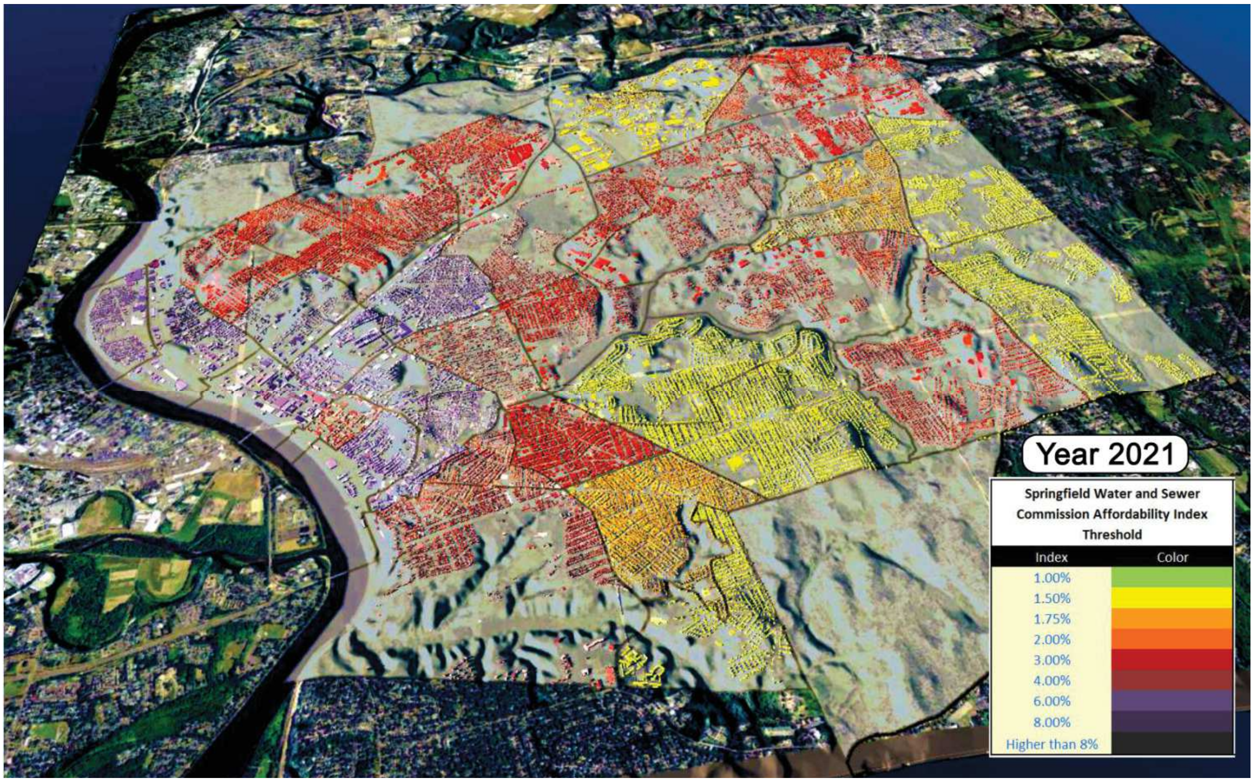
Years 2014, 2018, 2021 and 2035 are included. Year 2014 begins with the average annual bill by census tract already moving from weighted average 2% to 6% in the older, low income areas of the City. By 2018, following a steady stream of rate increases; the map illustrates how the new 2% threshold spreads through the City. By 2021 the city is at a 1.5% in only a few spots while the map is covered in red and purples representing the 2% to 6% MHI ranges. The last map from 2035 illustrates the permanent state of unaffordable bills through the entire service area with a majority of the households at about 2.79% and some low income households reaching as high as 8.3% of the weighted average scale.
Table.5.7-1 is the color key provided to understand how the various census tract's sewer bills become less affordable and to what degree using weighted average calculations.

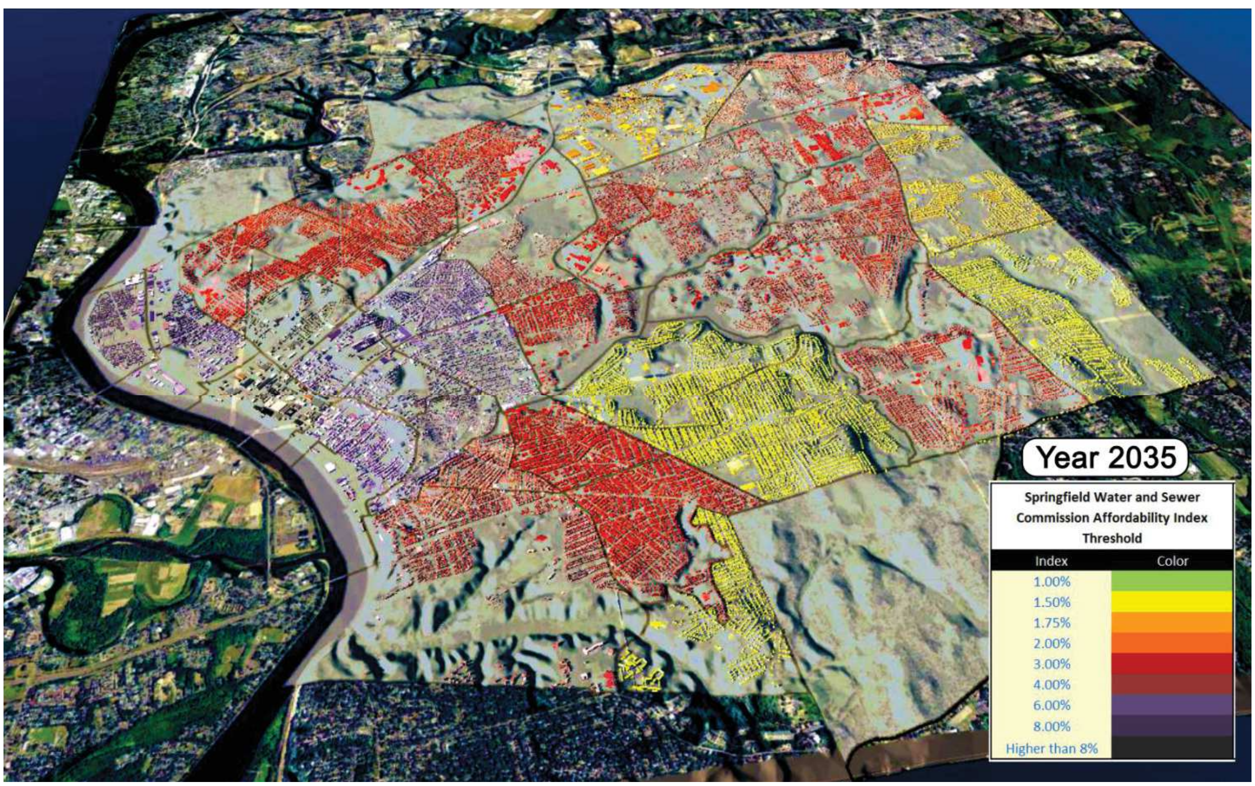
Table 5.7-1 GIS MAP Affordability Index per Census Tract Key

Level	Item	Index	Color
Low	Less than	1.00%	
Low-Mid	Up to	1.50%	
Mid	Up to	1.75%	
Mid-High	Up to	2.00%	
High	Up to	3.00%	
Higher	Up to	4.00%	
Highest	Up to	6.00%	
Really Really High	Up to	8.00%	
Extreme	Higher Than	8.00%	


Year 2014
Springfield Water and Sewer Commission Affordability Index Threshold
Index
Color
1.00%
1.50%
1.75%
2.00%
3.00%
4.00%
6.00%
8.00%
Higher than 8%


Year 2018
Springfield Water and Sewer Commission Affordability Index Threshold
Index
Color
1.00%
1.50%
1.75%
2.00%
3.00%
4.00%
6.00%
8.00%
Higher than 8%


Year 2021
Springfield Water and Sewer Commission Affordability Index Threshold
Index
Color
1.00%
1.50%
1.75%
2.00%
3.00%
4.00%
6.00%
8.00%
Higher than 8%


Year 2035
Springfield Water and Sewer Commission Affordability Index Threshold
Index
Color
1.00%
1.50%
1.75%
2.00%
3.00%
4.00%
6.00%
8.00%
Higher than 8%

This financial capacity section, with enhanced weighted average calculations on a micro-community level, provides solid evidence of the pending financial instability of the utility and the increasing level of unaffordable sewer bills placed on lower income households. These factors demonstrate the Commission community's financial capability reaches a high burden to undertake additional water quality related capital improvements, both to comply with regulatory requirements of U.S. Environmental Protection Agency (EPA) and Massachusetts Department of Environmental Protection (DEP). As a result, the Commission requests a reduction in capital project costs through reducing regulatory requirements and an extended schedule for the remaining projects.

Section 6
Integrated Wastewater Plan Implementation

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6.1 Integrated Wastewater Plan for Cost-Effective Water Quality Improvements

The intent of the Integrated Wastewater Program is to maximize water quality benefit through cost-effective improvements to be implemented over the next 40 years, while maintaining operation flexibility to react to changes. As described in Section 5, the cost of the program will generate an economic burden on its rate payers; however, the anticipated rate increases and residential indicator (RI) for affordability currently forecasted align with what is typically required for municipalities and utility owners implementing Long Term CSO control Plans (LTCPs). Moving forward, implementing the Integrated Wastewater Plan will require careful management, mindful of CWA goals, a changing regulatory environment, shifting economics and demographics, all while meeting the Commission's core service needs.

6.2 Integrated Planning Framework

As discussed in Section 1, the USEPA's Integrated Planning Framework (IPF) provides the flexibility to implement the most cost-effective CWA solutions in a sequence which will prioritize important projects first so that the most serious water quality and risk-based prioritization of wastewater collection and treatment system issues can be addressed sooner. The integrated planning approach does not lower compliance standards. Instead, it allows agencies to consider a municipal/utility owner's financial capability for meeting all CWA requirements and prioritizing infrastructure improvements. A summary of the consistency with the IPF demonstrated by the May 2012 FLTCP (incorporated by reference) and this Integrated Wastewater Plan follows in Section 6.3.4.

6.3 Commission Program Development

The CSO Control Plan continues to include specific CSO improvement projects and costs and considers the impacts of stormwater in the context of CSO control and water quality. The Wastewater Capital Improvement Plan continues to include short term, intermediate term and long term infrastructure improvement projects identified based on condition and risk assessment data for existing system assets. After parallel development of both plans, they were brought together to re-evaluate overall system priorities and were considered jointly when the Commission performed a re-evaluation of its financial capability assessment for implementation. Through an iterative financial analysis process that included the impact to rate payers for needed drinking water projects, the CSO Control and Wastewater Capital Improvement projects were re-prioritized and re-sequenced to identify an updated Integrated Wastewater Program which represents the most cost-effective and beneficial solutions to the community, while reducing risk. With this approach, the Commission can direct its resources to one comprehensive Integrated Wastewater Plan which optimizes benefit to receiving water quality, renewal of existing infrastructure, and value to the rate-payers. This program is consistent with the USEPA's guidelines for its Integrated Planning Framework.

6.3.1 Recommended CSO Control Plan

Table 6.3-1 presents a summary of the major components for the updated Recommended CSO Control Plan and the cost associated with those improvements. Further details applicable to the components of each project phase can be found in Section 4 in this text. Figure 6.3-1 shows the locations of the recommended improvements. Abbreviated program highlights are as follows.

Table 6.3-1: Recommended CSO Control Plan and Cost

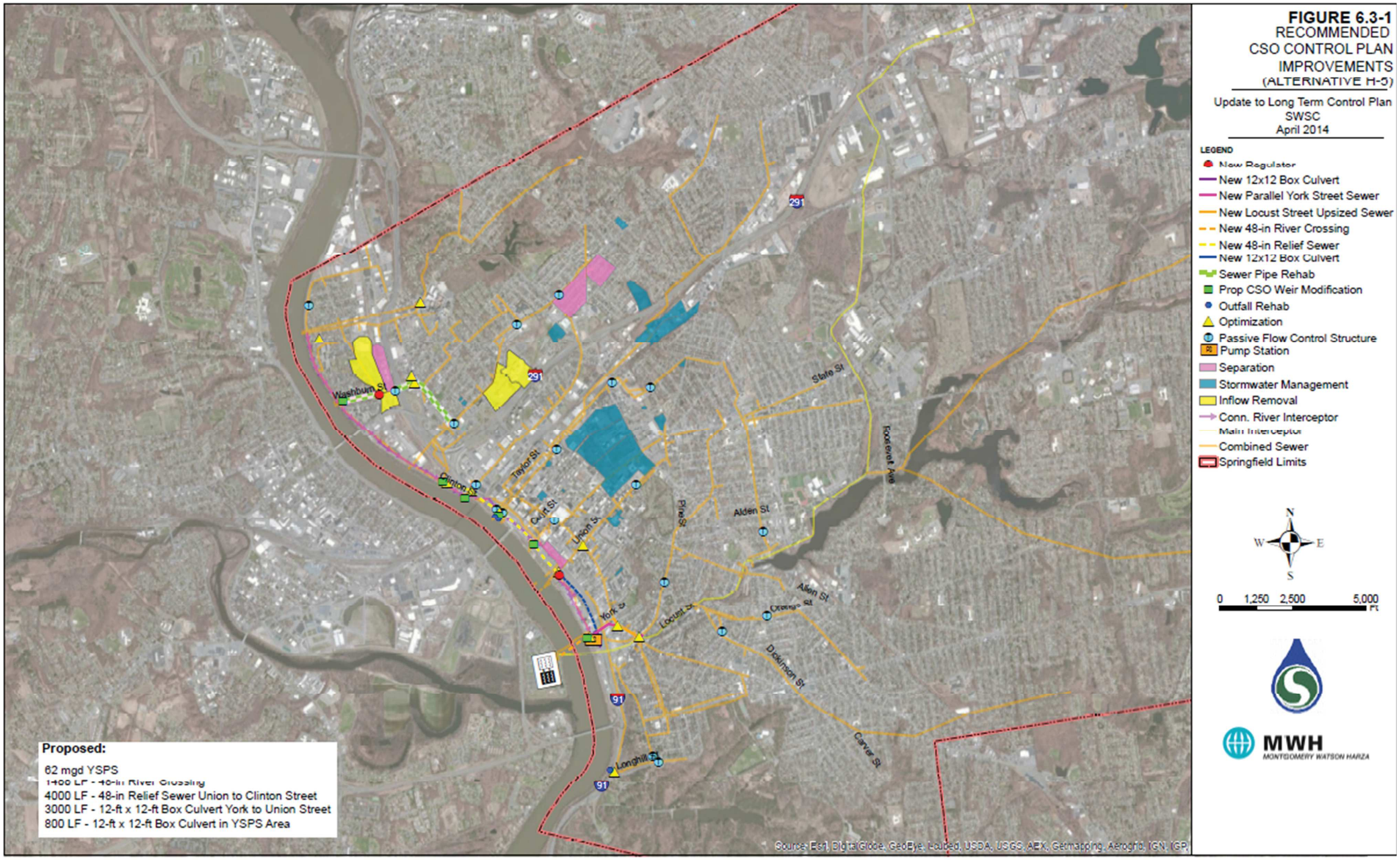
Recommended Improvement	Capital Cost (Nov 2013 Dollars)
Washburn CSO Control	$20,927,000
CSO 012/013/018 Modifications	$5,640,000
York Street Pump Station and River Crossing	$58,043,000
Locust Transfer Structure/Conduit and Flow Optimization in Mill System	$17,100,000
York to Union Box Culvert	$32,131,000
Union to Clinton Relief Conduit	$18,720,000
Targeted Sewer Separation, Stormwater Management, and Miscellaneous Flow Control and System Optimization	$30,761,000
Plan Total	**$183,323,000**
Previous CSO Projects	**$100,000,000**[1]
Total CSO Control Costs	**$283,323,000**

[1]Previous CSO Project Costs include debt service payments incurred to date (approximately $12M) in addition to $88M in capital monies previously committed.

Washburn CSO Control: Phase 1 of the Recommended CSO Control Plan, the Washburn CSO Control Project, is currently being constructed. The work in this project area consists of the separation of Washburn Street (includes relocation of Regulator 008 and inflow removal of storm drains) and Birnie Avenue. Two new flow control structures are installed, and in addition, throttling devices and weirs in the CSO 007 and CSO 049 regulator structures are modified. System optimization will also occur at Main Street/and Arch Street through the Garden Brook sewer and four high-level cross connections are established between the CSO 007 subcatchment and the CSO 008 subcatchment to improve combined sewer level of service in both areas. Finally, the 84-inch Washburn Street combined sewer and the 66-inch Garden Brook sewer will be rehabilitated to extend the service life of those critical conduits.

CSO 012/013/018 Modifications: The work in this project area consists of rehabilitation of the failing 012 and 013 outfall structures with maintenance of existing flood protection structures. Access to the CSO 018 infrastructure for inspection and maintenance will be improved, in addition to rehabilitation improvements to the outfall. Elimination of CSO 018 will be evaluated.

Figure 6.3-1: Recommended CSO Control Plan Improvements (Alternative H-5) – Updated



<u>York Street Pump Station (YSPS) and Connecticut River Crossing to Springfield Regional Wastewater Treatment Facility (SRWTF)</u>: The work in this project area consists of a new York Street Pump Station, which will be constructed to supplement pumping capacity from the existing York Street Pump Station to create a combined cross-river pumping capacity of 62 mgd. The river crossing is planned to be a 48-inch force main, approximately 1,400 LF long, running from the new pumping facility to the influent structure at the SRWTF. Additional improvements include provision of new flow control structures or optimization of existing structures in the Regulator catchments 010, 011, 012, 013, 014, 015A and 016.

<u>Locust Transfer Structure/Conduit and Flow Optimization in Mill System</u>: The work in this area consists of a Locust Street upsized sewer and new parallel York Street sewer that will be installed to allow for controlled diversion of Main Interceptor flow to York Street when needed for operational and maintenance activities. Two optimization structures along Locust St and four throttle structures will be added to optimize in-system storage of branch lines connecting to the Main Interceptor.

<u>York/Union Box Culvert</u>: The work in this project area consists of installing approximately 3,000 LF of 12-foot by 12-foot box culvert, which will extend from the CSO Regulator 016 structure on York Street to the CSO Regulator 015B structure at Union Street. In addition, 800 LF of box culvert will be constructed south of the York Street pump station on West Columbus Avenue from the CSO 016 regulator structure to the Main Interceptor's future cross connection pipe.

<u>Union/Clinton Relief Conduit</u>: This relief conduit is approximately 4,000 LF of 48-inch relief sewer running parallel to the CRI from the CSO 015B regulator structure at Union Street to the CSO 010 regulator structure at Clinton Street.

<u>Targeted Sewer Separation, Stormwater Management, and Miscellaneous Flow Control and System Optimization</u>: The work in this project area consist of approximately 3,000 LF of sewer separation in the East Columbus Avenue and South Main Street industrial and commercial areas, as well as 3,000 LF of sewer separation in the Liberty and Armory Street areas. There are also 180 acres of stormwater management improvements planned for Mercy Hospital, Albany Street, Springfield Technical Community College vicinities, and various other sites of the subcatchment. In addition, 40 acres of inflow removal is planned in the vicinity of Mercy Hospital. Flow control structures will be installed throughout the CSO 010, 011, 012, and 015 catchments.

Table 6.3-2 presents a summary of the Typical Year CSO activations for the updated Recommended CSO Control Plan (H-5) in terms of number of activations and total volume spilled. Under the updated Recommended CSO Control Plan the maximum number of CSO activations predicted is 7 for any one regulator structure and the average number of activations is 4.9 per regulator, each in the typical year (1976). The baseline CSO volume for the CRI system is predicted to be 441 MG- in the typical year (1976) and after implementation of the Recommended CSO Control Plan, the future total CSO volume discharge is predicted to be reduced to 59.0 MG in the typical year (1976).

Table 6.3-2: Recommended Alternative H-5 Summary of Overflows (Typical Year)

CSO Regulator/ By-Pass	Recommended CSO Control Plan (H-5) (Typical Year) # Activations	Volume (MG)
CSO 007	2	0.1
CSO 008	4	1.5
CSO 010	6	6.9
CSO 011	6	1.2
CSO 012	4	0.5
CSO 013	7	12.0
CSO 014	6	2.0
CSO 015A	6	6.1
CSO 015B	6	3.1
CSO 016	7	16.8
CSO 018	1	0.01
CSO 049	4	0.4
By-Pass 042	5	8.4
Totals	1-7 (Avg. 4.9)	59.0
% CSO Volume Reduction CRI		87%
% CSO Volume Reduction Total		89%

As indicated in the table above, the updated Recommended CSO Control Plan alternative achieves 87% CSO volume reduction for the CRI at completion and 89% CSO volume reduction system wide when adding the improvements already constructed in the Mill and Chicopee River systems. As stated in Section 4 of this text, the updated Recommended CSO Control Plan is considered equivalent to the previously selected Recommended CSO Control Plan, and thereby satisfies both the presumptive approach to compliance (elimination or capture for treatment of ≥85% by volume of the combined sewerage collected on a system-wide annual average basis) and demonstrative approach to compliance (≥ 95% water quality criteria compliance).

Upon completion, the Recommended CSO Control Plan results in the following CSO control level and capital expenditure using the typical year (1976) rainfall data:

- Baseline CSO volume per typical year (1976) (CRI, Mill, Chicopee systems) = 535.8 MG
- Final CSO volume per typical year (1976) (CRI, Mill, Chicopee systems) = 60.4 MG (89% CSO Volume Reduction, approximately 99% CSO Capture and Treatment)
- 1-7 CSOs (4.9 average) per typical year (1976) (approximately 99% receiving water quality compliance)

- $283.3M spent on CSO Reduction (including previous completed projects since 2000 and including $12M in debt service payments incurred to date on those projects)
- 475.2 MG removed (including previous completed projects since 2000)
- $96,000 spent per MG removed

6.3.2 Recommended WW Control Plan

The previously submitted Wastewater Capital Improvement Plan was developed on a parallel path to the CSO Control Plan to establish a system wide integrated plan for the Commission collection and treatment system. Since the submission of the May 2012 FLTCP, the Commission has continued to improve its existing collection system infrastructure through a program of targeted and prioritized infrastructure improvements. These improvements have included a continued plan of diagnostics and system assessment; improvements to the Commission's Asset Management Program which is used to prioritize the improvements and also improve Operations and Maintenance; continued cleaning of the existing infrastructure including the removal of grit, roots, and Fats, Oils and Grease (FOG) issues throughout the collection system; and improvements to structurally failing and aged collection system infrastructure. The Wastewater Capital Plan seeks collection and treatment system risk reduction through implementation of risk-based project prioritization, as described in Section 4.

6.3.2.1 Wastewater Plan Refinement

The updated Wastewater Capital Improvement Plan reflects the additional level of detail developed since the May 2012 FLTCP to refine risk-based analyses of the following Commission assets. Many project elements remain from its makeup in the May 2012 FLTCP. However, wastewater capital projects have been further refined, detailed, and/or re-prioritized in the following asset classes and with the following project identifications and/or enhancements:

- **Refinement of capital collection system pipe rehabilitation**
    - *Ashley and Pine Streets Sewer Rehabilitation Project:* This Project which included infrastructure improvements on Pine St, Ashley St, Lebanon St, Bay St and Sherman St (SWSC Contract CA-1216-12) was completed between the Summer 2012 and Spring 2013 for a total Project Cost of approximately $2,750,000.
    - *Allen/Bradley/Spruce Streets Sewer Rehabilitation Project:* This Project which included sewer system improvements on Allen Street, Bradley Rd, and Spruce St (SWSC Contract CA-1315-3) was started in June 2013 and was completed in August 2013 for a total Project Cost of approximately $380,000.
    - *Pine/Thompson/Ingersoll Grove Streets Sewer Rehabilitation Project:* The Pine St, Thompson St, and Ingersoll Grove Sewer Replacements Project (SWSC Contract CA-1405-14) started in October 2013 and will be completed in Spring 2014. The Project Cost is currently estimated at approximately $2,600,000.
    - *"21 Streets" Sewer Rehabilitation Project:* Design of the "21 Streets" Project began in late 2013 and construction is anticipated to begin in the Spring 2014. The work includes the rehabilitation and/or replacement of 10,600 LF of sewer infrastructure on Allen Street, Sumner Avenue, Wellington Street, Walnut Street,

Belmont Avenue, Andrew Street, Central Street, Sumner Chalmers Avenue, Saint James Avenue, Bay Street/Sherman Street/McKnight Street, Middlesex Street, Charter Avenue, and Armory Street. Capital construction costs are expected to total approximately $8.8 million.

- *Main Interceptor, Dickinson Siphon, CSO 018, and CSO 012/013 Outfalls Improvements Project:* This Project is in design and is expected to begin Construction in Winter 2015 with completion by Spring 2016. This project consists of rehabilitating/replacing the Main Interceptor, and eliminating the Dickinson Street Siphon by redirecting flow. Capital construction costs are expected to total approximately $12 million. Other project components dealing with eliminating CSO Outfall Pipe 018 by maximizing the use of upsystem capacity, and rehabilitating CSO Outfalls 012 and 013 are carried in the CSO CIP (capital construction costs are expected to total approximately $6 million).
- *67 Discrete Sites with Failed Sewers:* 67 additional discrete sites have been identified which have failing infrastructure that falls within the Risky and Failing Assets category. This list will be modified each year as new condition information comes in, as projects are completed, as priorities change, as rankings change, etc. At this time, it is estimated, to address the highest ranking remaining 67 sites, it will cost approximately $25M, spread out in 15 yearly $1.67M contracts
- Escalation of Capital pipeline rehabilitation project costs to November 2013 dollars from July 2011 dollars previously projected in the May 2012 FLTCP

- **Refinement of ongoing collection system assessment needs**
  - Update of progress toward assessment goals since May 2012 FLTCP and remaining resources to complete the system assessment
  - Escalation of collection system assessment project costs to November 2013 dollars from July 2011 dollars previously projected in the May 2012 FLTCP
- **Refinement of Capital improvements at SRWTF**
  - *SRWTF Electrical Distribution System Rehabilitation:* This Project has been identified amongst previously forecasted capital improvements projected for the SRWTF and will provide replacement of the 37-year-old electrical components there. Capital construction costs are expected to total approximately $20 million and to begin in 2015. This project requires re-prioritization of a portion of SRWTF capital funds previously programmed for later program phases
  - Escalation of Capital SRWTF improvement project costs to November 2013 dollars from July 2011 dollars previously projected in the May 2012 FLTCP
- **Refinement of capital improvements at pump stations**
  - Escalation of Capital pump station improvement project costs to November 2013 dollars from July 2011 dollars previously projected in the May 2012 FLTCP

6.3.2.2 Updated Wastewater Plan Costs

Table 6.3-3 presents a summary of the major components for the recommended Wastewater Capital Improvement Plan and the updated costs associated with those improvements. Due to uncertainties surrounding the financial picture on a distant time horizon, the financial model summarized in Section 5 of this text forecasts through FY 2035 which would represent an approximate 23 year Capital Plan (dating back to the May 2012 FLTCP). The Wastewater Capital Plan in its entirety is planned over a 40 year implementation period, which would extend through FY 2051. Costs and sequencing presented herein represent the full length Wastewater Capital Plan. Future affordability analyses will forecast into and beyond the FY2036 horizon as those years fit into an approximate 25-year future forecast.

Table 6.3-3: Recommended Wastewater Capital Improvement Plan and Cost

Recommended Improvement	Estimated Cost
Capital Pipe Rehabilitation Cost	$142,842,000
Continued Diagnostics and Pipeline Cleaning	$24,221,000
Capital Improvements at SRWTF (0-30 years)	$139,011,000
Capital Improvements at Pump Stations (3-10 years)	$2,325,000
Capital Improvements at Pump Stations (20-40 years)	$70,000,000
Misc. Annual Capital Improvements – Collection System / SRWTF / Pump Stations (0-20 years)	$16,800,000
Totals	**$395,199,000**

<u>Capital Pipe Rehabilitation Cost (0-30 years)</u>: This work consists of rehabilitation and/or replacement of approximately 240,500 LF of pipe. These costs are broken into multiple groups for the implementation and phasing in Table 6.3-6 and distributed as applicable to the identified projects and time periods.

<u>Continued Diagnostics and Pipeline Cleaning (0-30 years)</u>: This work includes assessing the remaining collection system pipe through CCTV inspection and cleaning, GIS and Risk Assessment model updates and continued CMOM activities associated with compliance maintenance.

<u>Capital Improvements at SRWTF (0-30 years)</u>: These improvements are three-fold. The first group consists of modifications to the bar screens by adjusting the screen size to 1.5 inches to improve hydraulic capacity through that process area, to be accomplished in the first 5 years of the Plan. The second group consists of general facility repairs and improvements, refurbish or replace the grit cyclones, grit classifiers and centrate (former filtrate) recycle pumps, repair the biofilter duct, replace or rehabilitate the air collection system for WAS tanks, replace or rehabilitate the butterfly valves in the ductwork from each sludge storage tank. The third group includes primary processes improvements and upgrade and expansion of the solids handling systems. Construction of a new grit and screenings facility that would replace two flumes, demolish two primary thickeners, construct two new grit tanks, modify the influent channels, install new sluice gates, piping modifications, replace the grit classifiers and associated piping, process instrumentation, electrical, and controls upgrades, rehabilitate ventilation and electrical system in the screening facility, and rehabilitate the biofilter at the influent structure. Capital improvements at the SRWTF in this group includes SRWTF electrical system distribution system rehabilitation

Capital Improvements at Pump Stations (3-10 years): These improvements include upgrades at nine pump stations including Rowland, York, Union, Clinton and Washburn to prevent failure or loss of function, eliminate critical life safety risk, or changes to meet standard codes. Additional improvements include upgrades at 12 other pump stations to prevent further deterioration.

Capital Improvements at Pump Station (20-40 years): Long term maintenance improvements at eight pump stations to prevent further deterioration.

Miscellaneous Annual Improvements in Collection System / SRWTF / Pump Stations (0-20 years): These improvements represent unidentified annual needs as they arise in the collection system (new collection system pipe, manhole rehabilitation, pipe rehabilitation and assessment), wastewater treatment improvements, and pump station improvements.

6.3.3 Integrated Wastewater Plan Implementation with Adaptive Management

6.3.3.1 CSO Plan Implementation

In the May 2012 FLTCP, the implementation schedule was developed after evaluation of numerous sequences of both CSO Control and Wastewater Capital Improvement Plans projects against the financial capability assessment, with implementation periods of 10 to 40 years considered. The financial capability assessment considered the financial impacts of both plans on rate payers since each is critical to overall water quality and core service requirements. For the May 2012 FLTCP document, an optimized implementation schedule was developed where CSO Controls would be constructed over a 20 year period and the Wastewater Capital Improvement Plan would be implemented over a 40 year period.

The re-evaluation of affordability (see Section 5 for further details) continues to consider both the CSO and Wastewater Capital Improvements Plans in conjunction when assessing the Commission's financial capabilities.

The updated H-5 alternative continues to serve as the Recommended CSO Control Plan, with minor updates as described in Section 4. The major components of H-5 continue to be packaged into projects for phased implementation, over a recommended 20 year period. Table 6.3-4 summarizes the Recommended CSO Control Plan implementation schedule.

Table 6.3-4: Recommended 20-Year Implementation of the CSO Control Plan

CSO Components		
Recommended Improvement	**Capital Cost (Nov 2013 Dollars)**	**Schedule**
Phase 1: Washburn CSO Control	$20,927,000	2012 - 2014

CSO Components		
Recommended Improvement	**Capital Cost (Nov 2013 Dollars)**	**Schedule**
Phase 1.5: CSO 012/013/018 Modifications	$5,640,000	2014-2016
Phase 2: York Street Pump Station and River Crossing	$58,043,400	2015 - 2020
Phase 3: Locust Transfer Structure/Conduit and Flow Optimization in Mill System	$17,100,000	2020 - 2021
Phase 4: York to Union Box Culvert	$32,131,000	2022-2029
Phase 5:Union to Clinton Relief Conduit	$18,720,000	2025-2030
Phase 6: Worthington/Clinton Targeted Sewer Separation and Stormwater Management	$30,761,000	2027-2031
Recommended Plan Totals	**$183,323,000**	**20 years**
Previous CSO Projects	**$100,000,000**[1]	**2000 - 2012**
Total CSO Control Costs	**$283,323,000**	

[1]Previous CSO Project Costs include debt service payments incurred to date (approximately $12M) in addition to $88M in capital monies previously committed.

Step-wise benefit from the implementation of the CSO Control Plan in terms of reduction of CSO activations and reduction in CSO volume is presented in Table **6.3-5.** A detailed breakdown by regulator structure is included in Appendix B.

Table 6.3-5: Cumulative CSO Reduction by Program Phase

Recommended Improvement	# Activations	Peak # Activations / Regulator	% Reduction in # Activations	CSO Volume (MG)	Cumulative % Reduction in CRI CSO Volume
Baseline	342	69	0%	441	0%
Phase 1 - Washburn CSO Control	334	68	2%	390	12%
Phase 1.5: CSO 012/013/018 Modifications	334	68	2%	390	12%
Re-Evaluate CSO Control Plan after Completion of Phase 1.5					
Phase 2 - York Street Pump Station and River Crossing	203	38	41%	216.7	51%
Re-Evaluate CSO Control Plan after Completion of Phase 2					
Phase 3 - Locust Transfer Structure/Conduit and Flow Optimization in Mill System	200	38	42%	213	52%
Re-Evaluate CSO Control Plan after Completion of Phase 3					
Phase 4 - York to Union Box Culvert	147	38	57%	181.2	59%

Recommended Improvement	# Activations	Peak # Activations / Regulator	% Reduction in # Activations	CSO Volume (MG)	Cumulative % Reduction in CRI CSO Volume
Re-Evaluate CSO Control Plan after Completion of Phase 4					
Phase 5 - Union to Clinton Relief Conduit	129	20	62%	112.0	75%
Re-Evaluate CSO Control Plan after Completion of Phase 5					
Phase 6 - Worthington/Clinton Sewer Separation and SWM	64	7	81%	59.0	87%
Re-Evaluate CSO Control Plan after Completion of Phase 6					

The proposed sequencing of the CSO control projects continues to provide a front loading of CSO reduction in the combination of Phases 1 and 2 (greater than 50% of program CSO volume reduction by completion of Phase 2) and works within the affordability framework for the rate payers. With a greater understanding of the configuration and additional level of detail reflected in the updated hydraulic model network (see Sections 2 and 4), the updated Recommended CSO Plan accomplishes equivalent CSO abatement as presented in the May 2012 FLTCP. While the pace of CSO reduction is more modest in the updated Recommended CSO Plan, CSO goals are met while minimizing risk to the collection system and its impacted users.

In addition, the initial CSO projects continue to provide a third river crossing that allows more flow to Bondi Island for treatment and provides critical existing system redundancy which aligns with the risk based prioritization for wastewater capital projects.

6.3.3.2 Wastewater Plan Implementation

Table 6.3-6 provides a summary and projected schedule for the Wastewater Capital Improvement Plan components. This Plan reflects the additional level of detail developed since the May 2012 FLTCP to refine risk-based analyses of the following Commission assets. Wastewater capital projects have been further detailed and/or re-prioritized in the following phased asset classes:

- capital improvements at pump stations (Phases 1 and 10)
- collection system (Phases 2 and 7),
- ongoing collection system assessment needs (Phases 3 and 8)
- capital improvements at SRWTF (Phases 4, 5, 6, and 9)

Table 6.3-6: Recommended 40-Year Implementation of the Wastewater Capital Improvement Plan

Wastewater Capital Plan Components		
Recommended Improvement	**Estimated Capital Cost (Nov 2013 $)**	**Schedule**
Phase 1 – Capital Improvements at Pump Stations	$2,325,000	2016 - 2024
Phase 2a – Collection system pipe rehab – Ashley/Pine	$2,750,000	2012
Phase 2b – Collection system pipe rehab – Pine/Thompson/Grove	$2,600,000	2014
Phase 2c – Collection system pipe rehab – Allen/Bradley/Spruce	$1,067,000	2013 - 2014
Phase 2d – Collection system pipe rehab – '21 Streets'	$8,700,000	2014 - 2015
Phase 2e – Collection system pipe rehab – Main Interceptor	$12,780,000	2014 - 2016
Re-Evaluate WW Plan after Completion of Phase 2e		
Phase 2f – Collection system pipe rehab – 67 failing sites	$25,000,000	2017 - 2031
Phase 2g – Collection system pipe rehab - Miscellaneous	$30,017,000	2016 - 2031
Re-Evaluate WW Plan on 5-yr Interval During Course of Phases 2f and 2g		
Phase 3a – Continuing pipeline diagnostics – FY2013	$3,000,000	2012
Phase 3b – Continuing pipeline diagnostics – FY2014	$3,700,000	2013
Phase 3c – Continuing pipeline diagnostics – FY2015	$3,000,000	2014
Phase 3d – Continuing pipeline diagnostics – FY2016	$3,000,000	2015
Phase 3e – Continuing pipeline diagnostics – FY2017-2031	$2,220,000	2016 - 2031
Phase 4 – Bar Screen facility upgrades	$212,000	2015 - 2017
Phase 5 – Capital Improvements at the SRWTF – Elec Distribution System Rehab	$20,000,000	2015 - 2035
Re-Evaluate WW Plan on 5-yr Interval During Course of Phase 5		
Phase 6 – Grit and screenings facility at the SRWTF	$36,464,000	2021 - 2025
Re-Evaluate WW Plan at completion of Phase 6		
Phase 7 – Additional collection system pipe rehabilitation and replacement	$59,928,000	2032 - 2041
Phase 8 – Additional pipeline diagnostics	$9,301,000	2032 - 2041
Re-Evaluate WW Plan on 5-yr Interval During Course of Phases 7 and 8		
Phase 9 – Capital Improvements at the SRWTF	$82,335,000	2032 - 2041
Re-Evaluate WW Plan on 5-yr Interval During Course of Phase 9		

Wastewater Capital Plan Components		
Recommended Improvement	**Estimated Capital Cost (Nov 2013 $)**	**Schedule**
Phase 10 – Capital Improvements at Pump Stations	$70,100,000	2032 - 2051
Re-Evaluate WW Plan on 5-yr Interval During Course of Phase 10		
Phase 11 - Misc. Annual Capital Improvements – Collection System / SRWTF / Pump Stations	$16,800,000	2014 - 2031
WW CIP Totals	**$395,199,000**	**40 years**

6.3.3.3 Adaptive Management

The Integrated Wastewater Plan continues to recommend an adaptive management approach be taken during the implementation of each of the CSO and Wastewater Plans. Re-evaluations of the Integrated Plan should be regular and comprehensive in nature and are indicated in Tables 6.3-5 and 6.3-6. Re-evaluations of each plan are recommended after each CSO phase and during and after key Wastewater phase milestones.

During re-evaluations, the overall plan, measured performance, and cost of the Integrated Plan should be evaluated against the implementation schedule and adapted to the latest conditions. This will allow the Commission and the EPA and DEP to re-evaluate the Integrated Plan based on measured performance, financial and affordability changes, and new regulations so that it can be tailored to fit future conditions and priorities. Re-evaluation of the IWP will maintain flexibility for the Commission in achieving CWA goals while engaging stakeholders to evaluate plan progress and the implementation schedule in light of changing economic conditions, technologies, water quality conditions, and regulatory environment. Each of these implementation features aligns with EPA's integrated planning guidance.

In addition to periodic comprehensive reviews of the IWP, an annual update to the affordability model is recommended to be undertaken, to incorporate new information gathered and to coincide with and inform the annual capital budgeting process.

6.3.4 Integrated Wastewater Plan Summary

Following on the development and production of the May 2012 FLTCP, the Commission has refined its Integrated Wastewater Plan (IWP) by updating and re-prioritizing its 20-year CSO Control Plan and 40-year Wastewater Capital Improvements Plan. Each plan was re-evaluated on parallel paths and projects re-prioritized using a risk-based asset management approach. Key CSO and Wastewater projects have been identified and described in the IWP due to the risk and criticality of failure each presented to water quality and levels-of-service. Furthermore, the Commission continues to recommend an adaptive management approach to Integrated Wastewater Plan implementation which will allow periods to re-evaluate the integrated program after critical milestones.

Both plans and projected stormwater expenditures were incorporated into a detailed financial model to determine overall IWP affordability. The financial analysis indicates that shorter implementation periods would create an adverse financial burden to the rate payers. Similarly, an emphasis on one plan over the other (CSO Control vs. Wastewater Capital) would place undue risk to both water quality and levels-of-service throughout the system. The IWP seeks to strike a balance between the requirements for water quality goals and existing system needs within the financial limits of the rate-payer community, while being sustainable and adaptable to adjust to changing needs.

The updated recommended implementation program is designed to achieve greater than one half of the full program's ultimate CSO reduction in the earliest phases of the program (see Table 6.3-5) yet retain enough financial flexibility to perform needed existing system wastewater capital projects. The first three phases are high impact projects in terms of CSO reduction with an average cost of $377,000/ million gallons of CSO removed which is an efficient use of limited capital. This compares with a final program efficiency of $571,000/million gallons removed as steps to reduce CSO volumes become more difficult and cost intensive.

In addition, these early projects provide critical system redundancy and risk reduction with a third river crossing, and provide the Commission enhanced O&M ability in the form of the opportunity to more effectively inspect, maintain, and rehabilitate, if needed, the existing river crossings. The age, condition and criticality of the two river crossings were identified as the highest risk assets (other than the Main Interceptor sewer), in the existing system. Therefore the early phases of the CSO Control Plan implementation also address the highest Wastewater Capital Improvement Plan priorities.

At the same time, the implementation program continues to provide for other critical wastewater capital projects identified in the risk based model that will address existing system needs, including pipe rehabilitation and replacement, limited improvements to pump stations and the treatment plant, and continuing collection system diagnostics that identify additional collection system needs. These needs cannot be ignored at the expense of the CSO Control Plan since they represent a high risk to water quality and levels-of-service as well.

This Integrated Wastewater Plan, including updates to the CSO and Wastewater Capital Plans, the re-evaluation of affordability, and refinement of the implementation schedule and adaptive management approach, plus the original May 2012 FLTCP (incorporated by reference) together represents an Integrated Plan consistent with the EPA's Integrated Planning Framework (IPF). Section 1 of this Integrated Wastewater Plan summarized the means in which the May 2012 FLTCP complies with the six elements of IPF. Sections 2 through 6 of this Integrated Wastewater Plan continue to demonstrate consistency with IPF as follows:

- **Element 1:** A description of the water quality, human health, and regulatory issues to be addressed in the plan.
    - Sensitive areas and environmental concerns have been identified in Section 3 of this Integrated Wastewater Plan.

- **Element 2**: A description of existing wastewater and stormwater systems under consideration and summary information describing the systems' current performance.
  - Section 2 of this Integrated Wastewater Plan discusses recent temporary and permanent monitoring of rainfall and sewer flows undertaken of the wastewater and stormwater collection systems, in addition to updates to system modeling of existing conditions and flow characterization of CSO behavior and bacteria loadings.
  - Section 4 of this Integrated Wastewater Plan discusses opportunities for stormwater management via green infrastructure improvements at a number of potential sites in the study area

- **Element 3**: A process which opens and maintains channels of communication with relevant community stakeholders in order to give full consideration of the views of others in the planning process and during implementation of the plan.
  - Regulatory coordination has taken place since submission of the May 2012 FLTCP as summarized in Section 1 of this Integrated Wastewater Plan. Annual reporting of Plan performance continues to occur in accordance with the Commission's Nine Minimum Controls (NMC) program
  - This Integrated Wastewater Plan does not appreciably change the Integrated Wastewater Plan from the May 2012 FLTCP, submitted after continuous public engagement during the Plan's development. Upon acceptance of the Integrated Wastewater Plan, public meetings and hearings are anticipated to be held to update stakeholders on changes.

- **Element 4:** A process for identifying, evaluating, and selecting alternatives and proposing implementation schedules.
  - Section 4 of this Integrated Wastewater Plan discusses updates to the recommended CSO Control Plan including description, costs, performance, implementation schedule, benefit to receiving water quality, and post-construction monitoring program. Alternatives evaluation criteria from the May 2012 FLTCP are incorporated by reference and were unchanged for the purposes of this Integrated Wastewater Plan.
  - Section 4 of this Integrated Wastewater Plan discusses updates to the wastewater capital improvements plan, developed via an extensive asset assessment program, which employed a risk model to prioritize infrastructure improvements. Section 4 highlights asset management and risk based prioritization criteria and incorporates by reference criteria and evaluation procedures from the May 2012 FLTCP.
  - Section 5 of this Integrated Wastewater Plan discusses an updated financial capability assessment that reflects recent priority infrastructure spending undertaken by the Commission and a greater understanding of the financial implications of the Integrated Wastewater Program on the Commission's customer base.

  - Section 6 of this Integrated Wastewater Plan discusses the updated Integrated Wastewater Program implementation, including the planning framework, implementation schedule, and program summary.

- **Element 5**: A process for evaluating the performance of projects identified in a plan as the projects identified in the plan are being implemented, which may include evaluation of monitoring data, information developed by pilot studies, and other relevant information.
  - Section 4 of this Integrated Wastewater Plan highlights post-construction monitoring practices to be implemented that address hydraulic model suitability, including performance criteria, measures of success, and reporting requirements, the full details of which are incorporated by reference and were unchanged for the purposes of this Integrated Wastewater Plan.
  - Section 4 of this Integrated Wastewater Plan discusses the evaluation of the performance of green infrastructure and other innovative measures

- **Element 6:** A process for identifying, evaluating and selecting proposed new projects or modifications to ongoing or planned projects and implementation schedules based on changing circumstances.
  - Section 6 of this Integrated Wastewater Plan continues the recommendation of the May 2012 FLTCP of re-evaluations of the CSO Control Plan and Wastewater Plan as part of the Integrated Wastewater Plan's adaptive management approach. Updates to the financial affordability model are recommended to be undertaken annual, during the annual Commission budgeting process. Additionally, recommended comprehensive re-evaluations of the CSO Plan are sequenced after each completed CSO phase and during and after many key Wastewater phase milestones. Re-evaluation of the IWP will maintain flexibility for the Commission in achieving CWA goals while engaging stakeholders to evaluate plan progress and the implementation schedule in light of changing economic conditions, technologies, water quality conditions, and regulatory environment.

APPENDIX A

Appendix A

Recent LTCP-related Correspondence between SWSC and DEP

Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection

Western Regional Office • 436 Dwight Street, Springfield MA 01103 • 413-784-1100

DEVAL L. PATRICK
Governor

TIMOTHY P. MURRAY
Lieutenant Governor

RICHARD K. SULLIVAN JR.
Secretary

KENNETH L. KIMMELL
Commissioner

Ms. Kathy Pedersen, Executive Director
Springfield Water and Sewer Commission
P.O. Box 995
Springfield, MA 01101-0995

April 30, 2012

Re: Springfield - WWM
Combined Sewer Overflow (CSO)
Final Long Term Control Plan
Draft CSO-Specific Abatement Plan

Dear Ms. Pedersen:

The Massachusetts Department of Environmental Protection (MassDEP) has reviewed the Springfield Water and Sewer Commission's (SWSC) January 17, 2012 "Draft CSO- Specific Abatement Plan" (the "plan"). Review of the plan was made alongside review of printouts provided at the January 17, 2012 meeting, SWSC financial information provided February 3, 2012, and previous information provided by SWSC. Submittal of the plan was made in fulfillment of MassDEP April 22, 2011 and EPA September 13, 2011 letters, which required such a plan prior to the submittal of Springfield's Final Long Term Control Plan ("FLTCP") in May 2012. MassDEP's comments on the plan are found below.

Plan Assumptions:
Due to the number of variables, the complexity of the work proposed and other uncertainty associated with developing the plan and a FLTCP, SWSC has made a number of assumptions in the plan. As noted in the specific comments in this letter, some of those assumptions may result in construction and capital cost estimates within the plan that could be higher than actual costs subsequently incurred for each project. As a result, actual costs may be lower than estimated in the plan.

As noted in the document, SWSC proposes a Level of Control ("LOC") that is less (lower) than complete elimination of all CSO regulators and CSO discharge. The lower LOC is proposed because the cost of complete elimination cannot be achieved with the funds available by raising the Residential Sewer Rate to 2% of median household income ("MHI"). The plan does not detail at this time if non-residential sewer rates will be raised. The LOC proposed by SWSC in the plan is to retain all 24 existing CSO regulators, allowing up to 8 CSO discharges per year per regulator.

MassDEP has not approved a LOC within a FLTCP to date that provides for more than 4 untreated CSO discharges/year, per CSO regulator. Based upon SWSC's reliance on limitations resulting from the limited sewer rate increases, the requirements of existing water quality standards, and the necessary reliance on estimated project costs and level of control, MassDEP suggests that the plan and subsequent FLTCP consider an approach where SWSC's design objective in the first 3 phases of CSO projects (from 2012 -2020, as shown on page 6-120 of the plan) will be to reduce the frequency of CSO discharge to 4 discharges per CSO regulator/year, with provision to update the FLTCP following completion of such first 3 phases of CSO projects. At that time SWSC and MassDEP can better evaluate whether SWSC can achieve a LOC of 4 untreated CSO discharges/year, and whether a closer evaluation of non-residential Sewer Rates within Springfield is warranted at that time.

Background:
Springfield presently discharges approximately 64% of the 700 million gallons per year (MG/yr) of remaining untreated CSO discharge in Western Massachusetts. Therefore, SWSC's forthcoming FLTCP is pivotal to reducing the frequency and volume of untreated CSO discharges to the receiving waters in Western Massachusetts. Springfield is one of nine CSO communities in Western Massachusetts required to develop a FLTCP, seven of which completed FLTCP's and identified their LOC's as follows:

- five FLTCP's recommended the highest achievable LOC, Complete Elimination of all CSO regulators and all CSO discharges. As of December 2010, all those five communities had achieved this LOC, resulting in cumulative elimination of 71 CSO regulators and all CSO discharges.
- two FLTCP's recommended a lesser (lower) LOC than Complete Elimination, and were closely reviewed. By CY 2029 their LOC's will result in elimination of approximately 478 of their cumulative 492 MG/yr of untreated CSO discharge, and elimination of 29 of their cumulative 33 CSO regulators. The four remaining CSO regulators are limited to a frequency of 4 untreated CSO discharges per year, verified by empirical on-site monitoring.

The eighth Western Massachusetts CSO community has eliminated 80% of its untreated CSO discharge since Calendar Year ("CY") 2000 and has 12 remaining CSO regulators. It will be following Springfield in development of its FLTCP to further reduce its frequency and volume of its CSO discharge.

Every CSO discharge is a violation of Springfield's NPDES Permit (as the Chicopee and Connecticut Rivers are classified as Class B waters under the MA water quality standards - MA CMR 4.00), therefore any recommended LOC less than Complete Elimination will be closely scrutinized to ensure that the resulting frequency of CSO discharge is minimized to the maximum extent possible.

Springfield's January 17, 2012 CSO-Specific Abatement Plan ("the plan"), and related information:

1. The plan evaluates a number of treatment options, alternatives, combinations of alternatives (summarized on pages 6-58 and 6-107) in an effort to guide Springfield to the highest LOC attainable within calculated affordability constraints while also taking into account (in terms of costs) the need for additional collection system improvements resulting from deferred maintenance.
2. The plan provides the following lowest estimated Capital costs to achieve various LOC's:

LOC	Estimated Capital Cost, Alternative (reference Page #)	Volume of annual CSO discharge (MG/yr) (1976 typical year)	Remaining CSO regulators	Frequency of CSO discharge (1976 typical year)
Complete Elimination of all CSO discharge and CSO regulators	$ 682,200,000 Separation (page 6-51)	0.0 MG/yr, all years	No remaining CSO regulators	No CSO discharges, all years
No CSO discharge to CT River during largest 1976 storm., 4 CSO discharges per year from Chicopee & Mill River CSO' s Some CSO to CT River during larger storms	$ 370,900,000 Hybrid (page 6-51)	0.0 MG/yr to CT River , 1.3 MG/yr to Mill & Chicopee Rivers. Additional CSO discharges to CT River during larger storms than 1976 storms.	All 24 existing CSO regulators to remain (7 Mill River, 4 Chicopee River, 13 CT River (including WWTP CSO 042")	No discharges to CT River. Some discharge to CT river for larger storms than 1976. 4 discharges/yr to Mill and Chicopee Rivers
4 untreated CSO discharges/year, or less, per CSO regulator	$ 311,600,000 Hybrid "S-8" (S8C-2C-Mill4a) (pgs 6 – 108)	25.7 MG/yr to CT River, 1.3 MG/yr to Mill & Chicopee Rivers	All 24 CSO regulators remain	Up to 4 discharges/year per CSO regulator

6 untreated discharges/year, or less, per CSO regulator	$ 196,280,000 Hybrid "H-4" (H4-Mill-4a) (page 6-111)	35.0 MG/yr to CT River, 1.3 MG/yr to Mill & Chicopee Rivers	All 24 CSO regulators remain	Up to 6 discharges/year per CSO regulator
8 untreated discharges/year, or less, per CSO regulator	$ 135,943,000 Hybrid "H-5" (combination of Hyb S-8 & H-4) (page 6-113)	56.9 MG/yr to CT River, 1.3 MG/yr to Mill & Chicopee Rivers	All 24 CSO regulators remain	Up to 8 discharges/year per CSO regulator

3. Estimated Capital cost for the LOC of Complete Elimination is provided at approximately $682 million dollars (page 6-51). This amount greatly exceeds the initial estimated affordability threshold of $225 to $266 million dollars discussed and presented in the January 17, 2012 handouts.
4. The plan cites affordability constraints, and proposes a lesser (lower) LOC than Complete Elimination. At this time, MassDEP is receptive to a LOC less than Complete Elimination, based upon the affordability constraints, provided that the resulting frequency of CSO discharge is minimized to the maximum extent, within affordability constraints. A LOC of 4 untreated discharges/year, or less, per remaining CSO regulator is the maximum frequency of untreated CSO discharge allowed in any Western Massachusetts FLTCP to date, and is therefore the next desired attainable LOC.
5. The plan proposes an even lesser (lower) LOC of 8 untreated CSO discharges/year, to be achieved within 20 years by recommended alternative H-5 at an estimated cost of approximately $ 136 million dollars. The $136 million dollars targeted for CSO abatement in the next 20 years is a portion of the $200 million dollars over 20 years resulting from raising the annual residential sewer fee to approximately 2% of Median Household Income (MHI).
6. Of the $200 million dollars resulting from a residential 2% MHI annual sewer fee, approximately $64 million dollars is expected to be required for non-CSO collection system wastewater projects within the next 20 years. In addition, approximately $184 million dollars in other non-CSO wastewater projects is expected to be required in years 20 through 40.
7. Page 6-120 of the plan provides a schedule for the recommended Alternative H-5 work, divided among 6 different time frames and Recommended Improvements , as follows:

Date	Project(s)	Estimated Cost	Reduction of CSO Volume
2012 - 2014	Washburn CSO 08 Abatement	$ 15,000,000	65 MG/yr
2015 - 2016	Union St/Clinton St Conduit	$ 14,400,000	*Not provided*
2015 - 2020	York St PS, Union St Box Culvert, and Ct River Crossing	$ 79,640,000	*Not provided*
2020 - 2027	Worthington sewershed Stormwater Management and Sewer Separation	$ 11,421,000	*Not provided*
2025 - 2029	Clinton sewershed Stormwater Management and Sewer Separation	$ 7,482,000	*Not provided*
2027 - 2031	Mill River Interceptor Sewer Separation and Locust St Transfer	$ 8,000,000	*Not provided*
Total		**$ 135,943,000**	**393 MG/yr**

8. The proposed Alternative H-5 work would be a major step forward in CSO abatement in Springfield; reportedly removing 87% of Springfield's remaining volume of CSO discharge.
9. Affordability analysis presented in the January 17, 2012 meeting indicated that the existing annual Residential Sewer bill is approximately $352, approximately one percent of the reported median household income (MHI) of $36,700. As mentioned in comment 3, the analysis indicated that $225

to $266 million dollars of additional sewer debt, accumulated over the next 20 years, would cause annual Residential Sewer bills to approach an affordability threshold of 2% MHI.

10. SWSC financial information for CY 2010 provided by SWSC on February 3, 2012 is summarized by DEP on Table A, attached at the end of this letter. As shown on Table A, there was approximately 31.3 million gallons per day (MGD) of billed wastewater within the SWSC service area in CY 2010, with approximately 18.0 MGD coming from sewer users within the City of Springfield and 13.3 MGD coming from contracted satellite communities. Of the 18.0 MGD from Springfield sewer users, approximately 10.3 MGD was contributed by Springfield Residential users and approximately 5.0 MGD average was contributed by Solutia.
11. As shown on Table A the calculated average-overall sewer rate of all classes of sewer users in the City of Springfield is approximately $2.23/100 cubic feet of billed wastewater, and $1.78/100 cubic feet of billed water use, of which the Residential Sewer Rate is $3.09/100 cubic feet used in the affordability values presented at the January 17, 2012 meeting.

Specific Comments

12. The schedule of recommended Alternative H-5 work, as shown on page 6-120 of the plan, and discussed in comment 7 of this letter, should include the incremental reduction in CSO volume in each phase of work.
13. The design objective of the first 3 phases of CSO projects (from 2012-2020), as shown on page 6-120 of the plan and in comment 7 of this letter, should be to reduce the frequency of untreated CSO discharge to 4 discharges per CSO regulator/year, or less. Due to the wide range of Construction Cost (from 50 % too high to 30% too low, page 6-15 of plan) and high estimated Capital Cost estimates (capital cost estimated as 150% of the "high-average" Construction Cost estimates –page 6-31 of plan, and market interest rates were assumed instead of CWSRF rates), actual cost of such CSO projects will be better known at completion of design. It is possible that CSO projects could in fact reduce the maximum frequency of untreated CSO discharge to less than the 8 maximum untreated discharges per CSO regulator recommended in the plan, with the reported $136 million to $266 million dollars available over the next 20 years. With the objective of 4 untreated CSO discharges per year, or less, built into the first three phases of projects and with actual capital costs to date known at the time, an evaluation of Springfield's ability to achieve a LOC of 4 CSO discharges/year, or less, per remaining CSO regulator can be evaluated in 2020 after completion of the first 3 phases of projects.
14. Gains from improvements to the collection system, both from the CSO control projects and collection system upgrades completed by 2020 should be factored into the future cost estimates discussed in comment 13 above.
15. If the evaluation discussed in comment 13 above indicates that a LOC of 4 untreated CSO discharges/year cannot be achieved by raising the Residential Sewer Rate to 2 % MHI alone, closer evaluation of other Sewer Rates within Springfield (including Solutia) will be warranted.

Other Comments:

16. Any remaining CSO regulator weir overflows , and any remaining or proposed throttling devices (example: vortex valves) within the Springfield combined sewer system will be required to have clear visual access above overflow weirs and throttling devices, so as to field verify frequency of CSO overflows and proper operation of throttling devices.
17. Page 6-9, first paragraph, regarding York Street Pump Station. It is believed that the Connecticut River Interceptor (CRI) actually acts as storage due to the limited depth of the York Street Pump Station wet well and the on-off settings of the pumps, which possibly reduces hydraulic capacity of CRI and causes additional CSO discharge. Modifications as part of the pump station upgrades (or construction of the parallel pump station referenced as "New CRI pump station" on page 6-101) to relieve this problem should be considered..

18. Page 6-10: Stormwater Runoff Management: To attenuate peak stormwater flow into the combined sewer system (and therefore attenuate peak wet weather flow rate in CSO regulators), stormwater treatment (and related costs) is not required if such stormwater does not discharge to a receiving surface water, but instead re-enters the combined system after peak flow rates have subsided.
19. Page 6-13: third paragraph: Private Inflow sources. The FLTCP should list all known private inflow sources and those discovered during the recent FLTCP work, by sewershed and address. Such private inflow sources could be candidates for Inflow management, at later date, if frequency of CSO discharges remains unacceptably high.
20. Demonstration Approach vs. Presumption Approach clarification:
    a. Use of the Demonstration Approach is correct in Massachusetts. As stated on Page 6-6 of the plan: SWSC LTCP Approach to Compliance : "DEP's guidelines and the EPA Demonstration Approach were used as a framework for selecting the preferred alternative and demonstrating compliance with DEP's CSO control policy and water quality standards"
    b. Page 6-4: *Presumption Approach*: The EPA Presumption Approach (85% CSO removal, average of 4 overflow events per year) is not applicable to compliance with MA water quality standards, as any CSO discharge in MA violates the existing MA Class B water quality standards.
    c. Page 6-114: first full paragraph, Recommended Alternative H-5: As mentioned in comments 20 a. and 20 b. above, the Demonstration Approach, and *not the Presumption Approach*, is to be used. Justification for Alternative H-5 as the recommended alternative should not come from meeting Presumption Approach (85% CSO removal, "average" of four CSO discharges). However, the first paragraph on Page 6-114 discusses the Recommended H-5 alternative in this way by stating:

       " The H-5 alternative was selected as the recommended CSO abatement plan since it provides > *85% CSO capture* at a lower cost than the other hybrid alternatives. As explained in Section 6.2.1, the *EPA presumption approach to compliance presumes water quality standards are met when a CSO control plan satisfies the condition of elimination or capture for treatment > 85% by volume* of the combined sewerage collected on a system wide annual basis. *The SWSC recommended plan would reduce CSO volume by 89% for the typical year upon completion, which is a conservative estimate for meeting the EPA's presumption approach guidelines".*

Note that Comment # 13 of this letter recommends that the design objective of the first 3 phases of CSO projects (from 2012 -2020, as shown on page 6-120 of the plan is to reduce the frequency of CSO discharge to 4 discharges per CSO regulator/year, or less. Also note that Comment # 15 of this letter states that closer evaluation of other Sewer Rates within Springfield (including Solutia) will be warranted, if the evaluation to be performed in 2020 (upon completion of the first 3 phases in 2020) indicates that a Level of Control ("LOC") of 4 untreated CSO discharges/year cannot be achieved by raising the Residential Sewer Rate to 2% of median household income ("MHI") alone. If there are any questions, please contact Kurt Boisjolie at (413)-755-2284.

Respectfully,

Brian D. Harrington
Deputy Regional Director
Bureau of Resource Protection

Attachment : Table A

cc: Josh Schimmel, SWSC
Matt Travers, Melissa Carter: MWH, 12 Farnsworth St, 2nd F, Boston MA 02210
Tom Ritchie, Kleinfelder/SEA
Mike Wagner, Doug Koopman, Gina Snyder: EPA Region 1,
Kurt Boisjolie, Mark Casella, MassDEP

wpc/CSO/KSWSCcsoSpcfcFLTCPCmnts4.27.12

TABLE A

Following Table prepared by DEP from Information on Pages 11, 12, 12, and 14 of SWSC's Revenue Document: (Official Nov 9, 2010 Statement General Revenue Bonds, 2010 Series B), attached to SWSC Feb 3, 2012 e-mail

SWSC 2010 Annual Information

1	2	3	4	5	6
User Type	**Listed Sewer Rate** Page 11	**Cumulative Sewer Sales Volume 100 Ft3 /year**	**Percent % Sewer / *Water* Sales Volume**	**Sewer Sales Annual $**	**Calc Sewer Rate (Col 5 /Col 3)**
Residential	$ 3.09/100 Ft3	5,043,730 **(10.3 MGD)**	95 % *(water = 5,338137)*	$ 13,445,959	**$ 2.66 /100 Ft3** ($ 2.52 *Water vol*)
Commercial	$ 3.40/100 Ft3	762,824 (1.6 MGD)	53 % *(water = 1,432,980)*	$ 2,380,012	$ 3.12/100 Ft3 ($ 1.65 *Water vol*)
Industrial	$ 3.71/100 Ft3	221,730 (0.4 MGD)	37 % *(water = 594,405)*	$ 753,881	$ 3.40 /100 Ft3 ($ 1.26 *Water vol*)
Munic/other	Not Listed	78,692 (0.2 MGD)	67 % *(water = 117,800)*	$ 222,698	$ 2.83 /100 Ft3 ($1.90 *Water vol*)
Food Service	$4.02/100 Ft3	61,736 (0.1 MGD)	? *(no water volume info)*	$227, 807	$ 3.69 /100 Ft 3
Hospital	$ 3.40/100 Ft3	201,883 (0.4 MGD)	? *(no water volume info*	$ 629, 875	$ 3.12 /100 Ft3
Solutia	Contract	2,440,107 **(5.0 MGD)**	71 % *(water = 3,429,809)*	$ 1,999,189	**$ 0.82 /100 Ft3** ($0.58 *Water vol*)
Sub Total all classes Sewer Users in Springfield,		8,810,703 Ft3/yr (18.0 MGD) = 6.6 Billion Gal/yr	**80 %** 8,810,703 sewer sales volume divided by 10,958,131 water sales volume in Springfield	$ 19,659,421 from all classes Springfield Sewer users	**$ 2.23 /100 Ft3** AVG all classes sewer users in Springfield **($1.78 /100 Ft3 *Water sales volume*)**
Wholesale (Contracted Communities)	Contract	6,491,834 **(13.3 MGD)** = 4.9 Billion Gal/yr	N/A	$ 5,318,784	$ 0.82/ 100 Ft3
Cumulative Total (Springfield & Contracted Communities)		15,302,537 Cumulative Sewer Sales Volume **(31.3 MGD)** = 11.5 Billion Gal/yr *	**$ 24,978,205** Annual Sewer Sales CY 2010 *(water sales CY 2010 = $ 20,802,186)* Total CY 2010 Sewer and Water Sales of $45,780,391 **		$1.63 /100 Ft 3

* Column 3 (Cumulative): 11.5 Billion Gallons/year (BG/yr) Sewer Sales Volume compares to 14.6 BG/yr Total of annual CSO discharge & Flow Treated at Bondi's WWTP (0.5 BG/yr CSO modeled & 14.1 BG/yr WWTP metered flow per DMR's) in CY 2010.

** Column 5 (Cumulative): Total Sewer and Water Sales of $45,780,391 in 2010 ($24,978,205 Sewer + $20,802,186 *Water*, listed on Page 13 and Page 12 respectively of SWSC Official Statement), is $6,926,591 less than the $52,706,982 in User Fees Revenue for 2010 listed at the top of page 14 of SWSC Official Statement.

SPRINGFIELD WATER AND SEWER COMMISSION

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July 12, 2012

Mr. Brian D. Harrington
Deputy Regional Director
Bureau of Resource Protection
MA Department of Environmental Protection
436 Dwight Street
Springfield, MA 01103

Re: 4-30-2012 DEP Comments to SWSC Draft Long Term Control Plan

Dear Mr. Harrington:

The Springfield Water and Sewer Commission ("SWSC") has submitted its Final Long Term Control Plan ("FLTCP") in accordance with US EPA Administrative Order Docket No. 08-037 et al. In addition to this submittal, the Commission is herein providing a response to the comments received April 30, 2012. MADEP provided comments on the *CSO Specific Abatement Plan* and other information provided to it and USEPA on January 17, 2012.

Response to comments are below each section of the text as copied from the original MADEP letter.

Plan Assumptions:
Due to the number of variables, the complexity of the work proposed and other uncertainty associated with developing the plan and a FLTCP, SWSC has made a number of assumptions in the plan. As noted in the specific comments in this letter, some of those assumptions may result in construction and capital cost estimates within the plan that could be higher than actual costs subsequently incurred for each project. As a result, actual costs may be lower than estimated in the plan.

The Commission and its consulting engineers have prepared the FLTCP in accordance with the USEPA Combined Sewer Overflows Guidance for Long Term Control Plan (EPA 832-B-95-002), and as such have followed parameters established within the guidance document on assumptions made within the plan. Construction cost estimates for this report are planning level estimates and, as such, have an inherent level of uncertainty associated with them. Actual costs for projects ultimately constructed may be more or less than currently identified. However, the approach used reflects standard practices presented by the USEPA guidance documents including the use of published cost curves and is appropriate for this level of project development.

> MassDEP has not approved a LOC within a FLTCP to date that provides for more than 4 untreated CSO discharges/year, per CSO regulator. Based upon SWSC's reliance on limitations resulting from the limited sewer rate increases, the requirements of existing water quality standards, and the necessary reliance on estimated project costs and level of control, MassDEP suggests that the plan and subsequent FLTCP consider an approach where SWSC's design objective in the first 3 phases of CSO projects (from 2012 -2020, as shown on page 6-120 of the plan) will be to reduce the frequency of CSO discharge to 4 discharges per CSO regulator/year, with provision to update the FLTCP following completion of such first 3 phases of CSO projects. At that time SWSC and MassDEP can better evaluate whether SWSC can achieve a LOC of 4 untreated CSO discharges/year, and whether a closer evaluation of non-residential Sewer Rates within Springfield is warranted at that time.

Concerning the assertion that MADEP has not approved a FLTCP with greater than four overflows per year, the Commission respectfully defers to all available guidelines and documents that support the development of a FLTCP none of which make mention of regional historical precedence as a design or planning parameter. The FLTCP is specific to the community submitting it, and should reflect the specific circumstances affecting the community pursuant to the available guidance documents and publications. EPA stated, in its CSO Policy, that a key principle is "Providing sufficient flexibility to municipalities, especially disadvantaged communities, to consider the site-specific nature of CSOs and to determine the most cost-effective means of reducing pollutants and meeting CWA objectives and requirements." (59 Fed. Reg. 18688, 18689 (Apr. 19. 1994)). EPA has confirmed this principle in its own guidance, stating that "flexibility is an important aspect of the CSO Policy." ("Combined Sewer Overflows – Guidance for Financial Capability Assessment and Schedule Development," EPA 832-B-97-004 (1997) ("EPA Financial Capability Guidance"). Therefore, there is no basis for DEP insisting on a level of control of 4 CSO discharges per year, based simply on the fact that other communities in the area are being required to meet that level. The inquiry must be site-specific and focused on Springfield's particular situation.

Comments with respect to "*limited sewer rate increases*" and "*the necessary reliance on estimated project costs and level of control*" are unwarranted as the report submitted was prepared in adherence to both MADEP and USEPA policies and guidance documents. The Commission's Financial Capability Assessment (FCA) prepared in accordance with the EPA Financial Capability Guidance demonstrates the significant additional financial burden to Springfield residents, and by no means is the economically burdensome 200% rate increase considered "limited" by the Commission. Also, the concept that the Commission should commit to a "design objective" for the next 8 years of 4 discharges per year, with a possible "update" at that time, is extremely troubling. DEP justifies this concept by stating that in 8 years, it and the Commission "can better evaluate whether SWSC can achieve a LOC of 4 untreated CSO discharges/year." The problem is that DEP's "design objective" would be memorialized in a final Long-Term Control Plan, and ultimately in the Commission's NPDES permit. Any change to that "objective" at a later time could be subject to antibacksliding requirements, and is extremely uncertain in any event. Since we cannot truly evaluate the feasibility of meeting the 4 discharges/year target for another 8 years, then it is not appropriate to ask the Commission to commit to that goal at this time. It makes much more sense to focus, as the Commission suggests, on meeting the goals supported by the submitted plan, and then reevaluate when appropriate, to see if further reductions can be cost-effectively achieved.

Background:
Springfield presently discharges approximately 64% of the 700 million gallons per year (MG/yr) of remaining untreated CSO discharge in Western Massachusetts. Therefore, SWSC's forthcoming FLTCP is pivotal to reducing the frequency and volume of untreated CSO discharges to the receiving waters in Western Massachusetts. Springfield is one of nine CSO communities in Western Massachusetts required to develop a FLTCP, seven of which completed FLTCP's and identified their LOC's as follows:

- five FLTCP's recommended the highest achievable LOC, Complete Elimination of all CSO regulators and all CSO discharges. As of December 2010, all those five communities had achieved this LOC, resulting in cumulative elimination of 71 CSO regulators and all CSO discharges.
- two FLTCP's recommended a lesser (lower) LOC than Complete Elimination, and were closely reviewed. By CY 2029 their LOC's will result in elimination of approximately 478 of their cumulative 492 MG/yr of untreated CSO discharge, and elimination of 29 of their cumulative 33 CSO regulators. The four remaining CSO regulators are limited to a frequency of 4 untreated CSO discharges per year, verified by empirical on-site monitoring.

The eighth Western Massachusetts CSO community has eliminated 80% of its untreated CSO discharge since Calendar Year ("CY") 2000 and has 12 remaining CSO regulators. It will be following Springfield in development of its FLTCP to further reduce its frequency and volume of its CSO discharge.

MADEP has provided a background of surrounding CSO communities and their achievements and strategies for CSO compliance. CSO programs and FLTCPs are specific to each community and its unique set of economic and operational circumstances. Information provided in both USEPA and MADEP policies and guidelines allows for specific circumstances relative to the affected community to be factored into the development of a FLTCP. No portion of these guidance documents provides for any type of relationship or comparative analyses to be drawn between what neighboring communities are doing with respect to CSO as the populations and socioeconomics of each community are incongruent. DEP's own policy on these issues ("Policy for Abatement of Pollution from Combined Sewer Overflows" (Aug. 11, 1997) ("DEP CSO Policy"), states as follows (on p. 5): The Long-Term Control Plan, which includes a public participation process, is the critical step in determining water quality-based control measures that are technically feasible, affordable, and which comply with water quality standards. The selection of the appropriate regulatory option will be based on information compiled in the long-term plan and other watershed information, which must demonstrate that the plan will achieve compliance with specific classifications."

Every CSO discharge is a violation of Springfield's NPDES Permit (as the Chicopee and Connecticut Rivers are classified as Class B waters under the MA water quality standards - MA CMR 4.00), therefore any recommended LOC less than Complete Elimination will be closely scrutinized to ensure that the resulting frequency of CSO discharge is minimized to the maximum extent possible.

The Commission has submitted a plan that provides the highest level of CSO control achievable and affordable pursuant to USEPA and MADEP guidelines and policies. The Commission welcomes constructive dialogue from any stakeholders. DEP's statement that CSO discharges must be "minimized to the maximum extent possible" does not state the complete legal criteria that are set forth in the Federal CSO Policy and DEP's own CSO policy. As noted above, the EPA CSO Policy sets a goal of "cost-effective CSO controls that ultimately meet appropriate health and environmental objectives and requirements." (59 Fed. Reg. at 18689.) Similarly, DEP's Policy states as follows (on p. 1): "The Policy encourages cost-effective options that promote progress toward water quality goals while avoiding, where possible, the downgrading of water bodies on a permanent basis."

The plan cites affordability constraints, and proposes a lesser (lower) LOC than Complete Elimination. At this time, MassDEP is receptive to a LOC less than Complete Elimination, based upon the affordability constraints, provided that the resulting frequency of CSO discharge is minimized to the maximum extent, within affordability constraints. A LOC of 4 untreated discharges/year, or less, per remaining CSO regulator is the maximum frequency of untreated CSO discharge allowed in any Western Massachusetts FLTCP to date, and is therefore the next desired attainable LOC.

There is no relationship between what other Western Massachusetts communities are doing or have proposed to do with their CSO programs and what the Commission has proposed. The FLTCP submitted has identified the proposed LOC supported by documented research and analyses that demonstrate adherence with said guidelines and policies. The DEP CSO Policy specifically allows for a number of different regulatory options to address remaining CSO discharges. For example, in situations where "elimination of CSOs is not economically feasible and the impacts from remaining CSO discharges will be minor, the segment will be identified as B(CSO). Although a high level of control will be achieved, Class B standards may not be fully met during infrequent, large storm events." (DEP CSO Policy at p. 3.) This option is based on approval of a facilities plan "showing that minor CSO discharges are the most environmentally protective and cost-effective option available," and "the highest level of control must always be achieved for each case as determined in the facilities plan through a cost-benefit analysis." Other options, such as variances, are available as well. There is no basis, under that Policy, for DEP to simply mandate that a community must achieve 4 discharges per year. That "bright-line" test has no basis in DEP or EPA policies. It should be noted that other communities elsewhere have had Long-Term Control Plans approved that allow more than 4 overflows per year, based on their particular situations. (An example is Terre Haute, Indiana, whose plan allows 7 overflows per year. A copy of the approval letter from its state agency is attached.)

10. SWSC financial information for CY 2010 provided by SWSC on February 3, 2012 is summarized by DEP on Table A, attached at the end of this letter. As shown on Table A, there was approximately 31.3 million gallons per day (MGD) of billed wastewater within the SWSC service area in CY 2010, with approximately 18.0 MGD coming from sewer users within the City of Springfield and 13.3 MGD coming from contracted satellite communities. Of the 18.0 MGD from Springfield sewer users, approximately 10.3 MGD was contributed by Springfield Residential users and approximately 5.0 MGD average was contributed by Solutia.
11. As shown on Table A the calculated average-overall sewer rate of all classes of sewer users in the City of Springfield is approximately $2.23/100 cubic feet of billed wastewater, and $1.78/100 cubic feet of billed water use, of which the Residential Sewer Rate is $3.09/100 cubic feet used in the affordability values presented at the January 17, 2012 meeting.

Economic analyses prescribed by guidance documents specifically evaluates only the residential rates, and therefore residential use. Comparison of Listed Sewer Rates (column 2 of Table A) and Calculated Sewer Rate (column 5 of Table A) is not an accurate methodology for analysis. The calculations performed by MADEP do not account for the three month lag in billing at the end of the fiscal year. The first month of the revenue for the new fiscal year is charged at the previous fiscal years rate. This accounts for the difference. The Listed Sewer Rates are the rates that are billed for usage in that fiscal year. Analysis of average sewer rates for all classes is not relevant to the FCA per available guidance documents and policies. Footnote ** states that there is $6,926,591 difference between total water and sewer sales of $45,780,391 and the User Fees Revenue $52,706,982. This is correct, the User Fees Revenue is based on adjusted revenues, included the lag in billing from the previous year, as well as other non water and sewer use revenue,

13. The design objective of the first 3 phases of CSO projects (from 2012-2020), as shown on page 6-120 of the plan and in comment 7 of this letter, should be to reduce the frequency of untreated CSO discharge to 4 discharges per CSO regulator/year, or less. Due to the wide range of Construction Cost (from 50 % too high to 30% too low, page 6-15 of plan) and high estimated Capital Cost estimates (capital cost estimated as 150% of the "high-average" Construction Cost estimates -page 6-31 of plan, and market interest rates were assumed instead of CWSRF rates), actual cost of such CSO projects will be better known at completion of design. It is possible that CSO projects could in fact reduce the maximum frequency of untreated CSO discharge to less than the 8 maximum untreated discharges per CSO regulator recommended in the plan, with the reported $136 million to $266 million dollars available over the next 20 years. With the objective of 4 untreated CSO discharges per year, or less, built into the first three phases of projects and with actual capital costs to date known at the time, an evaluation of Springfield's ability to achieve a LOC of 4 CSO discharges/year, or less, per remaining CSO regulator can be evaluated in 2020 after completion of the first 3 phases of projects.

Construction cost estimates were prepared using standard practices in published EPA guidance documents and up to date local information. Financial assumptions, specifically interest rates are assumed to be market value as there are no guarantees on available low interest loans for the life of the CSO program. The Commission plans on reevaluating its operational, legal, and financial status at every programmed event and specific project milestone. The CSO Specific Abatement Plan submitted in January had varying LOC, with a system average LOC of 5.77 overflows per year. The FLTCP submitted in May has an average LOC of 5.31 overflows per year, with four of the twelve CSOs having a LOC of 4 or less in the typical year.

15. If the evaluation discussed in comment 13 above indicates that a LOC of 4 untreated CSO discharges/year cannot be achieved by raising the Residential Sewer Rate to 2 % MHI alone, closer evaluation of other Sewer Rates within Springfield (including Solutia) will be warranted.

Economic analyses prescribed by guidance documents specifically evaluate only the residential rates, no industrial, commercial, or wholesale rate structure is factored into the FCA. The specific reference to a single customer is irrelevant to the FCA. Solutia is one of the largest single sources of revenue for the Commission. In an economy where operating margins are slim, the loss of the revenue due to closure of this facility because of an increase in water and sewer rates would have catastrophic economic impacts to the region. This would result in a 20% loss in revenue, which would be passed on to all customers. Any rate increases to Springfield residents from such a loss would push the FCA analysis closer to the RI of 2%, thus reducing the amount of any work that could be done per the EPA Financial Capability Guidance.

17. Page 6-9, first paragraph, regarding York Street Pump Station. It is believed that the Connecticut River Interceptor (CRI) actually acts as storage due to the limited depth of the York Street Pump Station wet well and the on-off settings of the pumps, which possibly reduces hydraulic capacity of CRI and causes additional CSO discharge. Modifications as part of the pump station upgrades (or construction of the parallel pump station referenced as "New CRI pump station" on page 6-101) to relieve this problem should be considered..

The York Street Pump Station and the CRI are operated pursuant to the EPA CSO Control Policy, Part II, B. Nine Minimum Controls; 1. Maximum use of the collection system for storage and 4. Maximization of flow to the POTW for treatment. The size of the conduit is the limiting factor. The Commission has, and will continue to operate the system to fulfill its permit and regulatory requirements. **There are no operational measures being conducted in any way that limit the capacity of the CRI or cause additional CSO discharge.**

20. Demonstration Approach vs. Presumption Approach clarification:
   a. Use of the Demonstration Approach is correct in Massachusetts. As stated on Page 6-6 of the plan: SWSC LTCP Approach to Compliance : "DEP's guidelines and the EPA Demonstration Approach were used as a framework for selecting the preferred alternative and demonstrating compliance with DEP's CSO control policy and water quality standards"
   b. Page 6-4: *Presumption Approach:* The EPA Presumption Approach (85% CSO removal, average of 4 overflow events per year) is not applicable to compliance with MA water quality standards, as any CSO discharge in MA violates the existing MA Class B water quality standards.
   c. Page 6-114: first full paragraph, Recommended Alternative H-5: As mentioned in comments 20 a. and 20 b. above, the Demonstration Approach, and *not the Presumption Approach*, is to be used. Justification for Alternative H-5 as the recommended alternative should not come from meeting Presumption Approach (85% CSO removal, "average" of four CSO discharges). However, the first paragraph on Page 6-114 discusses the Recommended H-5 alternative in this way by stating:
      " The H-5 alternative was selected as the recommended CSO abatement plan since it provides > 85% *CSO capture* at a lower cost than the other hybrid alternatives. As explained in Section 6.2.1, the *EPA presumption approach to compliance presumes water quality standards are met when a CSO control plan satisfies the condition of elimination or capture for treatment > 85% by volume* of the combined sewerage collected on a system wide annual basis. *The SWSC recommended plan would reduce CSO volume by 89% for the typical year upon completion, which is a conservative estimate for meeting the EPA's presumption approach guidelines".*

As stated throughout this letter, the submitted plan was prepared in accordance with EPA and MADEP guidelines and policies. Receiving water quality impact analyses were included in the FLTCP to support a Demonstration Approach for selection of the recommended control alternative. The Commission is considering all available and relevant opportunities, specifically the reclassification of the receiving water body as Class B CSO, a Variance, and/or a Partial Use Designation. An updated version of the Regional Connecticut River Water Quality Model, which was originally completed in partnership with MADEP, was used to analyze various iterations of CSO control and its impact on water quality. Resulting model runs indicate limited water quality benefits in relation to the significant investment, and in the larger context of the stormwater contribution to water quality degradation. The availability of these alternatives supports the Commission's CSO system analyses with respect to providing informed planning and investment for all infrastructure needs. The FLTCP, and submitted Integrated Wastewater Plan must be affordable, sustainable, and above all, provide compensatory environmental benefit for the investment.

Note that Comment # 13 of this letter recommends that the design objective of the first 3 phases of CSO projects (from 2012 -2020, as shown on page 6-120 of the plan is to reduce the frequency of CSO discharge to 4 discharges per CSO regulator/year, or less. Also note that Comment # 15 of this letter states that closer evaluation of other Sewer Rates within Springfield (including Solutia) will be warranted, if the evaluation to be performed in 2020 (upon completion of the first 3 phases in 2020) indicates that a Level of Control ("LOC") of 4 untreated CSO discharges/year cannot be achieved by raising the Residential Sewer Rate to 2% of median household income ("MHI") alone. If there are any questions, please contact Kurt Boisjolie at (413)-755-2284.

Information provided in the CSO Specific Abatement Plan and the subsequent FLTCP and Integrated Wastewater Program (IWP) does not support the MADEP recommendation of a LOC for 4 events per year for the first three phases of the CSO program. A substantial level of effort and capital has been dedicated to developing these programs with sound engineering, legal, and financial practices. The proposed programs are the result of this effort, and reflect this significant investment with the best available information.

The SWSC recognizes the importance of maximizing CSO control within the limits of a responsible and reasonably feasible program to achieve the best obtainable water quality results, while simultaneously recognizing the economic constraints of the community it serves. In furtherance of this goal we have already expended millions of dollars in order to develop an FLTCP framework and Integrated Wastewater Program in accordance with requirements set forth in USEPA and MADEP guidelines and policies. The Plan which we are now presenting is designed to achieve greater than 95% attainment of receiving water quality standards for E-Coli per MADEP regulations, and greater than 85% capture of overflow volume. This complies with the EPA CSO Policy and the DEP CSO Policy, and is in adherence to the EPA Financial Capability Guidance.

The Commission looks forward to discussions on the FLTCP and IWP with both MADEP and USEPA and will be contacting your agencies to further discuss the architecture and implementation of this program.

Your partner in environmental stewardship:

Springfield Water and Sewer Commission

By: Kath J. Peden

Katherine J. Pedersen, Executive Director

Cc: Kurt Boisjolie, MassDEP
Mark Casella, MassDEP
Mike Wagner, USEPA Region 1
Doug Koopman, USEPA Region 1

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

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August 10, 2011

The Honorable Duke Bennett, Mayor
City Hall
17 Harding Avenue
Terre Haute, Indiana 47807

Dear Mayor Bennett:

Re: CSO LTCP Approval
City of Terre Haute
NPDES Permit No. IN0025607
Vigo County

In a collaborative effort, IDEM and the United States Environmental Protection Agency (EPA) Region 5 NPDES permit staff have worked together to complete your Long Term Control Plan (LTCP) review. The review process included multiple LTCP development submittals from the City and coordination meetings between IDEM/EPA staff, City staff and the City's consultant.

Plan Summary

The City of Terre Haute operates a Class IV, 24 MGD activated sludge wastewater treatment plant (WWTP). The City has 10 active CSO points which discharge to the Wabash River. The City's recommended LTCP alternative is a combination of several controls that will be constructed over a 20 year period at a cost of approximately $120 million. The LTCP, once implemented, is expected to result in an average of seven overflow events per typical year (correlating to 96% capture and treatment of CSO volume). The implementation schedule will be enforced through State Agreed Judgment No. 84D02-0809-CC-11402.

Proposed LTCP projects include:

- Construction of wastewater treatment plant improvements that will increase the sustained peak flow capacity through the entire plant from 40 MGD to 48 MGD.
- Rehabilitation of a portion of the existing lagoons at the former International Paper site for CSO storage. CSO 003 will be relocated as an emergency relief point for the rehabilitated lagoons.
- Construction of an interim force main from the existing lift station to the CSO storage lagoons.
- Combination of CSOs 004 and 011 (eliminating CSO 004) and combination of CSOs 009 and 010 (eliminating CSO 009) with new floatable controls on each.
- Construction of a new main lift station.
- Construction of a new CSO Interceptor that will extend from CSO 008 to the new main lift station (to be constructed in two phases). This will lead to the elimination of CSOs 005, 006, 007, and 008.
- Construction of various green infrastructure projects in Basins 009 and 010.
- Possible construction of 2 MG CSO storage basin at CSOs 009 and 010 (if needed based on effectiveness of green infrastructure projects).

The implementation schedule for the City's LTCP is 20 years. During that time period, the City has committed to continue its efforts to reduce wet weather flow through green infrastructure projects. If those projects, along with the projects outlined above, will result in the attainment of the target level of control within the 20-year time period then no further time will be needed or requested. However, if it appears that the target level of control cannot be achieved without additional or larger "gray" infrastructure projects, particularly in CSO Basins 009 and 010, then the City may request an additional 5 years to construct the additional projects to meet the target level of control and State Agreed Judgment No. 84D02-0809-CC-11402 will be modified accordingly.

Since the LTCP will not result in compliance with Water Quality Standards (WQS) and/or allow for meeting criteria to protect designated uses, the City will be preparing a Use Attainability Analysis (UAA), as provided for in both federal and state law. The UAA is a process to identify attainable use designations for CSO receiving waters. The UAA should support the assertion that complete elimination of combined sewer overflow impacts to water quality would be both unaffordable and infeasible, and will request approval of a refinement to the recreational designated use in waterways affected by Terre Haute's CSOs. The UAA, if approved by IDEM, USEPA and the Indiana Water Pollution Control Board, will require a formal change to the water quality standards for the affected waterways.

By this letter IDEM approves the LTCP, contingent upon completion and approval of a UAA, as dictated in State Agreed Judgment No. 84D02-0809-CC-11402. Formal approval of the LTCP will be upon issuance of the modified NPDES permit IN0025607. However, Terre Haute may begin implementing the LTCP immediately.

Please contact Holly Zurcher at (317) 234-2122 or by email at hzurcher@idem.in.gov if you have questions regarding this letter.

Sincerely,

Paul Higginbotham, Chief
Permits Branch
Office of Water Quality

Cc: Chuck Ennis, City of Terre Haute
Mike Cline, Hannum, Wagle, and Cline Engineering
Eric Smith, Hannum, Wagle, and Cline Engineering
Fred Andes, Barnes and Thornburg
Jonathan Schweizer, EPA Region 5
Originator

MassDEP

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Ms. Kathy Pedersen, Executive Director
Springfield Water and Sewer Commission (SWSC)
P.O. Box 995
Springfield, MA 01101-0995

April 16, 2013

Re: Springfield - WWM
Combined Sewer Overflow (CSO)
Proposed Final Long Term Control Plan

Dear Ms. Pedersen:

Mass DEP has reviewed SWSC's May 2012 proposed Final Long Term Control Plan (FLTCP) for combined sewer overflow (CSO) abatement, together with information submitted by SWSC January 24, 2013 intended for inclusion in Appendix G of the May 2012 FLTCP. For purposes of this letter, the January 24, 2013 submittal will be referred to hereafter as "Appendix G". In addition, MassDEP has reviewed SWSC's July 12, 2012 letter (submitted in response to MassDEP's April 30, 2012 comment letter) and SWSC's November 8, 2012 letter to EPA Region 1, together with information presented at the December 17, 2013 meeting between SWSC, EPA, and MassDEP.

In summary, in light of the flexibility built into the proposed FLTCP, and with the significant reduction in annual CSO volume to occur by the end of CY 2020, MassDEP supports the first three phases of work proposed in the FLTCP, as discussed, described and conditioned below.

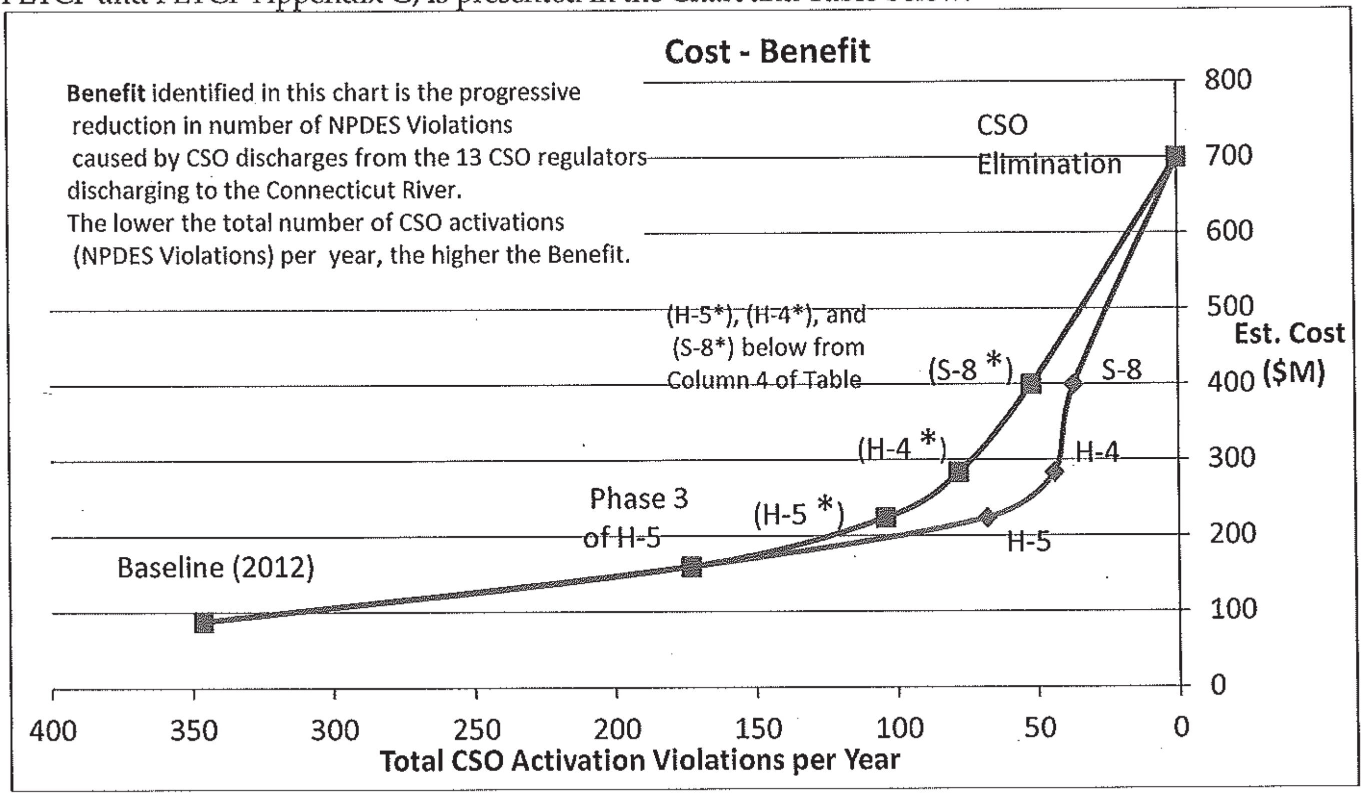
As shown on Table 5-15 and elsewhere in the FLTCP, SWSC has 25 remaining active untreated CSO discharge points (referred hereafter as 25 CSO regulators), consisting of 24 CSO regulators and the "CSO 042" sewage bypass at Bondi's WWTP. Each of these CSO regulators discharge CSO a wide frequency of times per year, with each CSO discharge violating SWSC's NPDES permit and MA water quality standards.

Model predictions provided in the FLTCP and in FLTCP Appendix G roughly estimate that, at present:

- the 13 Connecticut River CSO regulators (including "CSO 042") cumulatively discharge approximately 346 times per year, resulting in approximately 458 Million gallons per year (MG/yr) of untreated CSO into the Connecticut River during those 346 violations, and
- the remaining 12 CSO regulators discharging to the Chicopee and Mill Rivers, which have completed some CSO abatement projects, cumulatively discharge approximately 16 times/year, resulting in approximately 1.5 MG/yr of CSO into those rivers during those 16 discharge events. It is noted that the rough model estimates for frequency of CSO discharges/year from the Chicopee and Mill River CSO regulators has not yet been verified by the required on-site monitoring and it appears that discharges occur at a higher actual frequency of discharge than the model estimates.

The FLTCP evaluated various alternatives which progressed through the screening process and which provided different CSO Levels of Control (LOC). The FLTCP recommends a LOC which retains all of SWSC's 25 existing CSO regulators, and limits the frequency of CSO discharge from any such CSO regulator to eight (8) times per year, or less. The alternative recommended in the FLTCP to achieve this proposed LOC is identified as recommended "Alternative H-5".

A summary pertaining to recommended Alternative H-5 and other alternatives evaluated for various LOC's applicable to the 13 Connecticut River CSO regulators, taken from information within the FLTCP and FLTCP Appendix G, is presented in the Chart and Table below.



Condition, or Alternative	Max # of CSO discharges per year per CSO regulator	Cumulative # of CSO discharges to CT River/yr, per FLTCP estimate	Max Cumulative # CSO discharges to CT River after all CSO abatement work completed , if all 13 CSO regulators discharge at Max # shown in Column 2	Volume (MG/Year) CSO discharge to CT River	Estimated Cost ($ Million)
Baseline (2012)	71	346	N/A	458 MG/yr	$ 88
Completion of Phase 3 (CY '20) Recommended Alternative H-5	38	173	N/A	157 MG/yr	$ 160
Recommended Alternative H-5 (completed, CY 2031)	8	68	104 (H-5 *) on Chart above	59 MG/yr (per Col 3 #/yr)	$ 224
Alternative H-4	6	44	78 (H-4 *) on Chart above	35 MG/yr (per Col 3 #/yr)	$ 284
Alternative S-8	4	37	37 (S-8 *) on Chart above	26 MG/yr (per Col 3 #/yr)	$ 400
Complete Elimination :	0	0	0	0 MG/yr	$ 682

As described in the Massachusetts CSO policy, eventual CSO LOC in Massachusetts is not primarily determined by Cost-Benefit analysis, but instead by the highest LOC achievable within a community's affordability constraints. However, if considering cost-benefit consideration as a secondary determinant for SWSC's LOC, the chart on the preceding page shows that Alternative H-4 can be considered a cost effective alternative, as compared to recommended Alternative H-5.

Column 4 was included in the Table, and charted on the curve, on the preceding page to show the cumulative number of CSO violations/year if all 13 remaining Connecticut River CSO regulators discharge the same number of times as the most active CSO regulator within each Alternative's LOC. Such approach is consistent with completed CSO abatement projects to date, in which empirical data to date indicates higher frequency of CSO discharges per year than was estimated in the planning and design phases for those projects.

As shown on the Chart and Table on the preceding page, and as discussed in the FLTCP, the recommended Alternative H-5 could reduce the approximate frequency of untreated CSO discharges to the Connecticut River to approximately 68 times per year (average frequency of 5.2 times per year per discharge point), with up to 8 actual discharges per year per CSO regulator, by CY 2031. The FLTCP estimates that by doing so, Alternative H-5 will reduce the annual volume of untreated CSO discharged to the Connecticut River to 59 million gallons per year (MG/year), when completed in CY 2031. No proposed work for the 12 existing CSO regulators and associated sewersheds along the Chicopee and Mill Rivers in Springfield appear to be included in the recommended H-5 alternative.

Work within Alternative H-5 is proposed to be accomplished within six phases over a 20 year period, as shown in Table 11-4 of the FLTCP. A strong feature of the proposed phasing, as shown in Table 11-5 and Appendix G of the FLTCP, is that approximately 66% of the existing Connecticut River CSO volume will be removed (from 458 MG/year to 157 MG/year) within the first 8 years (by CY 2020), upon completion of proposed Phases 1, 2, and 3.

A key issue verified at the December 17, 2013 meeting was that the work in the first three proposed CSO Phases (Phases 1-3) could also be integral to other Alternatives (such as Alternative H-4) which could attain a higher eventual LOC than the recommended Alternative H-5,. In order to achieve a higher LOC, work within subsequent Phases 4, 5, and 6 would need to be changed from that shown in Alternative H-5 to the work necessary to achieve the higher LOC.

The ability of the first three proposed phases of work to be completed and remain integral and useful to Alternatives providing a higher LOC is a strong feature of the proposed FLTCP, in light of the potential for future regulatory action requiring a higher LOC than would be attained by Alternative H-5.

Section 11.2.2 and Table 11-5 of the FLTCP proposes an Adaptive Management approach upon completion of the Phase 3, and subsequent phases 4, 5, and 6. Such discussions during and upon completion of Phase 3 would allow an evaluation of the on-site monitoring of all 25 remaining CSO regulators, impact of the Phase 2 work on the Bondi's bypass (CSO 042), costs and revenues, future regulatory requirements, new NPDES permit requirements, status of user contracts and user fees, and whether the next phases of work are to be designed and constructed to achieve a higher LOC than would be provided by completion of Alternative H-5.

Therefore, in light of the flexibility built into the proposed FLTCP, and with the significant reduction in annual CSO volume predicted upon completion of the first three phases (completed by end of CY

2020), MassDEP supports the first three phases of work proposed in the FLTCP, with the following comments/caveats.

Comments/Caveats:

1. If not already provided before submittal of the Phase 2 design plans, the Phase 2 design plans shall include the type of on-site monitoring (level indicator, etc) for accurately monitoring the frequency and volume of CSO discharge from Bondi's "CSO 042" combined sewage bypass to the Connecticut River.
2. Concurrent with submittal of the Phase 2 design plans, a wet weather operating procedure for the Bondi's WWTP shall be submitted by SWSC and its contracted operator (if any at the time) to identify WWTP actions to accept the much higher flow rates from the new York Street Pump Station (62 MGD, as compared to existing 22 MGD) while meeting the estimated annual volume of CSO discharged from Bondi's "CSO 042" shown on Appendix G of the FLTCP. Appendix G of the FLTCP indicates that the annual estimated frequency of untreated CSO discharged from Bondi's "CSO 042" after completion of Phase 2 work will not increase (remaining at 6 discharges/year), and the annual estimated volume will only increase from 5.4 MG/yr to 9.2 MG/yr following the Phase 2 work. Keeping annual CSO discharge from CSO 042 to 9.2 MGD or less is critical to achieving the projected 66% volume reduction in CSO to the Connecticut River following completion of Phases 1 through 3.
3. SWSC's compliance with the projected LOC upon completion of a past (Chicopee and Mill River CSO's) and future (Connecticut River CSO's) CSO abatement projects is to be verified by on-site monitoring of each remaining CSO regulator. In the case of the 25 CSO regulators which the FLTCP proposes to remain for SWSC, model estimates will not be substituted for such on- site monitoring until such time as the model predictions can show consistent agreement with the on-site monitoring results for a sufficient number of years. Such verification has not occurred to date.
4. In light of the Adaptive Management approach proposed by SWSC and evaluation after Phase 3, it is also important to note and include the following:
    a. To ensure a preservation of the context of discussions for consideration at the end of Phase 3, this letter, together with MassDEP's previous April 30, 2012 letter, shall be included as a separate Appendix within the FLTCP for reference at the time of the future evaluation.
    b. MassDEP has not attributed all expenditures as either CSO or non-CSO related for the purposes of approving the first 3 Phases under the FLTCP; however it does not waive the right to do so in the future. One example is the proposed River Crossing to be constructed in Phase 2, which could be considered either a wastewater capital expenditure (to provide such necessary wastewater conveyance redundancy) or a CSO related cost (to allow increased pumping rate from the new York Street Pump Station).
    c. The actual cost to construct the new proposed River Crossing in Phase 2 shall be identified separately from the actual costs for the proposed new York Street Pump Station, following the Phase 2 work. Such separate costs shall be provided to MassDEP prior to the proposed Adaptive Management discussions following completion of Phase 3.
    d. The analysis for the purposes of approving the first 3 Phases under the FLTCP accepted the existing contracts and rate structures for non-standard customers; however, MassDEP does not waive the right to consider such contracts and agreements in the future.
    e. Additional CSO abatement work may be required in the Chicopee River and Mill River sewersheds to meet the intended LOC (less than 4 CSO discharges/violations per year per CSO regulator). On-site monitoring to date indicates significantly more than 4 CSO discharges/year per regulator, and much higher frequency of CSO discharge than model estimates. SWSC should consider reduction of peak stormwater flow from these sewersheds into these CSO regulators by any available "Green Infrastructure" funds or

programs, or local bylaws addressing private sources of inflow, which can help to "fine-tune " the work already accomplished by detaining or removing such problematic stormwater inflow.

5. Additional work to eliminate any remaining CSO discharges may be required upon completion of the Final Longterm Control Plan as it does not provide for complete elimination.

If there are any questions, please contact Kurt Boisjolie at (413)-755-2284.

Respectfully,

Brian D. Harrington
Deputy Regional Director
Bureau of Resource Protection

cc: Josh Schimmel, SWSC Wastewater Operations, PO Box 995, Springfield MA 01101,
Matt Travers, Melissa Carter: MWH 12 Farnsworth St, 2nd F, Boston MA 02210
Tom Ritchie, Kleinfelder/SEA
Mike Wagner, Doug Koopman, Gina Snyder: EPA Region 1,
Kurt Boisjolie, Mark Casella, MassDEP

wpc/CSO/KSWSCfltcpCmntsOKBDH4.16.13

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Mr. Brian D. Harrington
Deputy Regional Director
Bureau of Resource Protection
MA Department of Environmental Protection
436 Dwight Street
Springfield, MA 01103

August 12, 2013

Re: April 16, 2013 MassDEP Review of Proposed Integrated Long Term CSO Control Plan

Dear Mr. Harrington:

The Springfield Water and Sewer Commission (Commission) has received MassDEP's April 16, 2013 letter pertaining to the Final Long Term Control Plan (FLTCP) which was submitted in May of 2012. The letter provides conditional support for only a portion of the plan. The Commission is troubled by many aspects of the MassDEP letter, and this response explains our concerns.

As you are aware, the Commission has provided a comprehensive FLTCP based on the USEPA's *Integrated Municipal Stormwater and Wastewater Planning Approach Framework (6/5/2012).* The Commission provided a presentation to MassDEP and USEPA staff on December 17, 2012 detailing the specifics of the Integrated FLTCP. A productive dialogue occurred subsequent to the presentation, in which all parties acknowledged the desire to have the FLTCP reviewed as an Integrated Plan. The plan as submitted was based on a balanced integration of CSO, Wastewater Collection, and Wastewater Treatment system needs, with the goal of obtaining environmental compliance within the context of a sustainable program. The plan was developed using information from extensive field investigation, metering, and modeling programs. The plan utilizes multiple modeling efforts that integrate the results of our hydraulic, financial, risk, and water quality models. The Commission invested significant resources to develop this plan with consideration of factors including but not limited to: system condition, infrastructure renewal needs, operational functionality, risk and risk reduction, level of service, primary and secondary community benefits, regulatory compliance, and public health and safety issues.

The April 16, 2013 MassDEP letter provides only partial support of this comprehensive plan. In doing so, the MassDEP letter fails to incorporate the language or intent of USEPA's *Integrated Municipal Stormwater and Wastewater Planning Approach*

Framework. Nor does the MassDEP letter reflect what was discussed by the Commission, USEPA, and MassDEP during the December 17, 2012 meeting. MassDEP's comments are inconsistent with USEPA guidelines and polices regarding development of CSO Long Term Control Plans, Financial Capability Assessment, and Integrated Planning. Additionally, the April 16, 2013 letter shows no consideration of previous information and comments provided by the Commission to MassDEP in 2011 and 2012 in response to similar correspondence from MassDEP.

The Commission would like to be actively engaged with MassDEP and the USEPA in finalizing the FLTCP using the integrated planning framework. However, the statements in the April 16, 2013 MassDEP letter do not support such efforts. This letter sets forth our responses to each of the MassDEP's key statements where we disagree or take exception. Our comments are provided below the section of the text as copied from the original letter.

> In summary, in light of the flexibility built into the proposed FLTCP, and with the significant reduction in annual CSO volume to occur by the end of CY 2020, MassDEP supports the first three phases of work proposed in the FLTCP, as discussed, described and conditioned below.

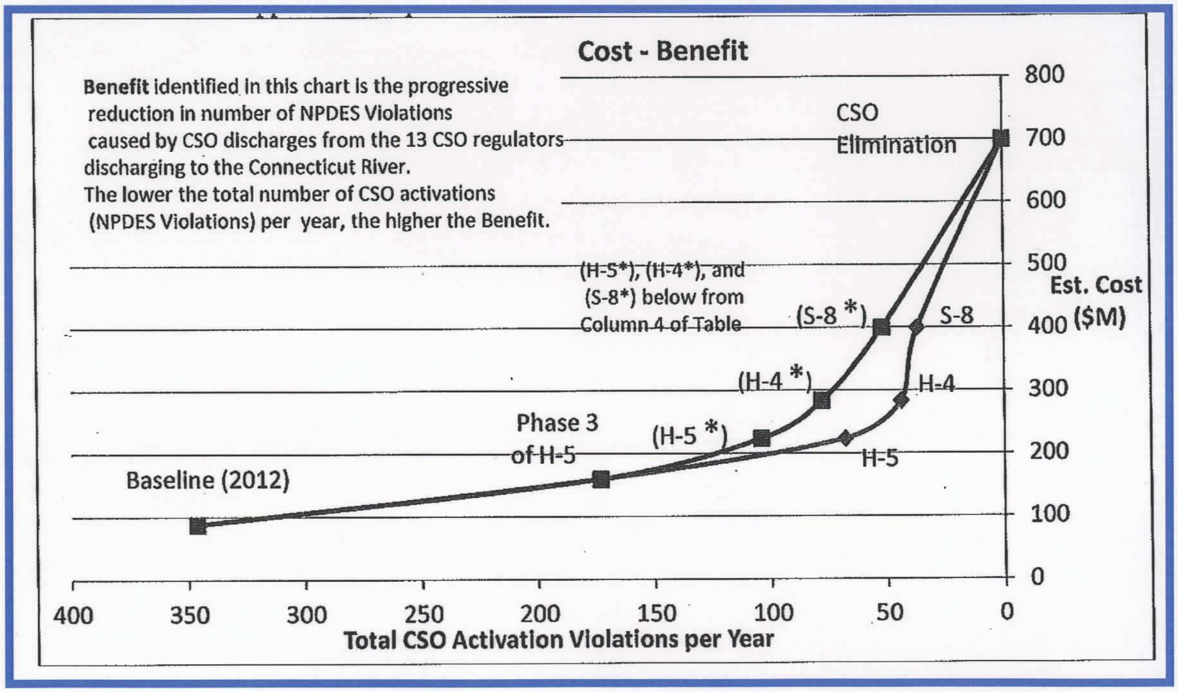
Conditional approval of a portion of the plan will not provide the Commission with the commitment necessary to initiate a comprehensive program in excess of $200,000,000.

> As shown on Table 5-15 and elsewhere in the FLTCP, SWSC has 25 remaining active untreated CSO discharge points (referred hereafter as 25 CSO regulators), consisting of 24 CSO regulators and the "CSO 042" sewage bypass at Bondi's WWTP. Each of these CSO regulators discharge CSO a wide frequency of times per year, with each CSO discharge violating SWSC's NPDES permit and MA water quality standards.

The influent by-pass at the Springfield Regional Wastewater Treatment Facility is not a permitted CSO and should not be referred to as such. This point has been made on multiple occasions. Referring to this as a CSO causes confusion, since the NPDES CSO Permit does not identify a "CSO 042," and could be taken to imply that there is an unpermitted discharge, when that is not actually the case.

> Model predictions provided in the FLTCP and in FLTCP Appendix G roughly estimate that, at present:
>
> - the 13 Connecticut River CSO regulators (including "CSO 042") cumulatively discharge approximately 346 times per year, resulting in approximately 458 Million gallons per year (MG/yr) of untreated CSO into the Connecticut River during those 346 violations, and
> - the remaining 12 CSO regulators discharging to the Chicopee and Mill Rivers, which have completed some CSO abatement projects, cumulatively discharge approximately 16 times/year, resulting in approximately 1.5 MG/yr of CSO into those rivers during those 16 discharge events. It is noted that the rough model estimates for frequency of CSO discharges/year from the Chicopee and Mill River CSO regulators has not yet been verified by the required on-site monitoring and it appears that discharges occur at a higher actual frequency of discharge than the model estimates.

Performance of completed CSO projects must be based on the agreed upon design criteria. Design of completed CSO projects and those proposed in the LTCP are based on the Typical Year Rainfall analysis which statistically has been determined by MassDEP as the 1976 storm series. This information has been the basis for the CSO program for more than a decade. Rain events whose intensities and duration are greater than those established in the Typical Year will result in CSO triggering events. These events are not indicative of a CSO control failure, but are indicative of the arbitrary nature of weather and the variability of the duration and intensity of individual storm events. The Commission provides a detailed analysis each year that identifies every CSO triggering rain event and statistically categorizes the event in comparison to the Typical Year data. This allows for an accurate evaluation of system performance with respect to design storms. The discussion between the Commission and MassDEP regarding the Typical Year, design intent, and actual rainfall data has continued for several years. The Commission has provided information regarding how system performance is evaluated and how rainfall data is analyzed to MassDEP on multiple occasions in presentations, discussions, and in correspondence. The MassDEP letter implies, incorrectly, that overflows in a particular year in excess of the model estimates necessarily reflect a shortcoming that may have to be addressed. That statement is inconsistent with the concept of a typical year that has been used throughout the LTCP process, and the statement should be deleted. The Commission continually evaluates overall system performance with every update to the metering and modeling programs. Similar to the proposed integrated planning frame work and adaptive management policies, adjustments to subsystems that may be under performing are incorporated into design and construction projects.



Condition, or Alternative	Max # of CSO discharges per year per CSO regulator	Cumulative # of CSO discharges to CT River/yr, per FLTCP estimate	Max Cumulative # CSO discharges to CT River after all CSO abatement work completed , if all 13 CSO regulators discharge at Max # shown in Column 2	Volume (MG/Year) CSO discharge to CT River	Estimated Cost ($ Million)
Baseline (2012)	71	346	N/A	458 MG/yr	$ 88
Completion of Phase 3 (CY '20) Recommended Alternative H-5	38	173	N/A	157 MG/yr	$ 160
Recommended Alternative H-5 (completed, CY 2031)	8	68	104 (H-5 *) on Chart above	59 MG/yr (per Col 3 #/yr)	$ 224
Alternative H-4	6	44	78 (H-4 *) on Chart above	35 MG/yr (per Col 3 #/yr)	$ 284
Alternative S-8	4	37	37 (S-8 *) on Chart above	26 MG/yr (per Col 3 #/yr)	$ 400
Complete Elimination :	0	0	0	0 MG/yr	$ 682

MassDEP has provided a chart and table utilizing information provided in the FLTCP. The information provided in column four of the table, in which MassDEP presumes that all CSOs will activate an equal number of times in a year, is misleading and inaccurate. Each CSO tributary area is unique to that CSO; as such, each CSO reacts and activates differently to the same storm and between different storms. This is the result of many factors, including but not limited to topography, pipe network size, length, connectivity to other sewer sheds, outfall elevations, tailwater conditions, pipe condition, and many other factors. No two CSOs will react the exact same way to any single storm. The assumptive data presented in column four of the table would result in a gross over prediction of CSO occurrences and/or volume. Designing projects based on this inaccurate information would likely result in significant overdesign and wasteful use of limited funding.

> As described in the Massachusetts CSO policy, eventual CSO LOC in Massachusetts is not primarily determined by Cost-Benefit analysis, but instead by the highest LOC achievable within a community's affordability constraints. However, if considering cost-benefit consideration as a secondary determinant for SWSC's LOC, the chart on the preceding page shows that Alternative H-4 can be considered a cost effective alternative, as compared to recommended Alternative H-5.

The Commission is not suggesting that CSO control decisions would primarily be determined by Cost-Benefit analysis. What we are stating is that when utilizing the integrated planning methodology as we have, other factors, beyond a limited affordability analysis, can and should play a significant role, and that includes an evaluation of other system wide infrastructure needs as they relate to available funding. Thus, a comprehensive financial capability assessment in conjunction with cost benefit analysis is relevant and important. As explained in the December 17, 2012 presentation and included in the FLTCP, the Commission has not only considered affordability and cost benefit, but other factors such as operation and maintenance requirements, benefits and flexibility of specific implementation schedules, constructability, risk identification and reduction, level of redundancy provided, regulatory compliance, environmental impacts, public health and safety, disruption to the community, and others. A benefits model was developed as part of the FLTCP and used in the evaluation process. As a result, the Commission identified and utilized other factors that have significant impacts to operating a wastewater utility and providing affordable, sustainable service to the communities we serve. Our understanding of the integrated planning framework is that it responsibly allows for consideration of these factors.

> Column 4 was included in the Table, and charted on the curve, on the preceding page to show the cumulative number of CSO violations/year if all 13 remaining Connecticut River CSO regulators discharge the same number of times as the most active CSO regulator within each Alternative's LOC. Such approach is consistent with completed CSO abatement projects to date, in which empirical data to date indicates higher frequency of CSO discharges per year than was estimated in the planning and design phases for those projects.

Please see previous comments concerning Column Four. Additionally, reference is made in comparison to other completed projects. This has no bearing on any proposed projects.

> Work within Alternative H-5 is proposed to be accomplished within six phases over a 20 year period, as shown in Table 11-4 of the FLTCP. A strong feature of the proposed phasing, as shown in Table 11-5 and Appendix G of the FLTCP, is that approximately 66% of the existing Connecticut River CSO volume will be removed (from 458 MG/year to 157 MG/year) within the first 8 years (by CY 2020), upon completion of proposed Phases 1, 2, and 3.

It is important to keep in mind that the original FLTCP submittal had proposed implementation dates based on a 2012 approval and initiation of the program. No final comments have been received from USEPA to date, and in the year since submittal several priority projects have arisen that will require adjustment to the implementation schedule. The Commission will provide further information about these needed adjustments to USEPA and MassDEP, in a separate submittal.

> Section 11.2.2 and Table 11-5 of the FLTCP proposes an Adaptive Management approach upon completion of the Phase 3, and subsequent phases 4, 5, and 6. Such discussions during and upon completion of Phase 3 would allow an evaluation of the on-site monitoring of all 25 remaining CSO regulators, impact of the Phase 2 work on the Bondi's bypass (CSO 042), costs and revenues, future regulatory requirements, new NPDES permit requirements, status of user contracts and user fees, and whether the next phases of work are to be designed and constructed to achieve a higher LOC than would be provided by completion of Alternative H-5.

Status of user contracts and user fees is not within the purview of MassDEP

> 1. If not already provided before submittal of the Phase 2 design plans, the Phase 2 design plans shall include the type of on-site monitoring (level indicator, etc) for accurately monitoring the frequency and volume of CSO discharge from Bondi's "CSO 042" combined sewage bypass to the Connecticut River.

The SRWTF influent by-pass is monitored with alarms and level sensors which are used to calculate amount of overflow. This information is provided in the monthly reports submitted to MassDEP.

2. Concurrent with submittal of the Phase 2 design plans, a wet weather operating procedure for the Bondi's WWTP shall be submitted by SWSC and its contracted operator (if any at the time) to identify WWTP actions to accept the much higher flow rates from the new York Street Pump Station (62 MGD, as compared to existing 22 MGD) while meeting the estimated annual volume of CSO discharged from Bondi's "CSO 042" shown on Appendix G of the FLTCP. Appendix G of the FLTCP indicates that the annual estimated frequency of untreated CSO discharged from Bondi's "CSO 042" after completion of Phase 2 work will not increase (remaining at 6 discharges/year), and the annual estimated volume will only increase from 5.4 MG/yr to 9.2 MG/yr following the Phase 2 work. Keeping annual CSO discharge from CSO 042 to 9.2 MGD or less is critical to achieving the projected 66% volume reduction in CSO to the Connecticut River following completion of Phases 1 through 3.

See previous comment concerning the use of the term CSO 042, overflows in the Typical Year and design criteria.

a. To ensure a preservation of the context of discussions for consideration at the end of Phase 3, this letter, together with MassDEP's previous April 30, 2012 letter, shall be included as a separate Appendix within the FLTCP for reference at the time of the future evaluation.

MassDEP's statement regarding inclusion of its correspondence in the LTCP is confusing given the lack of any clear or definitive approval decision by MassDEP, or even a mutual dialogue on these issues. MassDEP has not approved the FLTCP, yet is requesting inclusion of correspondence regarding the conditional approval of specific components of the FLTCP. MassDEP has also failed to consider any of the substantial comments provided by the Commission on July 12, 2012 with respect to the April 30, 2012 MassDEP letter. Inclusion of only MassDEP documents without the Commission's response does not allow for a "*preservation of the context of discussions*" as stated, but rather portrays only MassDEP's interpretation with no regard to formal correspondence challenging such interpretations. This unilateral correspondence is clearly not in the spirit of the integrated planning framework, and to the contrary, does not promote a cooperative venture in achieving the best solution to this expansive and expensive commitment.

b. MassDEP has not attributed all expenditures as either CSO or non-CSO related for the purposes of approving the first 3 Phases under the FLTCP; however it does not waive the right to do so in the future. One example is the proposed River Crossing to be constructed in Phase 2, which could be considered either a wastewater capital expenditure (to provide such necessary wastewater conveyance redundancy) or a CSO related cost (to allow increased pumping rate from the new York Street Pump Station).

The framework for integrated planning considers all costs as they relate to overall affordability in the context of a prioritized implementation of projects. The Commission has expended significant resources to provide factual information as the basis for selecting and scheduling projects. MassDEP's assertion that it has not as of yet "attributed all expenditures as either CSO or Non CSO" is in direct conflict with the principles of the Integrated Planning Framework.

> c. The actual cost to construct the new proposed River Crossing in Phase 2 shall be identified separately from the actual costs for the proposed new York Street Pump Station, following the Phase 2 work. Such separate costs shall be provided to MassDEP prior to the proposed Adaptive Management discussions following completion of Phase 3.

Comments concerning how costs are attributed to projects as either CSO or Non CSO indicate that MassDEP is not considering the FLTCP as an integrated plan, and indicates that there is no acknowledgment of the importance of other costs outside of CSO control. This is not a reality to a utility that operates and maintains over 400 miles of collection system pipe, 33 pumping stations, and a 67 MGD treatment plant that is 40 years old; all while serving a population of more than 250,000 customers.

> d. The analysis for the purposes of approving the first 3 Phases under the FLTCP accepted the existing contracts and rate structures for non-standard customers; however, MassDEP does not waive the right to consider such contracts and agreements in the future.

Rate structures and contracts for wholesale customers and partner communities are not within MassDEP's authority to approve or accept. We have previously explained to MassDEP (letter dated July 12, 2012) the possible negative financial repercussions of losing wholesale customers or partners, which could result from imposing unbalanced rates in an effort to address CSO control costs. The loss of such customers could actually result in less money being available due to loss of revenue, thereby reducing the level of control achievable.

> e. Additional CSO abatement work may be required in the Chicopee River and Mill River sewersheds to meet the intended LOC (less than 4 CSO discharges/violations per year per CSO regulator). On-site monitoring to date indicates significantly more than 4 CSO discharges/year per regulator, and much higher frequency of CSO discharge than model estimates. SWSC should consider reduction of peak stormwater flow from these sewersheds into these CSO regulators by any available "Green Infrastructure" funds or

As previously stated, performance evaluations of completed CSO projects has to be based on the agreed-upon design criteria as it relates to the Typical Year. Design of all completed CSO projects and those proposed in the LTCP are based on the Typical Year Rainfall analysis, which statistically has been agreed upon by MassDEP as the 1976 storm series. This information has been the basis for the CSO program for more than a decade. Rain events that exceed those identified in the design using the Typical Year will result in CSO events that are not indicative of a CSO control failure, but are indicative of the variability of weather over the course of a year. The Commission provides a detailed analysis each year that identifies every CSO triggering rain event and statistically categorizes the event in comparison to the Typical Year data. This allows for an accurate evaluation of system performance with respect to design storms. The discussion regarding the Typical Year, design intent, and actual rainfall data has continued for several years. The Commission has provided information regarding how system performance is evaluated and how rainfall data is analyzed to MassDEP on multiple occasions in presentations, discussions, and in correspondence. Despite that long-term dialogue and understanding, the MassDEP letter implies that any overflows in excess of the design intent may result in additional work to reduce overflows, and that is simply not the case.

As has been stated on numerous occasions, the Commission is committed to addressing the CSO issue, as has been evidenced by its spending more than $100,000,000 on CSO planning, design, and abatement projects. The Commission is equally committed to maintaining our other critical water and sewer infrastructure in a responsible and sustainable manner, so that we may continue to provide affordable essential services to our community. We look forward to working together with MassDEP and USEPA to obtain these goals.

Respectfully

Springfield Water and Sewer Commission

By: Kath J Peder
Katherine J. Pedersen, Executive Director

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Mike Wagner, USEPA
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Ken Moraff, USEPA
Dave Webster, USEPA
Mark Pollins, USEPA
Deborah Nagle, USEPA

Appendix A

Integrated Planning Framework Guidance Documents

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JUN - 5 2012

MEMORANDUM

SUBJECT: Integrated Municipal Stormwater and Wastewater Planning Approach Framework

FROM: Nancy Stoner
Acting Assistant Administrator
Office of Water

Cynthia Giles
Assistant Administrator
Office of Enforcement and Compliance Assurance

TO: EPA Regional Administrators
Regional Permit and Enforcement Division Directors

In recent years, EPA has increasingly embraced integrated planning approaches to municipal wastewater and stormwater management. EPA further committed to work with states and communities to implement and utilize these approaches in its October 27, 2011 memorandum *"Achieving Water Quality Through Municipal Stormwater and Wastewater Plans."* Integrated planning will assist municipalities on their critical paths to achieving the human health and water quality objectives of the Clean Water Act by identifying efficiencies in implementing requirements that arise from distinct wastewater and stormwater programs, including how to best prioritize capital investments. Integrated planning can also facilitate the use of sustainable and comprehensive solutions, including green infrastructure, that protect human health, improve water quality, manage stormwater as a resource, and support other economic benefits and quality of life attributes that enhance the vitality of communities.

To provide further guidance on developing and implementing effective integrated plans under this approach, we have developed, with extensive public input, the attached Integrated Municipal Stormwater and Wastewater Planning Approach Framework document. We are posting the framework document on our website and, as they become available, will provide practical examples of how municipalities are implementing this approach. We would like to thank Regions 2, 4, 5, 7 and 10 for their assistance in conducting public workshops to gain input on the draft framework. We encourage all Regions to work with their States to identify appropriate opportunities for implementing the Integrated Planning approach. We will continue to work with the Regions as we explore the pathway forward on implementing this approach.

We encourage you to contact Deborah Nagle, Director, Water Permits Division (nagle.deborah@epa.gov) and Mark Pollins, Director, Water Enforcement Division (pollins.mark@epa.gov) with any questions you might have.

Attachment

cc: Regional Permit and Enforcement Liaisons
Association of Clean Water Administrators
United States Conference of Mayors
National League of Cities
American Rivers
National Association of Clean Water Agencies
National Association of Flood & Stormwater Management Agencies
Natural Resources Defense Council
Water Environment Federation
Environmental Council of States

INTEGRATED MUNICIPAL STORMWATER AND WASTEWATER PLANNING APPROACH FRAMEWORK

May, 2012

The purpose of this framework is to provide further guidance for EPA, States and local governments in developing and implementing effective integrated plans under the Clean Water Act (CWA). The framework identifies the operating principles and essential elements of an integrated plan. The integrated planning approach is voluntary. The responsibility to develop an integrated plan rests with the municipality that chooses to pursue this approach. If a municipality decides to take advantage of this approach, the integrated plan that it develops can provide information to inform the permit and enforcement processes and can support the development of conditions and requirements in permits and enforcement orders. The integrated plan should identify the municipality's relative priorities for projects and include a description of how the proposed priorities reflect the relative importance of adverse impacts on human health and water quality and the municipality's financial capability. The integrated plan will be the starting point for development of appropriate implementation actions, which may include requirements and schedules in enforceable documents.

EPA will continue to provide opportunities for stakeholder input during the implementation of this framework. Outreach activities associated with this effort will include the development of case studies and best practices.

EPA recognizes that approved National Pollutant Discharge Elimination System (NPDES) States are partners in the implementation of the program and have the lead for the day-to-day activities in their States. Many States have existing water quality management planning processes, which may include those established under Section 208 and 303 of the CWA, that may help facilitate the development of an integrated plan and work in conjunction with the implementation of an integrated plan. Integrated plans should be consistent with, and designed to meet the objectives of, existing total maximum daily loads (TMDLs). EPA is committed to working closely with the States in the implementation of this framework. EPA Regions and Headquarters will work with States when appropriate to determine the proper response to an integrated plan.

I. Background

In recent years, EPA has begun to embrace integrated planning approaches to municipal wastewater and stormwater management. EPA further committed to work with States and communities to implement and utilize integrated planning approaches to municipal wastewater and stormwater management in its October 27, 2011 memorandum *"Achieving Water Quality Through Municipal Stormwater and Wastewater Plans."*[1] Integrated planning will assist municipalities on their critical paths to achieving the human health and water quality objectives of the CWA by identifying efficiencies in implementing requirements that arise from distinct wastewater and stormwater programs, including how best to make capital investments.

[1] The October 27, 2011 memorandum is available at http://cfpub.epa.gov/npdes/integratedplans.cfm.

Integrated planning can also facilitate the use of sustainable and comprehensive solutions, including green infrastructure, that protect human health, improve water quality, manage stormwater as a resource, and support other economic benefits and quality of life attributes that enhance the vitality of communities. In February, 2012, EPA released "Planning for Sustainability: A Handbook for Water and Wastewater Utilities."[2] The Handbook describes a number of steps utilities can take to build sustainability considerations into their existing planning processes and make the best infrastructure choices that protect water quality and ensure the long-term sustainability of infrastructure assets. The elements of an integrated plan which are described below are complementary to the elements in the Sustainability Handbook.

The integrated planning approach does not remove obligations to comply with the CWA, nor does it lower existing regulatory or permitting standards, but rather recognizes the flexibilities in the CWA for the appropriate sequencing and scheduling of work.

II. Principles

Following are overarching principles that EPA will use in working with municipalities to implement an integrated approach to meet their wastewater and stormwater program obligations under the CWA. Also presented are guiding principles that EPA recommends municipalities use in the development of their integrated plans.

Overarching Principles

1. This effort will maintain existing regulatory standards that protect public health and water quality.

2. This effort will allow a municipality to balance CWA requirements in a manner that addresses the most pressing public health and environmental protection issues first.

3. The responsibility to develop an integrated plan rests with the municipality that chooses to pursue this approach. Where a municipality has developed an initial plan, EPA and/or the State will determine appropriate actions, which may include developing requirements and schedules in enforceable documents.

4. Innovative technologies, including green infrastructure, are important tools that can generate many benefits, and may be fundamental aspects of municipalities' plans for integrated solutions.

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[2] The February 2012 Handbook is available at http://water.epa.gov/infrastructure/sustain/upload/EPA-s-Planning-for-Sustainability-Handbook.pdf.

Principles to Guide the Development of an Integrated Plan

Integrated plans should:

1. Reflect State requirements and planning efforts and incorporate State input on priority setting and other key implementation issues.

2. Provide for meeting water quality standards and other CWA obligations by utilizing existing flexibilities in the CWA and its implementing regulations, policies and guidance.

3. Maximize the effectiveness of funds through analysis of alternatives and the selection and sequencing of actions needed to address human health and water quality related challenges and non-compliance.

4. Evaluate and incorporate, where appropriate, effective sustainable technologies, approaches and practices, particularly including green infrastructure measures, in integrated plans where they provide more sustainable solutions for municipal wet weather control.

5. Evaluate and address community impacts and consider disproportionate burdens resulting from current approaches as well as proposed options.

6. Ensure that existing requirements to comply with technology-based and core requirements are not delayed.

7. Ensure that a financial strategy is in place, including appropriate fee structures.

8. Provide appropriate opportunity for meaningful stakeholder input throughout the development of the plan.

III. Elements of an Integrated Plan

Defining Scope

NPDES requirements for separate sanitary sewer systems, combined sewer systems, municipal separate storm sewer systems and at wastewater treatment plants may be included in an integrated plan. Each of the aforementioned systems may have different owners/operators responsible for the various sewer systems and treatment plants as well as different geographic service areas and different service populations. In addition, integrated plans may address source water protection efforts that protect surface water supplies, and/or nonpoint source control through proposed trading approaches or other mechanisms. When developing an integrated plan, a municipality/community must determine and define the scope of the integration effort, ensure the participation of entities that are needed to implement the integrated plan, and identify the role each entity will have in implementing the plan. EPA will continue to work closely with State and local governments to incorporate green infrastructure approaches to water quality within permits and enforcement actions, consistent with the practice over the past several years.

Plan Elements

An integrated program should be tailored to the size and complexity of the wastewater and stormwater infrastructure addressed in the plan. Although the details of each integrated plan will vary depending on the unique challenges of each community, an integrated plan generally should address the following elements:

Element 1: A description of the water quality, human health and regulatory issues to be addressed in the plan, including:

- An assessment of existing challenges in meeting CWA requirements and projected future CWA requirements (*e.g.*, water quality-based requirements based on a new TMDL);
- Identification and characterization of human health threats;
- Identification and characterization of water quality impairment and threats and, where available, applicable wasteload allocations (WLAs) of an approved TMDL or an equivalent analysis;
- Identification of sensitive areas and environmental justice concerns; and
- Metrics for evaluating and meeting human health and water quality objectives.

Element 2: A description of existing wastewater and stormwater systems under consideration and summary information describing the systems' current performance, including:

- Identification of municipalities and utilities that are participating in the planning effort and a characterization of their wastewater and stormwater systems; and
- Characterization of flows in and from the wastewater and stormwater systems under consideration.

Element 3: A process which opens and maintains channels of communication with relevant community stakeholders in order to give full consideration of the views of others in the planning process and during implementation of the plan.

- Municipalities developing integrated wastewater and stormwater plans should provide appropriate opportunities that allow for meaningful input during the identification, evaluation, and selection of alternatives and other appropriate aspects of plan development;
- Municipalities participating in an integrated wastewater and stormwater plan should, during the implementation of the plan, make pertinent new information available to the public and provide opportunities for meaningful input into the development of proposed modifications to the plan; and
- Where a permit or enforcement order incorporates green infrastructure requirements, the municipalities required to implement the requirements should allow for public involvement to assist in evaluating the effectiveness of the approach and to assist in successful implementation of the approach.

Element 4: A process for identifying, evaluating, and selecting alternatives and proposing implementation schedules which addresses:

- The use of sustainable infrastructure planning approaches, such as asset management, to assist in providing information necessary for prioritizing investments in and renewal of major wastewater and stormwater systems;
- The use of a systematic approach to consider and incorporate, where appropriate, green infrastructure and other innovative measures where they provide more sustainable solutions;
- Identification of criteria, including those related to sustainability, to be used for comparing alternative projects and a description of the process used to compare alternatives and select priorities;
- Identification of alternatives, including cost estimates, potential disproportionate burdens on portions of the community, projected pollutant reductions, benefits to receiving waters and other environmental and public health benefits associated with each alternative;
- An analysis of alternatives that documents the criteria used, the projects selected, and why they were selected;
- A description of the relative priorities of the projects selected including a description of how the proposed priorities reflect the relative importance of adverse impacts on public health and water quality[3] and the permittee's financial capability;
- Proposed implementation schedules; and
- For each entity participating in the plan, a financial strategy and capability assessment that ensures investments are sufficiently funded, operated, maintained and replaced over time. The assessment of the community's financial capability should take into consideration current sewer rates, stormwater fees and other revenue, planned rate or fee increases, and the costs, schedules, anticipated financial impacts to the community of other planned stormwater or wastewater expenditures and other relevant factors impacting the utility's rate base. Municipalities can use as a guide the document "CSO Guidance for Financial Capability Assessment and Schedule Development," EPA 832-B-97-004) or other relevant EPA or State tools.

Element 5: Measuring success - As the projects identified in the plan are being implemented, a process for evaluating the performance of projects identified in a plan, which may include evaluation of monitoring data, information developed by pilot studies and other studies and other relevant information, including:

- Proposed performance criteria and measures of success;
- Monitoring program to address the effectiveness of controls, compliance monitoring and ambient monitoring; and
- Evaluation of the performance of green infrastructure and other innovative measures to inform adaptive design and management to include identification of barriers to full implementation.

[3] An example of an informal tool to help identify priorities is given by "Combined Sewer Overflow Guidance for Screening and Ranking", EPA, August 1995. The guidance is available at http://www.epa.gov/npdes/pubs/owm595.pdf.

Element 6: Improvements to the Plan

- A process for identifying, evaluating and selecting proposed new projects or modifications to ongoing or planned projects and implementation schedules based on changing circumstances; and
- In situations where a municipality is seeking modification to a plan, or to the permit or enforcement order that is requiring implementation of the plan, the municipality should collect the appropriate information to support the modification and should be consistent with Elements 1 – 5 discussed above.

IV. Implementation

Implementing an integrated approach to wastewater and stormwater management may require coordination between State and federal NPDES permit and enforcement authorities. EPA recognizes the importance of and encourages early coordination between NPDES States and EPA on key implementation issues that may arise in individual integrated plans. This will ensure that plans will not need to be revised in order for them to be implemented. State NPDES permit authorities should initiate discussions with EPA on their efforts to address integrated plans that raise issues associated with ongoing federal enforcement actions and when addressing the initial integrated plans developed in the State or when a permit may potentially present a novel approach. EPA and States will determine the appropriate roles of permit and enforcement authorities in addressing the regulatory requirements identified in the plan. As discussed below, elements of an integrated plan can be incorporated, where appropriate, into NPDES permits, enforcement actions, or both. Permit issuance and implementation of existing permit and enforcement requirements and activities shall not be delayed while an integrated plan is being developed.

Permits

All or part of an integrated plan can be incorporated into an NPDES permit as appropriate. Limitations and considerations for incorporating integrated plans into permits include:

- Compliance schedules for meeting water quality-based effluent limitations (WQBELs) in NPDES permits issued for discharges from publicly owned treatment works (POTWs) and/or combined sewer overflows need to be consistent with the requirements in 40 CFR section 122.47. Where appropriate, an NPDES permit authority may include a compliance schedule in a permit for WQBELs based on post July 1, 1977 State water quality standards provided the compliance schedule is "as soon as possible" and the State has clearly indicated in its water quality standards or implementing regulations that it intends to allow them. Compliance schedules in permits should prioritize the most significant human health and environmental needs first.

- Reopener provisions in permits consistent with section 122.62(a) may better facilitate adaptive management approaches.

- Green infrastructure approaches and related innovative practices that provide more sustainable solutions by managing stormwater as a resource should be considered and incorporated, where appropriate, where they provide more sustainable solutions for municipal wet weather control.

- Appropriate water quality trading may be reflected in NPDES permits (*see* EPA's 2003 Water Quality Trading Policy).

Enforcement

EPA and the States may bring enforcement actions against municipalities to address noncompliance with the CWA. Enforcement tools include administrative orders, negotiated consent decrees, or other state formal enforcement actions that require compliance with various requirements under the CWA. All or part of an integrated plan may be able to be incorporated into the remedy of a federal or State enforcement action. Considerations for incorporating integrated plans into enforcement actions include:

- The integrated planning framework should ensure that all necessary parties to a consent decree or administrative order are involved (*e.g.* municipality, utility authority).

- When there is a history of long-standing violations without significant progress, enforcement is used to address past violations and establish a path for coming into compliance.

- Where an extended time frame is necessary to achieve compliance, enforcement orders should provide schedules for CWA requirements that prioritize the most significant human health and environmental needs first.

- How permitting and enforcement actions may be used in conjunction to ensure implementation of the integrated plans.

- Sufficient flexibility should be provided in enforcement orders to allow for adaptive management approaches.

- Green infrastructure approaches and related innovative practices that provide more sustainable solutions by managing stormwater as a resource should be considered and incorporated, where appropriate, where they provide more sustainable solutions for municipal wet weather control.

- Environmentally beneficial projects that are identified in an integrated plan and which the municipality is not otherwise legally required to perform, such as water conservation measures, may be included in a settlement agreement consistent with EPA's Supplemental Environmental Projects Policy[4].

[4] The May 1, 1998, policy is available at http://www.epa.gov/oecaerth/resources/policies/civil/seps/fnlsup-hermn-mem.pdf.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JAN 1 8 2013

MEMORANDUM

SUBJECT: Assessing Financial Capability for Municipal Clean Water Act Requirements

FROM: Nancy Stoner
Acting Assistant Administrator
Office of Water (OW)

Cynthia Giles
Assistant Administrator
Office of Enforcement and Compliance Assurance (OECA)

TO: Regional Administrators
Regional Water Division Directors
Regional Enforcement Division Directors

We are working closely with local governments to clarify how the financial capability of a community will be considered when developing schedules for municipal projects necessary to meet Clean Water Act obligations. Our on-going conversations have been very encouraging and have helped identify several implementation issues, as well as more robust ways to present additional community-specific information within a financial capability analysis when considering a community's ability to achieve the shared goal of clean water. These issues are discussed in the attached financial capability framework document. We plan to develop an approach that addresses these issues in a way that achieves our shared goal of clean water. We expect to share a draft of the approach with you soon.

As we move forward, OW and OECA will continue to reach out to the Regions for your input and recommendations. If you have any questions, please contact one of us or have your staff contact Deborah Nagle, Director, Water Permits Division (nagle.deborah@epa.gov) or Mark Pollins, Director, Water Enforcement Division (pollins.mark@epa.gov).

cc: Randy Hill
Susan Shinkman
Lisa Lund
Deborah Nagle
Mark Pollins
Regional Permit and Enforcement Liaisons

Attachment

EPA's DIALOGUE WITH LOCAL GOVERNMENT
FINANCIAL CAPABILITY FRAMEWORK
January 2013

Over the last several months, the U.S. Environmental Protection Agency (EPA) and local governments have engaged in a dialogue to clarify how the financial capability of a community will be considered when developing schedules for municipal projects necessary to meet Clean Water Act (CWA) obligations. This dialogue demonstrates EPA's strong support for ensuring that communities move forward in a sustainable manner and within their financial capability to meet CWA obligations. EPA is committed to ensuring that the policies reflected in this discussion are implemented consistently throughout EPA's Regional offices.

Local governments play a critical role in providing wastewater and stormwater infrastructure and services for their citizens, businesses and institutions. These municipal functions have been an important part of implementing the CWA to improve water quality and increased public health protection in streams, lakes, bays, and other waters nationwide. However, significant water pollution challenges remain. Elected officials remain strong supporters of the CWA goals and objectives by directing the public investment that is necessary to comply with the Act and to promote the quality of life for their citizens. Many local governments face complex water quality issues that are heightened by the need to address population growth, increases in impervious surfaces, source water supply needs, and aging infrastructure. In recent years, many local governments have increased their investment in their wastewater infrastructure by providing increased capital investments to rehabilitate existing systems, improve operation and maintenance and address additional regulatory requirements. As programs to improve water quality and attain CWA objectives are implemented, many state and local government partners find themselves facing difficult economic challenges. We recognize these challenging conditions and are working with states and local governments to develop and implement new approaches that will achieve water quality goals at lower costs and in a manner that addresses the most pressing problems first.

It is essential that long-term approaches to meeting CWA objectives are sustainable and within a community's financial capability. A community's financial capability and other relevant factors are important when developing appropriate compliance schedules that ensure human health and environmental protection. As EPA implements the recently released Integrated Municipal Stormwater and Wastewater Planning Approach Framework, EPA's "Combined Sewer Overflows: Guidance for Financial Capability Assessment and Schedule Development" (EPA 832-B-97-004) (Guidance for Financial Capability Assessment) will continue to be a valuable guide for evaluating the level of burden placed on a community by necessary clean water investments. Input from communities and others have pointed to a need to further clarify how financial capability is considered when developing schedules for municipal projects to meet their CWA obligations. In response, EPA is developing an approach to provide clarification of the financial capability analysis and that ensures consistent implementation among EPA Regions. The EPA's on-going conversations with communities and stakeholder groups have been very encouraging and are providing a deeper understanding of the fiscal impacts that regulatory compliance has on consumers and households along the income distribution curve and on non-residential users. The flexibilities under the CWA, regulations, and EPA policies allow local government to continue to maintain existing wastewater and stormwater systems while making progress on clean water goals in a manner that is sustainable and within a community's financial capability. EPA and local government representatives will focus on the following topics associated with how a community's financial capability is assessed and considered when developing schedules to meet CWA objectives:

- How to expand the use of benchmark indicators of household, community and utility affordability, such as increasing arrearages, late payments, disconnection notices, service terminations, and uncollectable accounts;
- How to meet the obligations of the CWA by utilizing flexibilities in the statute and implementing regulations to prioritize necessary investments;
- How rate structures present both limitations and opportunities;
- How innovative financing tools, including public private partnerships, are related to affordability;
- How to facilitate consistent policy implementation at EPA Regional offices; and
- How other community specific factors, including obligations under the Safe Drinking Water Act, should be considered in developing appropriate compliance schedules

Prioritizing Investments

As articulated in the Integrated Planning Approach Framework, EPA encourages municipalities to balance CWA requirements in a manner that addresses the most pressing health and environmental protection issues first. For communities that have CWA responsibilities for stormwater and the collection and treatment of wastewater, it is entirely appropriate to consider the financial impacts of investments they need to make to manage both stormwater and wastewater discharges. EPA continues to explore ways in which the integrated planning approach can provide for meeting water quality standards and other CWA obligations by utilizing existing flexibilities in the CWA and its implementing regulations, policies and guidances.

Low Income Households

Uniform rate structures may place a disproportionately high financial burden on households with low incomes. EPA strongly encourages municipalities to consider establishing lower rates or subsidies for low income customers. This is consistent with one of the goals of integrated planning, which is to take advantage of synergies and savings that can be found through an integrated approach and thereby promote affordability.

Some communities have asked whether the CWA restricts a community's ability to set different rate structures to address such burdens or would limit their ability to receive grant funding from the Agency[1]. EPA plans to discuss both the limits and opportunities that different rate structures present for achieving clean water goals. Local officials have a great deal of latitude under these regulations and the EPA continues to encourage communities to consider and adopt rate structures that ensure that lower income households continue to be able to afford vital wastewater services. Several areas of discussion concerning rate structures involve state law, bond covenants, and implementation considerations.

In addition, EPA's Guidance for Financial Capability Assessment provides a flexible framework for considering the site-specific factors that impact a given community's rate base. The guidance encourages communities to consider and present any other documentation of their unique financial circumstances, so that it may be considered as part of the analysis. Where communities have adopted differential rates for low income customers, the income distribution that led to that approach may be valuable supplemental information that the community would choose to present as part of its financial analysis when determining the appropriate timeframe for reaching compliance. Examples of information that have been used in this context include poverty rates, income distribution by quintile, late payments, disconnection notices, service terminations, uncollectable accounts and average wastewater bill as a percentage of the median household income (MHI), although any information that the community believes is relevant may be presented.

The Role of Median Household Income in Developing Compliance Schedules

The EPA's Guidance for Financial Capability Assessment suggests using the percentage of MHI as one indicator for helping to determine the schedule for completing necessary work. The MHI indicator presents only one of many considerations that should be evaluated in determining the most appropriate schedule. EPA expects that the full range of financial indicators as well as municipal-specific information will be considered when developing schedules. A common misconception is that the EPA requires communities to spend to a level of 2% of MHI to meet CWA obligations. Rather, the percent MHI calculation is guidance, and is considered along with a suite of other financial indicators to assess the overall burden on a community. The guidance recommends that communities with higher burdens be given longer time periods to complete the needed work.

Community Specific Factors

The EPA's Guidance for Financial Capability Assessment provides a flexible framework for considering the site-specific factors that impact a given community's rate base. The guidance encourages communities to consider and present any other documentation of their unique financial circumstances, so that it may be considered as part of the analysis.

[1] Section 204(b)(1) of the CWA recognizes the use of lower charges for low-income residential users as satisfying the stipulation that recipients of services must pay their proportionate share. The EPA's regulations at 40 C.F.R. Section 35.2140(i) reflect this and authorize low income residential user rates.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1
5 POST OFFICE SQUARE, SUITE 100
BOSTON, MA 02109-3912

12:30 10/29/13

Please cc. to Kathy P. ORW 4/5

OCT 18 2013

Re: The Health of Your Buried Water Infrastructure Will Ensure the Health of Your Community

Dear Budget Official/Financial Committee:

Municipal officials have seen great benefit from programs that assess the condition of their infrastructure assets and from developing sustainable user rates based on keeping those assets in good condition. These programs preserve the value of the billions of dollars worth of water and wastewater assets that have been constructed with EPA, state, and municipal investments over more than forty years. These investments across the nation have improved the quality of our water, our lakes, rivers and streams. The water pollution control program has been extremely successful in restoring our nation's waters and we should all be proud of what we have accomplished.

One of the greatest challenges we face is sustaining our investment. So much of the process of wastewater collection and treatment takes place out of sight, as much of our infrastructure is underground and out of public view. Many of Massachusetts' treatment facilities have now reached their expected design life, and many sewer systems have exceeded their life expectancy. As our valuable infrastructure begins to show its age, it becomes critically important to engage in preventive maintenance activities and to conduct capital planning activities. The enclosed brochure spells out the tasks and provides some insight into programs to ensure sustainability of your underground infrastructure.

The costs of infrastructure maintenance and repair can be high, but these costs will only continue to mount as aging infrastructures continue to erode. With the average cost to replace a major sewer line at one million dollars per mile, wastewater collection and treatment facilities can be the most expensive infrastructure for many communities. When these systems fail due to age or maintenance issues, fines can add to the cost of repair or replacement. We hope that you will take a proactive approach to addressing and improving your community's wastewater treatment system by providing adequate funding during this upcoming budget cycle. Some of the most difficult challenges facing local wastewater facilities are balancing the need to sustain infrastructure while also financing new equipment and capital facilities.

MassDEP and EPA will continue to reach out to local officials to stress the importance and value of properly maintaining wastewater infrastructure. Viable and reliable infrastructure is also critical to the local economy. While there is little glamour in discussing a community's wastewater needs, we trust that the sentiment among the local officials and citizenry of Massachusetts is one of support for this basic need of public health and clean waterways.

Sincerely,

Sam Silverman, acting for

Susan Studlien, Director
Office of Environmental Stewardship
U.S. EPA - New England Region

cc: MassDEP

RECEIVED
OCT 23 2013
BY:

Do You Know the Condition of Your Sewer System?

U.S. EPA | WATER INFRASTRUCTURE OUTREACH

EPA United States Environmental Protection Agency

Why perform a condition assessment?

The compelling reason to perform a condition assessment of your collection system is to preserve the existing valuable infrastructure, minimize O&M and avoid emergencies and unexpected costs. Condition assessment of your collection system is an investment in managing risk. Knowing the structural condition of your underground assets will allow you to avoid emergencies, prioritize repair and replacement projects, and plan for the future.

In a condition assessment, data and information are gathered through observation, direct inspection, investigation, and monitoring. An analysis of the data and information helps determine the structural, operational, and performance status of capital infrastructure assets. A good written protocol, consistently applied, will help define the assessment. Use new data collection techniques to get the most out of your program. Implementing a pro-active program based on information and systematic assessment removes some of the politics and second-guessing from decision-making.

Performing a condition assessment has a cost, but prioritizing work by focusing on critical assets and the maintenance and replacement needs for your collection system is an essential step toward better management.

Online Tools & Contacts

For more information on Condition Assessment:
WasteWater Collection System Toolbox
www.epa.gov/region1/sso/toolbox.html

Other Online Resources:
Sustainable Water Infrastructure
water.epa.gov/infrastructure/sustain/sustainable_infrastructure.cfm

Aging Water Infrastructure
www.epa.gov/awi/con_assessment.html

Gina Snyder 617-918-1837 snyder.gina@epa.gov
Jack Healey 617-918-1844 healey.jack@epa.gov

Pipeline Defects
www.nassco.org

Liquid Assets Video
liquidassets.psu.edu/

These are links to non-EPA web sites that provide additional information on eliminating sanitary sewer overflows. You will leave the EPA.gov domain and enter another page with more information. EPA cannot attest to the accuracy of information on that non-EPA page. Providing links to a non-EPA Web site is not an endorsement of the other site or the information it contains by EPA or any of its employees. Also, be aware that the privacy protection provided on the EPA.gov domain may not be available at the external link.

Structural

If a sewer pipe is about to fail and you don't know about it, is it a problem? Structural problems can cause major headaches.

CCTV is one of the best tools available to check the condition of your buried assets. During CCTV field inspections, pipe defects and maintenance issues are discovered and classified using a standardized coding system. Following data analysis, structural condition information is used to estimate a pipe's performance, remaining useful life and to plan for the future and make decisions about pipe repair or replacement.

CCTV inspections also reveal maintenance issues, which aid the manager in making any necessary operation or maintenance changes.

- collapses
- fractures
- sags

Maintenance

Maintenance issues are the leading cause of backups and overflows of collection systems. Condition assessment helps utilities discover maintenance and capacity issues before they become maintenance problems. Knowing how your collection system really works will identify Trouble Spots and lead to preventive maintenance decisions, rather than being reactive to the consequences of emergency incidents. Implementing a pro-active program based on information and systematic assessment provides a manager with the tools to improve decision-making and solid information on which to base staffing and funding decisions.

- grease
- roots
- debris

Capacity

Hydraulic capacity is a primary performance measure for a wastewater collection system. Capacity (both hydraulic and treatment) can be taken up by clean water entering the sewer collection system. It may be obvious, based on dry weather and wet weather flows, that rainwater or groundwater inflow or infiltration (I/I) is a problem.

CCTV evaluation can determine the specific location and cause of I/I in many cases, however, flow data gathered by flow meters has been used to guide sewer system capacity management for decades. Flow data can be used as a tool in condition assessment either to identify areas for further CCTV inspection or to quantify the severity of I/I identified during CCTV work.

- excess flow
- infiltration
- inflow

APPENDIX B

Appendix B

IWP CSO Plan - Performance and Project Worksheets

CSO REGULATOR PERFORMANCE BY PHASE

CSO Regulator	BASELINE		PHASE 1		PHASE 1 .5		PHASE 2		PHASE 3		PHASE 4		PHASE 5		PHASE 6	
	Activation Frequency (1976)	CSO Volume (mg) (1976)	Activation Frequency (1976)	CSO Volume (mg) (1976)	Activation Frequency (1976)	CSO Volume (mg) (1976)	Activation Frequency (1976)	CSO Volume (mg) (1976)	Activation Frequency (1976)	CSO Volume (mg) (1976)	Activation Frequency (1976)	CSO Volume (mg) (1976)	Activation Frequency (1976)	CSO Volume (mg) (1976)	Activation Frequency (1976)	CSO Volume (mg) (1976)
CRI CSO System																
CSO 007	0	0.0	2	0.2	2.0	0.2	2	0.2	2	0,2	2	0.2	2	0.2	2	0.1
CSO 008	38	43.6	4	2.2	4.0	2.2	5	2.5	5	2.5	5	2.5	5	2.4	4	1.5
CSO 010	69	157.4	68	86.9	68.0	86.9	38	59.4	38	59.5	38	59.7	17	17.9	6	6.9
CSO 011	19	6.6	29	20.0	29.0	20.0	23	12.4	23	12.3	21	10.2	20	15.2	6	1.2
CSO 012	39	54.1	45	71.6	45.0	71.6	32	36.2	32	36.2	30	34.5	17	9.5	4	0.5
CSO 013	19	36.9	21	41.2	21.0	41.2	23	51.4	24	51.3	22	48.8	12	18.2	7	12.0
CSO 014	53	42.2	55	56.9	55.0	56.9	21	6.9	21	6.8	8	3.4	14	4.5	6	2.0
CSO 015A	42	26.8	43	33.5	43.0	33.5	22	14.8	22	14.6	5	4.0	14	14.3	6	6.1
CSO 015B	15	2.1	16	2.3	16.0	2.3	13	2.3	11	2.1	2	0.8	8	2.6	6	3.1
CSO 016	42	69.8	42	73.5	42.0	73.5	13	19.0	11	16.8	3	6.3	9	16.2	7	16.8
CSO 018	1	0.01	1	0.01	1.00	0.01	1	0.10	1	0.1	1	0.01	1	0.01	1	0.01
CSO 049	1	0.04	4	0.4	4.0	0.4	4	0.4	4	0.4	4	0.4	4	0.4	4	0.4
CSO 042	4	1.3	4	1.2	4.0	1.2	6	11.0	6	10.3	6	10.3	6	10.5	5	8.4
SUBTOTAL	342	440.7	334	390.0	334.0	390.0	203	216.7	200	213.0	147	181.2	129	112.0	64	59.0
Mill River CSO System																
CSO 019	1	0.03	1	0.03	1.00	0.03	1	0.03	1	0.03	1	0.03	1	0.03	1	0.03
CSO 017	1	0.03	1	0.03	1.00	0.03	1	0.03	1	0.03	1	0.03	1	0.03	1	0.03
CSO 025	7	0.8	7	0.8	7.0	0.8	7	0.8	7	0.83	7	0.8	7	0.8	7	0.8
CSO 048	1	0.1	1	0.1	1.0	0.1	1	0.1	1	0.09	1	0.1	1	0.1	1	0.1
CSO 024	0	0.00	0	0.00	0.00	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
CSO 045	0	0.00	0	0.00	0.00	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
CSO 046	5	0.1	5	0.1	5.0	0.1	5	0.1	5	0.11	5	0.1	5	0.1	5	0.1
SUBTOTAL	15	1.1	15	1.1	15	1.1	15	1.1	15	1.1	15	1.1	15	1.1	15	1.1
Chicopee River CSO System																
CSO 037	0	0.0	0	0.0	0.0	0.0	0	0.0	0	0.0	0	0.0	0	0.00	0	0.0
CSO 036	1	0.1	1	0.1	1.0	0.1	1	0.1	1	0.1	1	0.1	1	0.10	1	0.1
CSO 035	1	0.01	1	0.01	1.00	0.01	1	0.01	1	0.01	1	0.01	1	0.01	1	0.01
CSO 034	1	0.2	1	0.2	1.0	0.2	1	0.2	1	0.2	1	0.2	1	0.20	1	0.2
SUBTOTAL	3	0.3	3	0.3	3	0.3	3	0.3	3	0.3	3	0.3	3	0.3	3	0.3
SYSTEM TOTAL	360	442.2	352	391.4	352.0	391.4	221	218.2	218	214.4	165	182.6	147	113.4	82	60.4

SWSC Long Term CSO Control Plan
Integrated Wastewater Program Implementation
Recommended CSO Control Plan
Project Data Sheet

PROJECT OVERVIEW

Project: Washburn CSO Control

Phase: 1

Programmed Amount: $20,927,000

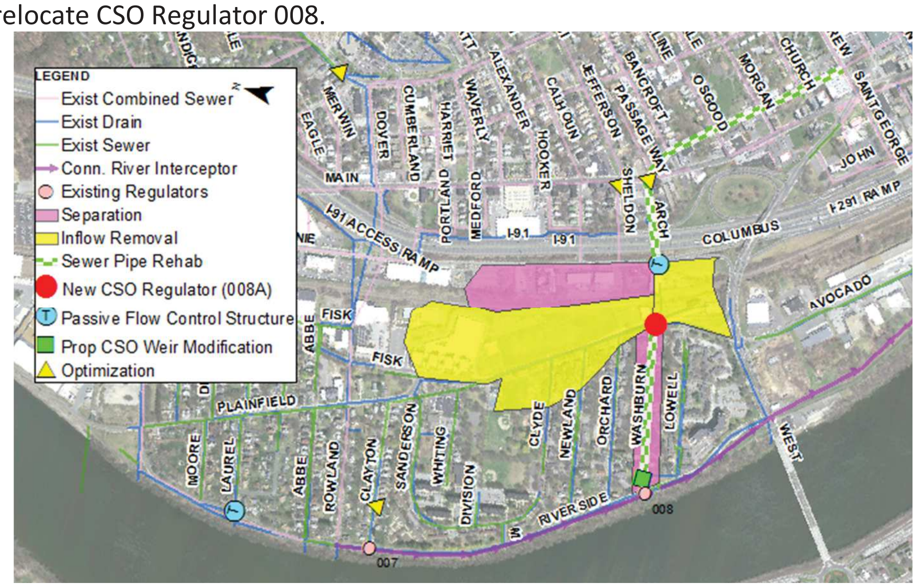
Design Year: 2012

Construction Year: 2013-2014

PROJECT INFORMATION

Project Objective: Maintain commitment to CSO spill frequency as outlined in updated CSO implementation plan for the typical precipitation year (1976); preserve sewer level of service; rehab key infrastructure

Description and Scope: Separate Washburn Street and Birnie Avenue; perform inflow removal along Plainfield Street; optimize the existing system storage capacity in the Garden Brook Sewer via Arch St throttle and the upper end of the CRI via Laurel St throttle; further optimize use of in-system storage upstream of CSO Regulators 007 and 049 via adjustments to underflow and overflow settings; provide system optimization at Main Street/Sheldon Street and Arch Street/Main Street; preserve or improve sewer level of service in CSO 007 and CSO 008 sub-catchments by balancing inter-catchment flows; rehab the 84-inch Washburn Street combined sewer and 66-inch Garden Brook sewer via trenchless approaches; relocate CSO Regulator 008.



Other Benefits: Extend the service life of key infrastructure including the 84-inch Washburn Street and 66-inch Garden Brook sewers; upgrade critical water infrastructure; green infrastructure recommended (stormwater detention feature)

Operating Impact: N/A

PROJECT OUTCOMES

CSO Reduction:

	# of CRI System Activations	% Reduction in # of CRI System Activations	CRI System CSO Volume (MG)	% Reduction in CRI System CSO Volume
Baseline	**342**	**0%**	**441**	**0%**
After Phase 1	**334**	**2%**	**390.0**	**12%**

Level of Service: Maintain or improve Level of Service per project objective (approx 6-ft below grade wherever possible or maintenance of baseline levels).

SWSC Long Term CSO Control Plan
Integrated Wastewater Program Implementation
Recommended CSO Control Plan
Project Data Sheet

PROJECT OVERVIEW

Project: CSO 012/ 013/018Modifications

Phase: 1.5

Programmed Amount: $5,640,000

Design Year: 2014-2015

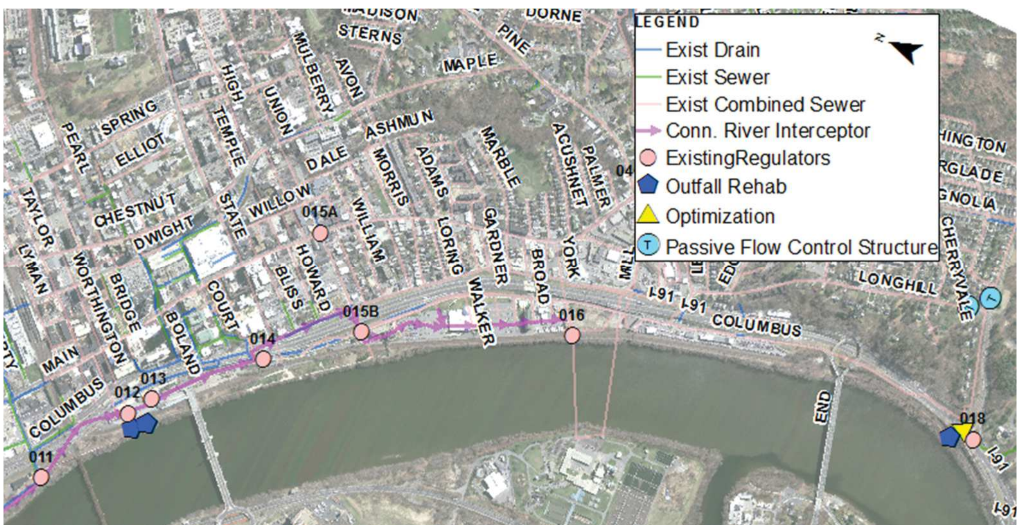
Construction Year: 2015-2016

PROJECT INFORMATION

Project Objective: Rehabilitate failing CSO infrastructure; improve sewer access and maintenance ability; preserve sewer level of service; maintain existing, or reduce, CSO spill frequency

Description and Scope:

Rehabilitate the failing CSO 012 and 013 outfall structures with maintenance of existing flood protection; explore elimination of CSO 018; rehabilitate the CSO 018 outfall.



Other Benefits: Related Wastewater project (to be included with this design and construction Work Order) to provide renewal of vital 66-in Main Intercepting sewer plus optimization of Dickinson St sewer siphon to improve hydraulics and/or enable maintenance

Operating Impact: N/A

PROJECT OUTCOMES

CSO Reduction:

	# Activations	% Reduction in # Activations	CSO Volume (MG)	% Reduction in CRI CSO Volume
Baseline	342	0%	441	0%
Through Phase 1	334	2%	390.0	12%
Phase 1.5	334	2%	390.0	12%

Level of Service: Maintain or improve Level of Service per project objective.

SWSC Long Term CSO Control Plan
Integrated Wastewater Program Implementation
Recommended CSO Control Plan
Project Data Sheet

PROJECT OVERVIEW

Project: York Street Pump Station (YSPS) and Connecticut River Crossing to Springfield Regional Wastewater Treatment Facility (SRWTF)

Phase: 2

Programmed Amount: $58,043,000

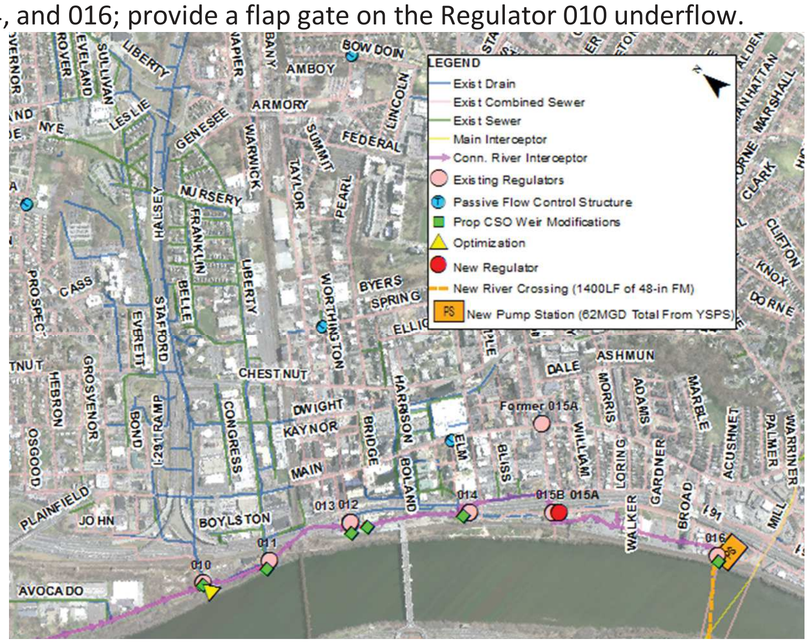
Design Year: 2015-2016

Construction Year: 2017-2020

PROJECT INFORMATION

Project Objective: Reduce CSO spill frequency to meet commitments in updated CSO implementation plan in the typical precipitation year (1976); preserve sewer level of service.

Description and Scope: Supplement pumping capacity of the existing YSPS to the SRWTF with new pump station such that total peak pumping capacity is 62mgd; install new 1400LF river crossing (preliminarily 48-in diameter) from the YSPS to the influent structure at SRWTF; relocate Regulator 015A along Union from Main Street to West Columbus Avenue; install the Elm Street weir at Main and adjust the Main Street invert; install the Carew Street throttle near Melha Avenue and the Worthington Street throttles near Spring Street and Bowdoin Street; provide CSO weir modifications to CSO Regulators 010, 011, 012, 013, 014, and 016; provide a flap gate on the Regulator 010 underflow.



Other Benefits: New river crossing offers redundancy of key infrastructure in case of failure of one or both of the two existing aging and degraded crossings

Operating Impact: Additional pumping capacity and river crossing enables SWSC to have operational flexibility in delivering wastewater flows to the SRWTF and an ability to isolate its key infrastructure (pipes and pumps) to enable maintenance/rehabilitation.

PROJECT OUTCOMES

CSO Reduction:

	# Activations	% Reduction in # Activations	CSO Volume (MG)	% Reduction in CRI CSO Volume
Baseline	**342**	**0%**	**441**	**0%**
Through Phase 1.5	**334**	**2%**	**390.0**	**12%**
Phase 2	**203**	**41%**	**216.7**	**51%**

Level of Service: Maintain or improve Level of Service per project objective (approx 6-ft below grade wherever possible or maintenance of baseline levels)

SWSC Long Term CSO Control Plan
Integrated Wastewater Program Implementation
Recommended CSO Control Plan
Project Data Sheet

PROJECT OVERVIEW

Project: Locust Transfer Structure/Conduit and Flow Optimization in Mill System

Phase: 3

Programmed Amount: $17,100,000

Design Year: 2020

Construction Year: 2020-2021

PROJECT INFORMATION

Project Objective: Maintain commitment to CSO spill frequency as outlined in updated CSO implementation plan in the typical precipitation year (1976);provide operational flexibility with wastewater flow diversion to the SRWTF.

Description and Scope: Enable optimization and controlled diversion of dry and wet weather Main Interceptor flows to the York Street Pump Station (YSPS) vicinity when needed for operational and maintenance activities; provide diversion and optimization structures along Locust Street and at the new York Street Pump Station; optimize in-system storage of branch line connections to the Main Intercetor via four flow control throttles; adjust existing regulator 016's weir.

Other Benefits: Optimization of Mill River CSO system branches results in attenuated peak flow at SRWTF, allowing for greater peak flow delivery from Connecticut River CSO system

Operating Impact: Ability to completely divert Main Interceptor flows to YSPS will enable isolation of existing degraded 66-in river crossing for rehabilitation and renewal

PROJECT OUTCOMES

CSO Reduction:

	# Activations	% Reduction in # Activations	CSO Volume (MG)	% Reduction in CRI CSO Volume
Baseline	**342**	**0%**	**441**	**0%**
Through Phase 2	**203**	**41%**	**216.7**	**51%**
Phase 3	**200**	**42%**	**213**	**52%**

Level of Service: Maintain or improve Level of Service per project objective.

SWSC Long Term CSO Control Plan
Integrated Wastewater Program Implementation
Recommended CSO Control Plan
Project Data Sheet

PROJECT OVERVIEW

Project: York to Union Box Culvert

Phase: 4

Programmed Amount: $32,131,000

Design Year: 2022-2023

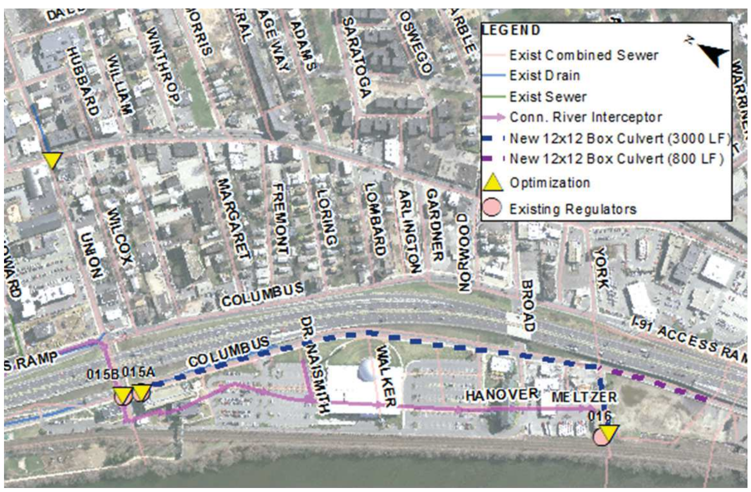
Construction Year: 2024-2029

PROJECT INFORMATION

Project Objective: Maintain commitment to CSO spill frequency as outlined in updated CSO implementation plan in the typical precipitation year (1976) and preserve sewer level of service.

Description and Scope:

Provide additional conveyance and storage capacity of combined sewer for the CRI (and Main Interceptor via Phase 3 Locust St transfer) systems through a new 12-ft x 12-ft reinforced concrete box culvert along West Columbus from the existing Union St CSO Regulator 015B to the existing York St CSO Regulator 016 (approx 3000LF) and an additional reach in the YSPS area (approx. 800 LF); optimize former Regulator 015A's underflow/overflow control settings at its Main Street location; install connections from Regulators 015A (at its new location on West Columbus), 015B and 016 to new 12-ft x 12-ft relief sewer.



Other Benefits: New 12-ft x 12-ft conduit offers system redundancy to the existing CRI for conveyance of dry and wet weather flows

Operating Impact: New conveyance conduit provides SWSC with operational flexibility in conveying wastewater to the SRWTF and an ability to isolate portions of the CRI and Main Interceptor (after future Locust St transfer) for maintenance/rehabilitation.

PROJECT OUTCOMES

CSO Reduction:

	# Activations	% Reduction in # Activations	CSO Volume (MG)	% Reduction in CRI CSO Volume
Baseline	**342**	**0%**	**441**	**0%**
Through Phase 3	**200**	**42%**	**213**	**52%**
Phase 4	**147**	**57%**	**181.2**	**59%**

Level of Service: Maintain or improve Level of Service per project objective (approx 6-ft below grade wherever possible or maintenance of baseline levels).

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PROJECT OVERVIEW

Project: Union to Clinton Relief Conduit

Phase: 5

Programmed Amount: $18,720,000

Design Year: 2025-2026

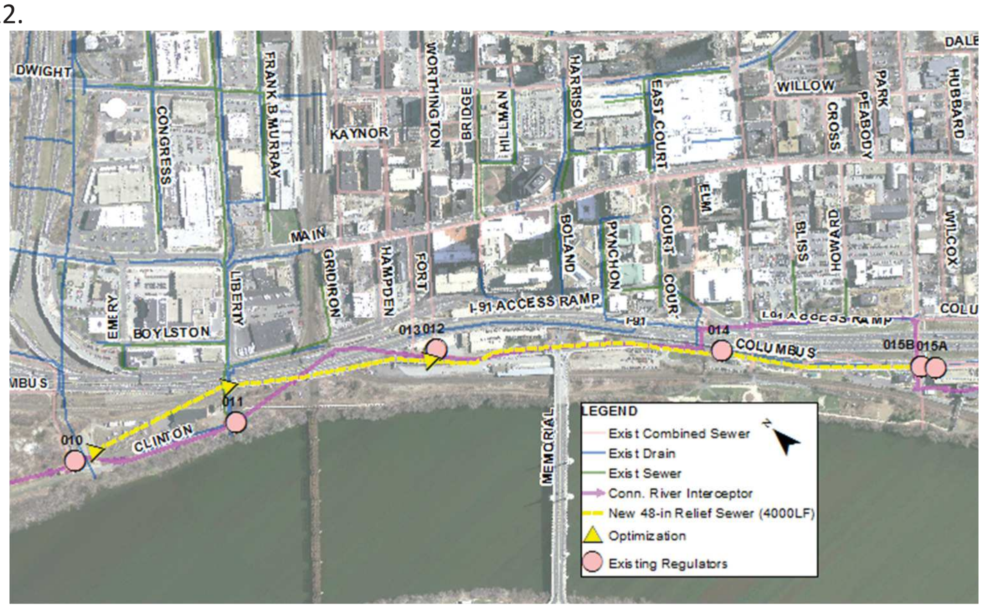
Construction Year: 2027-2030

PROJECT INFORMATION

Project Objective: Maintain commitment to CSO spill frequency as outlined in updated CSO implementation plan in the typical precipitation year (1976) and preserve sewer level of service.

Description and Scope:

Provide additional conveyance and storage capacity of combined sewer for the CRI (and Main Interceptor via future phase Locust St transfer) systems through a new 48-in relief sewer parallel to the existing CRI from the existing Clinton Street CSO Regulator 010 to the existing Union Street CSO Regulator 015B (approx 4000LF)including connections to the relief sewer at Existing CSO Regulators 010, 011 and 012.



Other Benefits: New conveyance conduit offers system redundancy for CRI

Operating Impact: New conveyance conduit enables SWSC to have operational flexibility in conveying wastewater toward to the SRWTF and an ability to isolate portions of the CRI and Main Interceptor (after future Locust St transfer) for maintenance/rehabilitation.

PROJECT OUTCOMES

CSO Reduction:

	# Activations	% Reduction in # Activations	CSO Volume (MG)	% Reduction in CRI CSO Volume
Baseline	342	0%	441	0%
Through Phase 4	147	57%	181.2	59%
Phase 5	129	62%	112.0	75%

Level of Service: Maintain or improve Level of Service per project objective (approx 6-ft below grade wherever possible or maintenance of baseline levels).

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PROJECT OVERVIEW

Project: Targeted Sewer Separation,Stormwater Management, and Miscellaneous Flow Control and System Optimization

Phase: 6

Programmed Amount: $30,761,000

Design Year: 2027-2028

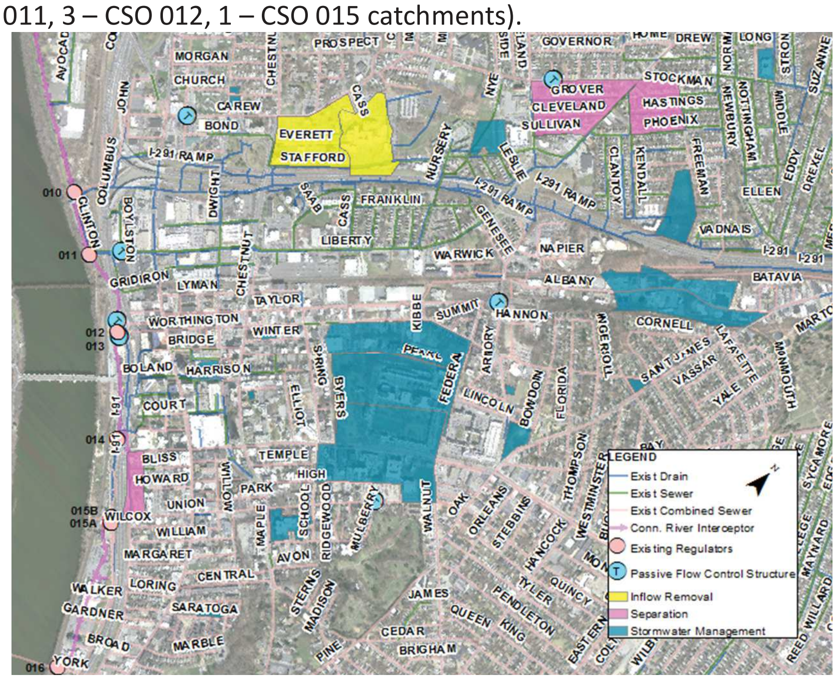
Construction Year: 2029-2031

PROJECT INFORMATION

Project Objective: Maintain commitment to CSO spill frequency as outlined in updated CSO implementation plan in the typical precipitation year (1976) and preserve sewer level of service.

Description and Scope:

Provide approximately 3,000 LF of sewer separation along E Columbus/South Main and 3,000 LF of separation along Liberty/Armory St, 40 acres of inflow removal in the vicinity of Mercy Hospital, approximately 180 acres of stormwater management improvements along Albany St, Springfield Technical Community College vicinities, and various other sites, and 7 flow control structures (2 - CSO010, 1 – CSO 011, 3 – CSO 012, 1 – CSO 015 catchments).



Other Benefits: Water quality improvements from SWM features

Operating Impact: N/A

PROJECT OUTCOMES

CSO Reduction:

	# Activations	% Reduction in # Activations	CSO Volume (MG)	% Reduction in CRI CSO Volume
Baseline	**342**	**0%**	**441**	**0%**
Through Phase 5	**129**	**62%**	**112.0**	**75%**
Phase 6	**64**	**81%**	**59.2**	**87%**

Level of Service: Maintain or improve Level of Service per project objective (approx 6-ft below grade wherever possible or maintenance of baseline levels).

Appendix B

IWP WW Plan – Additional Sites with Failing Infrastructure

ADDITIONAL SITES WITH STRUCTURALLY FAILING INFRASTRUCTURE

												Weighting Factor									
											4	4	3	3	1	1	1			
Prioritized Project Rank	**Project/Phase**	**FY Project Recommended**	**Status**	**Overview Sheet Number**	**Pipe Size (in)**	**Pipe Material**	**Project Risk Factor**	**Project Criticality Factor**	**# of Customers Potentially Affected by Failure**	**Maximum Project Depth**	**"Project" Length (LF)**	**Project Risk Value**	**Project Criticality Value**	**Potential Customer Impact**	**Predominant Defect Type**	**Impacts to Adjacent Utilities**	**Depth**	**Traffic Impact**	**Prioritization Score**	**Initial Recommended Resolution**	**Notes**
1	Saint James Avenue3	FY2014	New Project	12	12	VCP	4.8	4.26	275	11.7	2,805	3	3	5	5	1	4	5	**64**	Mix of dig and replace and CIPP Liners	VC pipe with various cracks/fractures/abandoned. Significant flow
2	WhiteSt6	FY2014	New Project	10	24	VCP	5.45	5.8	155	13.4	357	3	3	5	4	2	4	5	**62**	Dig and Replace with larger pipe to minimize backwater conditions	Uncoded hinge fractures. Very heavy flow due to E. Longmeadow Flows. Consider size increase for capacity. Possibly combine with DwightRoad1.
3	Locust Street1	FY2013	Removed by SWSC in 2013	3	30x45/33x49	BRICK	7.9	5.9	51	6.4	789	4	3	3	5	2	3	3	**60**	Overflow line only - does not require immediate attention	Brick overflow pipe with concrete invert - concrete is corroding - missing wall/holes
4	KnoxOutlet1	FY2014	New Project	3, 8	24	VCP	6.8	5.69	133	8	459	4	3	5	3	3	3	1	**59**	Relocate Knox connection to MIS as part of Main Interceptor project.	Some cracks and fractures.
5	CarewSt1	FY2014	New Project	5	12	VCP	5.1	4.05	166	8.2	645	3	3	5	2	5	3	5	**58**	CIPP Liner	Some cracks/fractures in critical sewer.
6	PlumAbbottSt1	FY2013	Removed by SWSC in 2014	15	10/12	VC	5.1	3.5	149	12.9	481	3	2	5	4	1	4	5	**57**	Dig and replace	Holes in invert of 2 pipes. Fractures/breaks in all segments.
7	Plumtree Road5	FY2013	Original Project	15	10	VC	5.1	2.64	316	8	575	3	2	5	4	1	3	5	**56**	CIPP Liner or sectional liner	Two large holes in two pipes
8	Allen Street3	FY2013	Removed by SWSC in 2015	9	12	VC	5.1	3.86	120	5.3	398	3	2	5	4	1	2	5	**55**	Dig and repair	Broken pipe at 216' DS of 17CE - requires spot repair
9	CambridgeSt1	FY2014	New Project	13	20	VCP	4.99	4.03	51	13	555	3	3	3	4	5	4	1	**55**	Coordinate with gas company. Dig and replace.	Hinge Fractures/Breaks. Beware of crossbore gas main.
10	DwightRd1	FY2014	New Project	10	18	VCP	6	4.6	46	10.9	352	4	3	2	4	1	4	3	**54**	Possibly combine with WhiteSt6. Dig and replace.	Hinge Fractures/Breaks - only segment on St.
11	Plumtree Road1	FY2013	Removed by SWSC in 2016	9, 15	12	VC	5.1	4.27	39	7.6	21	3	3	2	5	1	3	5	**54**	Dig and repair	COLLAPSED PIPE!!! Dig and repair at top of line near MH 11D4
12	WAllenGifford1	FY2014	New Project	16	10	VCP	4.98	3.49	335	11.5	2,062	3	2	5	4	1	4	1	**53**	Dig and replace/Burst	Lots of breaks - one pipe in private property easement, carries good amount of flow. Other segments in ROW in similar condition, including hinge fractures
13	IvySts1	FY2014	New Project	6, 13	15	VCP/CONC	4.33	3.31	117	13.2	3,142	3	2	5	4	1	4	1	**53**	Dig and Replace.	Concrete pipe with corrosion issues on various streets in neigborhood.
14	NorwoodSt1	FY2014	New Project	3	12	CONC	6	4.83	6	10.2	268	4	3	1	5	1	4	1	**52**	Dig and replace	Concrete pipe with corrosion issues and large offset joint/collapse. Only segment on street. Consider combining with Lombard/William/Wilcox
15	Jefferson Avenue1	FY2013	Removed by SWSC in 2017	1	8/12/15/18/20	VC/CONC	4.7	3.94	28	9.6	1,584	3	2	2	5	5	3	3	**52**	Dig and replace or burst	Mix of VC and unreinforced concrete in very bad condition. VC segments may be candidates for CIPP or sliplining. 36" and 12" W in street.
16	NoelStreet1	FY2014	New Project	3, 8	24	VCP	4.65	4.31	54	9.5	1,559	3	3	3	4	2	3	1	**51**	Dig and replace	Hinge Fractures/Breaks
17	State Street1	FY2013	Removed by SWSC in 2018	6, 7	18	CONC	4.35	3.69	11	7.7	1,884	3	2	1	5	5	3	5	**51**	Dig and replace or burst	Unreinforced concrete pipe - Significant missing wall defects causing abandoned surveys. Collapsed pipe with limited/no services. 24" W in street.

ADDITIONAL SITES WITH STRUCTURALLY FAILING INFRASTRUCTURE

												Weighting Factor									
												4	4	3	3	1	1	1			
Prioritized Project Rank	**Project/Phase**	**FY Project Recommended**	**Status**	**Overview Sheet Number**	**Pipe Size (in)**	**Pipe Material**	**Project Risk Factor**	**Project Criticality Factor**	**# of Customers Potentially Affected by Failure**	**Maximum Project Depth**	**"Project" Length (LF)**	**Project Risk Value**	**Project Criticality Value**	**Potential Customer Impact**	**Predominant Defect Type**	**Impacts to Adjacent Utilities**	**Depth**	**Traffic Impact**	**Prioritization Score**	**Initial Recommended Resolution**	**Notes**
18	GillmanCarr1	FY2014	New Project	16	10	VCP/CONC	3.45	2.74	148	9.6	1,870	2	2	5	5	1	3	1	**51**	Dig and replace	Concrete pipe with corrosion issues, VC with breaks/hinge fractures. Significant flow in pipe.
19	Avon Place2	FY2013	Original Project	2	24	VC	6.62	4.89	22	13.6	694	4	3	1	4	1	4	1	**49**	Dig and replace	Severe Hinge Fractures - Limited sewer services - carries flows from former brook through cemetary
20	MulberrySt1	FY2014	New Project	2	15	VCP/CONC	4.81	4.01	23	13.1	777	3	3	1	5	2	4	1	**49**	Dig and replace	Concrete pipe with corrosion issues and large offset joint/collapse
21	HancockFlorence1	FY2013	Original Project	2	10/15	CONC	4.78	4.04	39	9	1,312	3	3	2	4	1	3	3	**49**	Dig and replace or burst	One segment on Florence may be candidate for CIPP
22	GovernorSt1	FY2014	New Project	5	18	VCP	4.25	3.76	77	7.1	621	3	2	4	4	1	3	1	**49**	Mix of dig and replace and CIPP Liners	Multiple fractures in VC
23	WAllenRidgeRd1	FY2014	New Project	16	10	VCP	3.19	2.31	104	11.1	621	2	2	5	4	1	4	1	**49**	Dig and Replace	Several grade issues/sags, breaks, hinge fractures.
24	FederalSt1	FY2014	New Project	6	12	CONC	5.12	4.98	4	10.5	567	3	3	1	5	1	4	1	**48**	Dig and replace	COLLAPSED! Concrete pipe with corrosion issues.
25	ChestnutEdwards	FY2014	New Project	2	18	CONC	4.31	4.4	6	9.7	587	3	3	1	4	1	3	5	**48**	Dig and Replace	Concrete pipe with corrosion issues.
26	LaurenceStArea1	FY2014	New Project	5, 12	10	CONC/ACP	2.12	2.58	150	9.6	2,224	2	2	5	4	1	3	1	**48**	CIPP Liner with spot repairs	Concrete pipe with corrosion issues. Heavy flow. Preventative Project. Lowest segment in project has holes.
27	East Park Street1	FY2013	Original Project	2	18/24	VC	5.45	5.07	32	9.8	786	3	3	2	4	1	3	1	**47**	Dig and replace	Severe hinge fractures/deformation.
28	Eastern Avenue2	FY2013	Original Project	7	8/10/12	VC/CONC	5.2	3.46	14	8.7	1,512	3	2	1	5	3	3	3	**47**	Dig and replace	COLLAPSED PIPE!!! Unreinforced concrete pipe - Significant missing wall defects causing abandoned surveys. Significant grease issues in some of the pipes - assumed in poor condition.
29	Melrose to Hickory1	FY2013	Original Project	8	18	VC	4.82	5.49	31	6.7	424	3	3	2	4	1	3	1	**47**	CIPP liner	Severe hinge Cracking/Fracturing in VC pipe - Under a building.
30	Blaine Street1	FY2014	New Project	10	15	VCP	4.51	3.03	74	10.9	328	3	2	3	4	1	4	1	**47**	Dig and Replace	Hinge Fractures/breaks. Only segment on street requiring repair.
31	Allen Street9	FY2014	New Project	16	10	VCP	5.3	3.25	10	6.8	571	3	2	1	4	3	3	5	**46**	Dig and Replace	Hinge Fractures/holes. Top of line sewer - minimal flow, but under major roadway. Low Priority
32	Tyler Street2	FY2013	Original Project	7	10/15/18	CONC	5.29	3.43	47	8	1,645	3	2	2	5	1	3	1	**46**	Dig and replace or burst	Unreinforced concrete pipe - Significant missing wall defects causing abandoned surveys.
33	Quincy Street1	FY2013	Original Project	7	12	CONC	4.99	3.38	35	8.9	1,362	3	2	2	5	1	3	1	**46**	Dig and replace or burst	Unreinforced concrete pipe - Significant missing wall defects causing abandoned surveys.
34	Quincy Street2	FY2013	Original Project	7	15/18	CONC	4.48	3.51	40	9.6	1,339	3	2	2	5	1	3	1	**46**	Dig and replace or burst	COLLAPSED PIPE!!! Unreinforced concrete pipe - Significant missing wall defects causing abandoned surveys.

ADDITIONAL SITES WITH STRUCTURALLY FAILING INFRASTRUCTURE

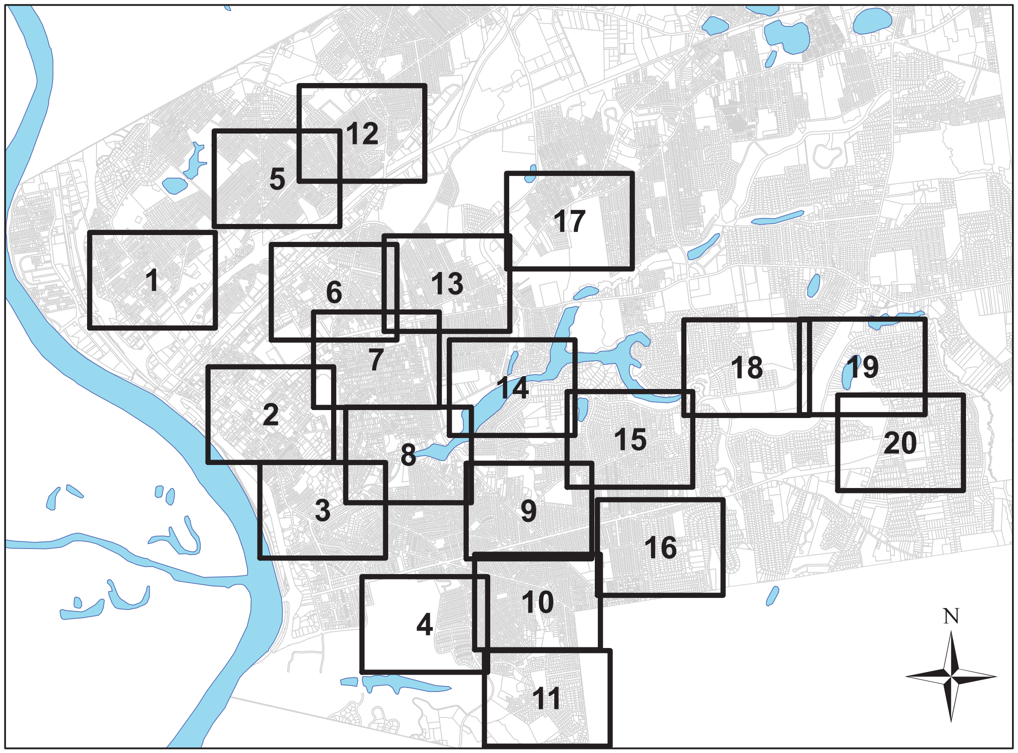
Prioritized Project Rank	Project/Phase	FY Project Recommended	Status	Overview Sheet Number	Pipe Size (in)	Pipe Material	Project Risk Factor	Project Criticality Factor	# of Customers Potentially Affected by Failure	Maximum Project Depth	"Project" Length (LF)	Project Risk Value	Project Criticality Value	Potential Customer Impact	Predominant Defect Type	Impacts to Adjacent Utilities	Depth	Traffic Impact	Prioritization Score	Initial Recommended Resolution	Notes
											Weighting Factor	4	4	3	3	1	1	1			
35	Cross Street1	FY2013	Original Project	2	10	VC	6	3.25	11	8.2	390	4	2	1	4	2	3	1	**45**	Dig and replace	SWSC partially repaired - recommend dig/replace entire pipe
36	WilliamSt1	FY2014	New Project	2	12	VCP	5.1	5.28	16	10.5	351	3	3	1	4	1	4	1	**45**	Consider combining with Lombard/Norwood/Wilcox. Dig and Replace.	Hinge Fractures/Breaks.
37	Cooley Street2	FY2013	Original Project	20	10	VC	5.1	3.86	#N/A	12.4	151	3	2	1	3	3	4	5	**44**	CIPP liner	Small holes, but severe gusher infiltration. SEVERE INFILTRATION AT MH 83B.
38	Greene Street1	FY2013	Original Project	7	15/18	CONC	4.32	3.63	44	11.9	1,403	3	2	2	4	1	4	1	**44**	Dig and replace or burst	Surface Corrision in Conc pipe - some missing wall defects
39	Hunt Street1	FY2013	Original Project	8	10	VC	5.99	3.25	11	8.5	273	3	2	1	5	1	3	1	**43**	Only segment on street requiring repair - Suggested dig and replace/burst	Poor condition - holes/collapses on dead end street
40	Spruce Street1	FY2013	Original Project	8	12	CONC	4.63	3.52	12	8.8	602	3	2	1	5	1	3	1	**43**	Dig and replace or burst	COLLAPSED PIPE!!! Unreinforced concrete pipe - Significant missing wall defects causing abandoned surveys.
41	Queen Street1	FY2013	Original Project	7	12	CONC	4.54	3.66	14	9.1	669	3	2	1	5	1	3	1	**43**	Dig and replace or burst	COLLAPSED PIPE!!! Unreinforced concrete pipe - Significant missing wall defects causing abandoned surveys.
42	South Branch Sewer Extension1	FY2013	Original Project	19	27	RCP	4.51	4.95	#N/A	15.7	784	3	3	1	3	1	5	1	**43**	CIPP Liner	One segement with severe infiltration - additional adjacent segments with some infiltration. Lots of flow to bypass.
43	Thorndyke Street1	FY2013	Original Project	9	12	VC	4.27	3.25	27	7.7	300	3	2	2	4	1	3	1	**43**	Only segment on street requiring repair - Suggested dig and replace/burst - limited customers affected	VC with breaks and other fractures
44	GrosvenorSt1	FY2014	New Project	1	18	CONC	4.13	3.75	15	10	824	3	2	1	4	1	4	3	**43**	Dig and Replace	Concrete pipe with corrosion issues/holes
45	AcushnetAve1	FY2014	New Project	3	12	VCP	5	3.03	13	5.4	97	3	2	1	5	1	2	1	**42**	Dig and Replace	Hinge Fractures/Breaks/Collapse. High PF, low risk. Only segment on street requiring repair
46	DesrosiersSt1	FY2014	New Project	1	10	VCP	5.1	4.15	12	6.2	208	3	3	1	3	1	3	1	**41**	Dig and Replace	2 large sags, multiple fractures and breaks in VC
47	Pendelton Avenue2	FY2013	Original Project	7	12/15	CONC	4.72	3.54	35	14.3	1,395	3	2	2	3	1	4	1	**41**	Dig and replace or burst	Surface Corrision in Conc pipe - dead end street
48	Davis Court1	FY2013	Original Project	2	12	VC	4.15	3.45	3	11.3	201	3	2	1	4	1	4	1	**41**	Only segment on street requiring repair - Suggested dig and replace/burst - limited customers affected	Hinge fractures/deformation in VC pipe.
49	Catherine Street1	FY2013	Original Project	6, 13	10	VC	4	2.84	12	7.9	384	3	2	1	4	2	3	1	**41**	Only segment on street requiring repair - Suggested dig and replace/burst - limited customers affected	VC with some significant holes/cracking/fracturing
50	Monroe Street1	FY2013	Original Project	7	15	CONC	5.98	3.86	2	7.3	316	3	2	1	4	1	3	1	**40**	Dig and replace or burst	Surface Corrision in Conc pipe. Top of line/dead end segment
51	Colchester Street1	FY2013	Original Project	8	10/12	VC	5.04	3.93	15	9	626	3	2	1	4	1	3	1	**40**	Dig and replace or burst	VC with hinge cracking/fracturing. Top of line/dead end segment

ADDITIONAL SITES WITH STRUCTURALLY FAILING INFRASTRUCTURE

												Weighting Factor									
												4	4	3	3	1	1	1			
Prioritized Project Rank	**Project/Phase**	**FY Project Recommended**	**Status**	**Overview Sheet Number**	**Pipe Size (in)**	**Pipe Material**	**Project Risk Factor**	**Project Criticality Factor**	**# of Customers Potentially Affected by Failure**	**Maximum Project Depth**	**"Project" Length (LF)**	**Project Risk Value**	**Project Criticality Value**	**Potential Customer Impact**	**Predominant Defect Type**	**Impacts to Adjacent Utilities**	**Depth**	**Traffic Impact**	**Prioritization Score**	**Initial Recommended Resolution**	**Notes**
52	Union Street2	FY2013	Original Project	7	10/15/18	VC/CONC	4.77	3.91	23	7.9	1,645	3	2	1	4	1	3	1	**40**	Dig and replace or burst	Surface Corrision in Conc pipe - some missing wall defects
53	King Street1	FY2013	Original Project	7	12/15	CONC	4.7	3.29	28	9.4	948	3	2	2	3	1	3	1	**40**	Dig and replace or burst	Surface Corrision in Conc pipe.
54	Ingersoll Street2	FY2013	Original Project	6	12	VC	4.42	2.84	6	6.1	96	3	2	1	4	1	3	1	**40**	Possibly line after repair to top of pipe from within electrical MH	VC with breaks - One break has telecomm or elec MH visible at 12 o'clock - Top of line/dead end segment
55	CapitolRd1	FY2014	New Project	18	10	VCP	4.27	3.33	8	6.1	381	3	2	1	4	1	3	1	**40**	Dig and Replace	Hinge fractures in non-critical line.
56	Alden Street1	FY2013	Original Project	8	15/18	CONC	3.98	3.46	41	9.8	1,413	2	2	2	3	5	3	1	**40**	Dig and replace or burst	Unreinforced concrete pipe - missing wall defects. 115 kV duct bank on street (197-U001)
57	Nelson Avenue1	FY2013	Original Project	7	10	CONC	3.73	2.64	7	12.1	255	2	2	1	5	1	4	1	**40**	Dig and replace	Material change from VC to CP halfway through, CONC has significant missing wall defects. Dead end street.
58	MeridaSt1	FY2014	New Project	12	10	VCP	3.65	2.85	48	10.3	1,102	2	2	2	4	1	4	1	**40**	Dig and replace	Various holes/breaks in invert.
59	Willow Street1	FY2013	Original Project	2	10/12/18	VC	3.38	3.54	11	10.5	936	2	2	1	5	1	4	1	**40**	Dig and replace	COLLAPSED PIPE!!! VC with significant cracks/fractures/holes
60	Allen Street5	FY2013	Original Project	9	10	VC	4.57	2.64	7	10.4	317	3	2	1	2	1	4	5	**39**	Dig and replace or burst	Sag in pipe, some fractures - Top of line/dead end segment
61	CarewTerrace1	FY2014	New Project	12	10	VCP	3.65	3.39	28	6.1	817	2	2	2	4	1	3	1	**39**	Dig and Replace	Various fractures/breaks in non-critical line.
62	Howes Street1	FY2013	Original Project	9	10/12	VC	3.57	2.92	25	8.9	657	2	2	2	4	1	3	1	**39**	CIPP liner	Multiple sections of VC with hinge cracks/fractures. Not deformed. Top of line/dead end segment
63	Orleans Street1	FY2013	Original Project	7	10	CONC	3.32	2.43	5	8.3	187	2	2	1	5	1	3	1	**39**	Only segment on street requiring repair - Suggested dig and replace/burst - limited customers affected	ABANDONED!! Abandoned due to very large hole in invert of the pipe. Surface corrosion throughout pipe. Top of line/dead end segment
64	MiddleSt1	FY2014	New Project	5, 12	10	VCP	3.26	2.58	38	7.6	324	2	2	2	4	1	3	1	**39**	Dig and replace	Various holes and cracking/fracturing. Only segment in street.
65	Irene Street1	FY2014	New Project	11	10	ACP	3.26	2.58	21	7.2	896	2	2	1	5	1	3	1	**39**	Dig and Replace	Concrete pipe with corrosion and collapse.
66	Braddock Street1	FY2013	Original Project	14	10	ACP	3.2	2.43	5	7.7	207	2	2	1	5	1	3	1	**39**	Only segment on street requiring repair - Suggested dig and replace/burst - limited customers affected	COLLAPSED PIPE!!! VC in very poor shape for part of survey. Top of line/dead end segment
67	Woodcliff Street1	FY2013	Original Project	17	10	VC	3.19	2.59	16	7.3	301	2	2	1	5	1	3	1	**39**	Dig and replace	COLLAPSE!!! Hole in side of one segment ofpipe. Cracking/fracturing trhoughout. Significant flow (likely heavy infiltration or carrying former creek)

FY 2014 - PRIORITIZED INFRASTRUCTURE IMPROVEMENT RECOMMENDATIONS

Long Term Control Plan
Springfield Water and Sewer Commission
January 2014



KLEINFELDER
Bright People. Right Solutions.

MWH
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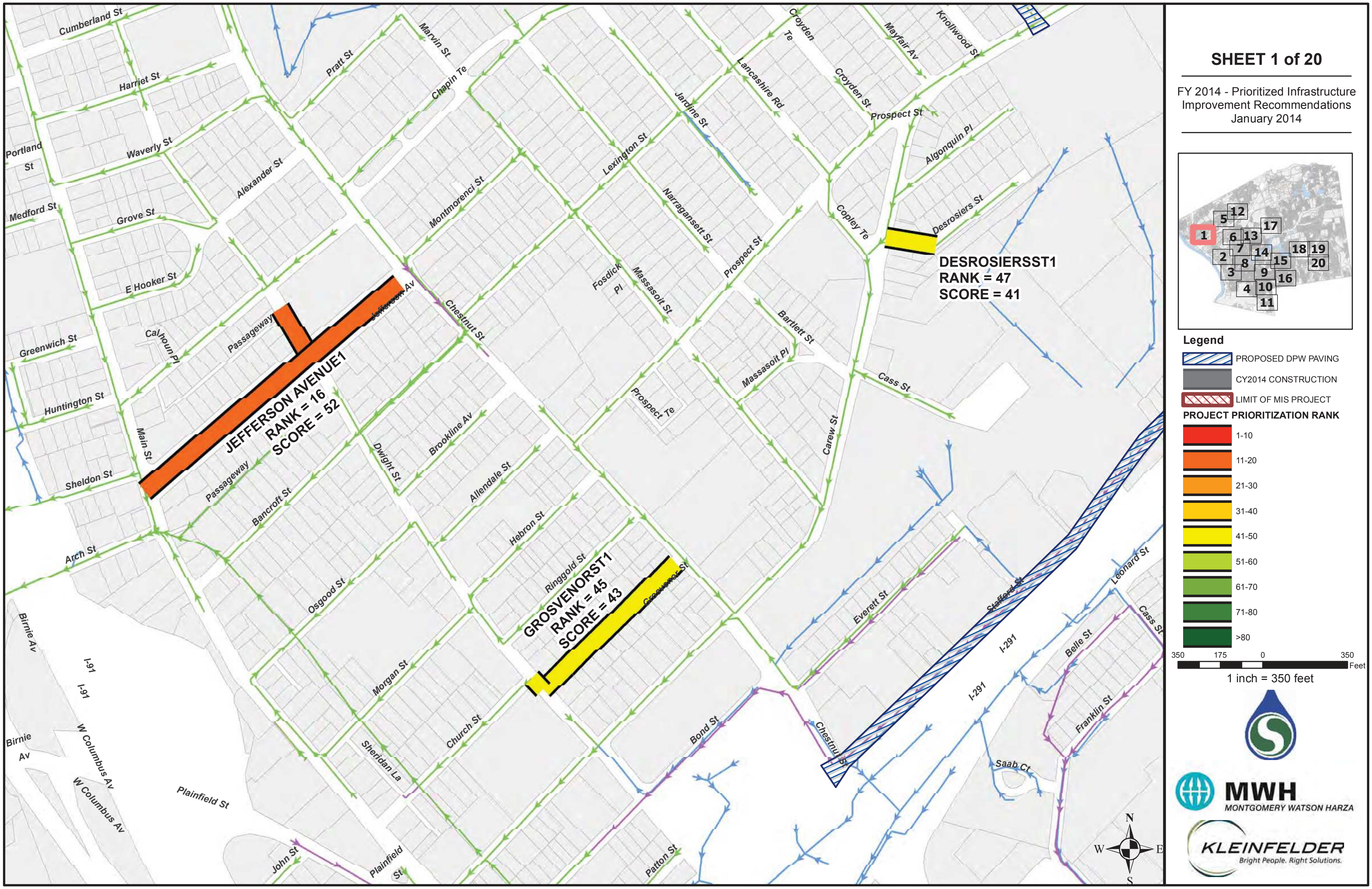

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FY 2014 - Prioritized Infrastructure Improvement Recommendations
January 2014
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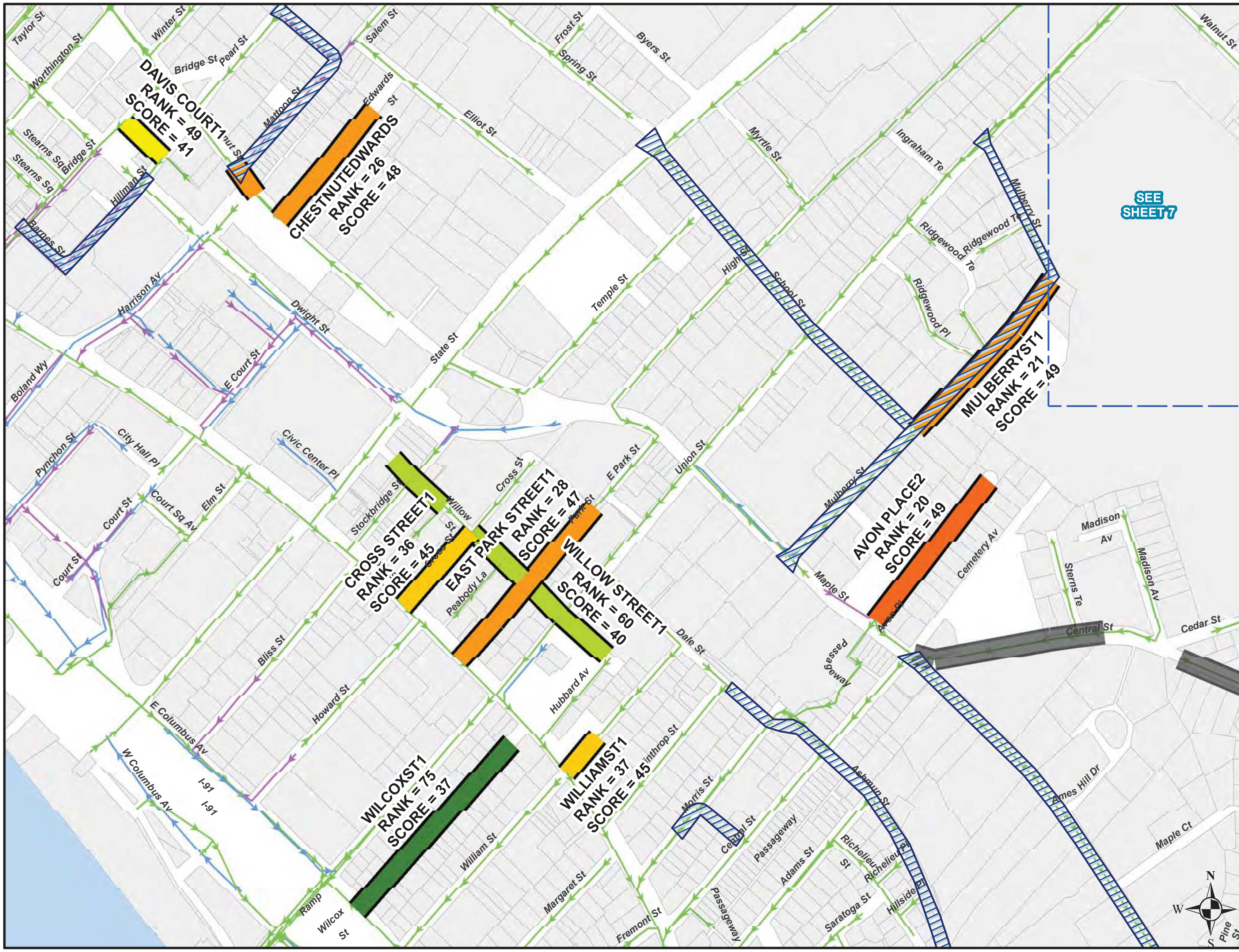

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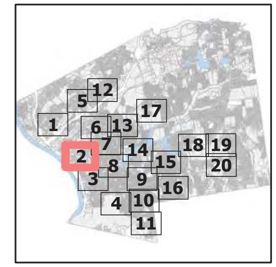

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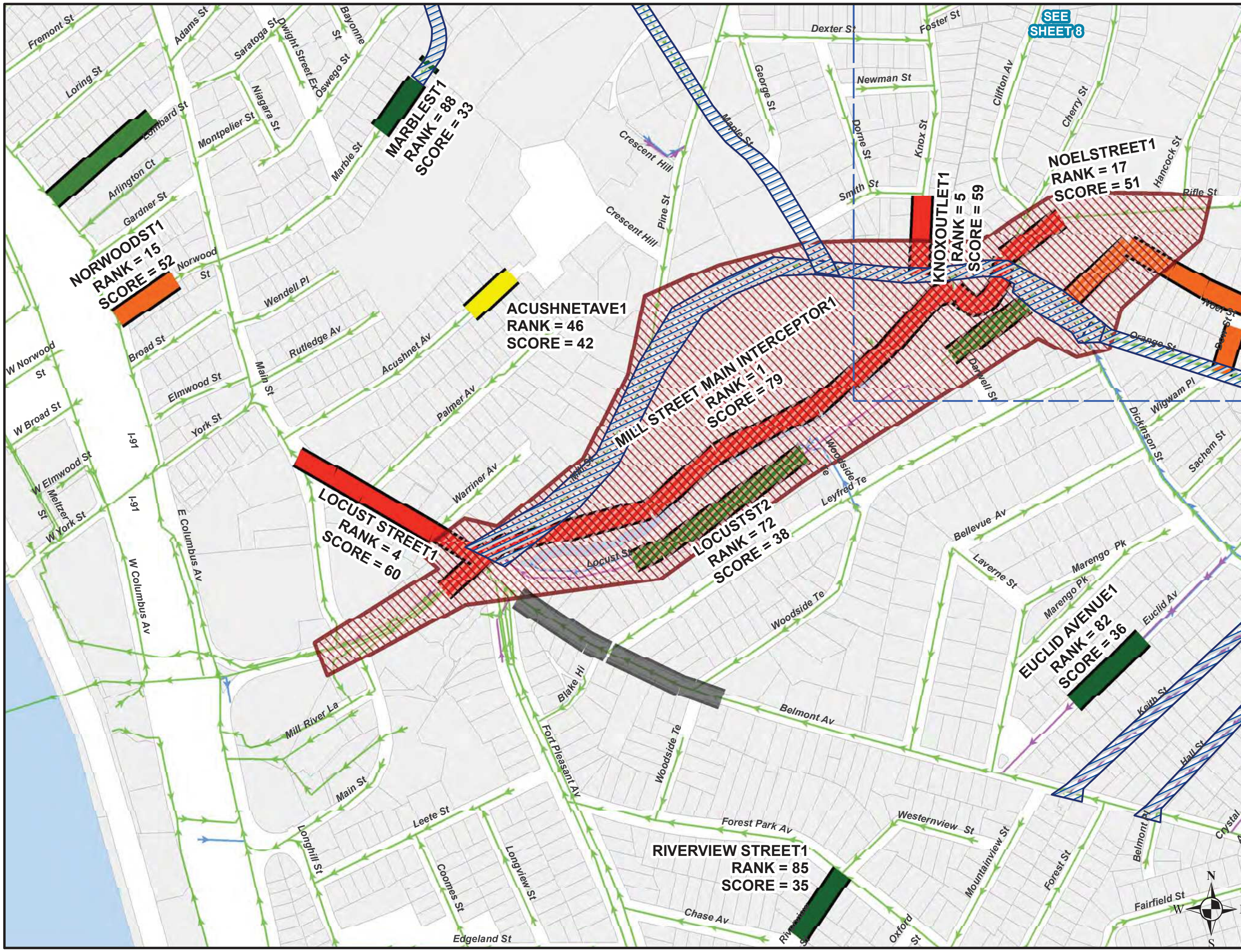

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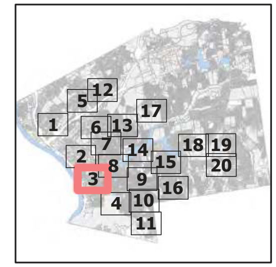

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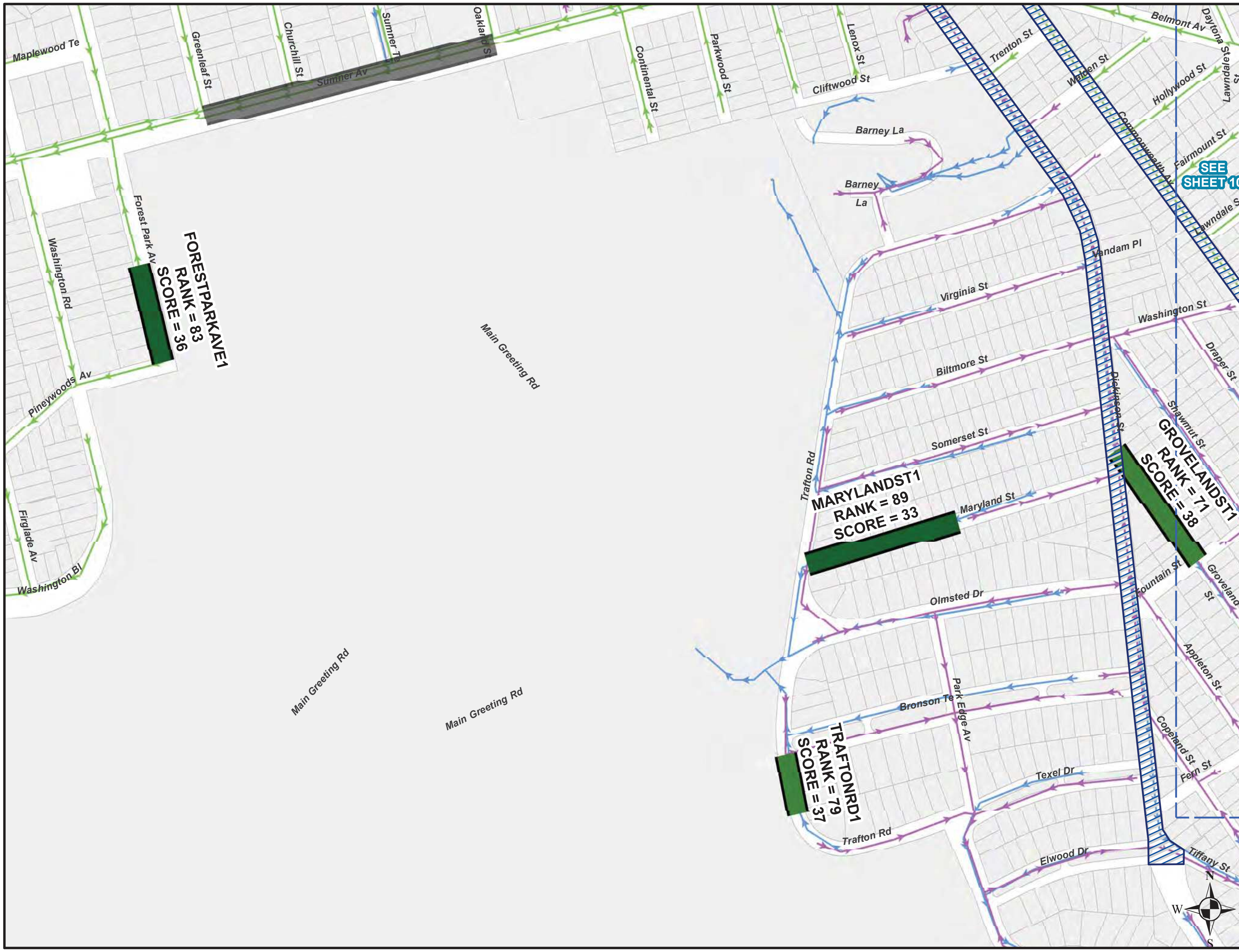

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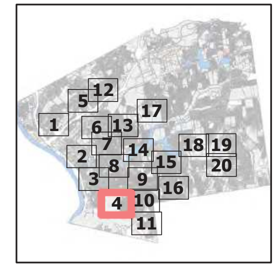

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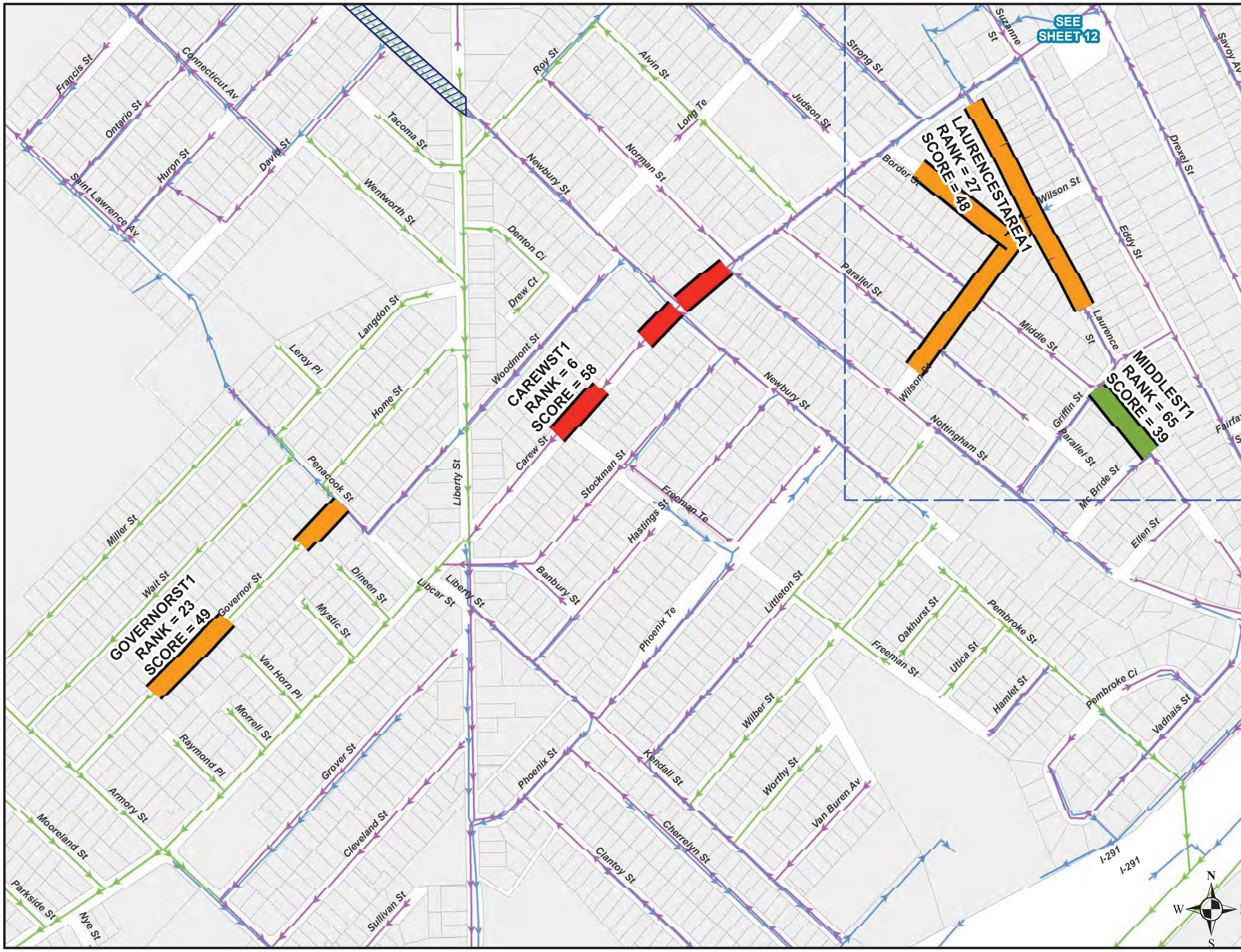

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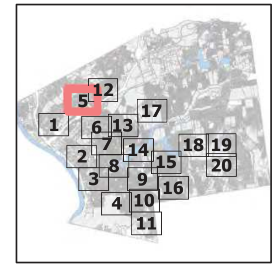

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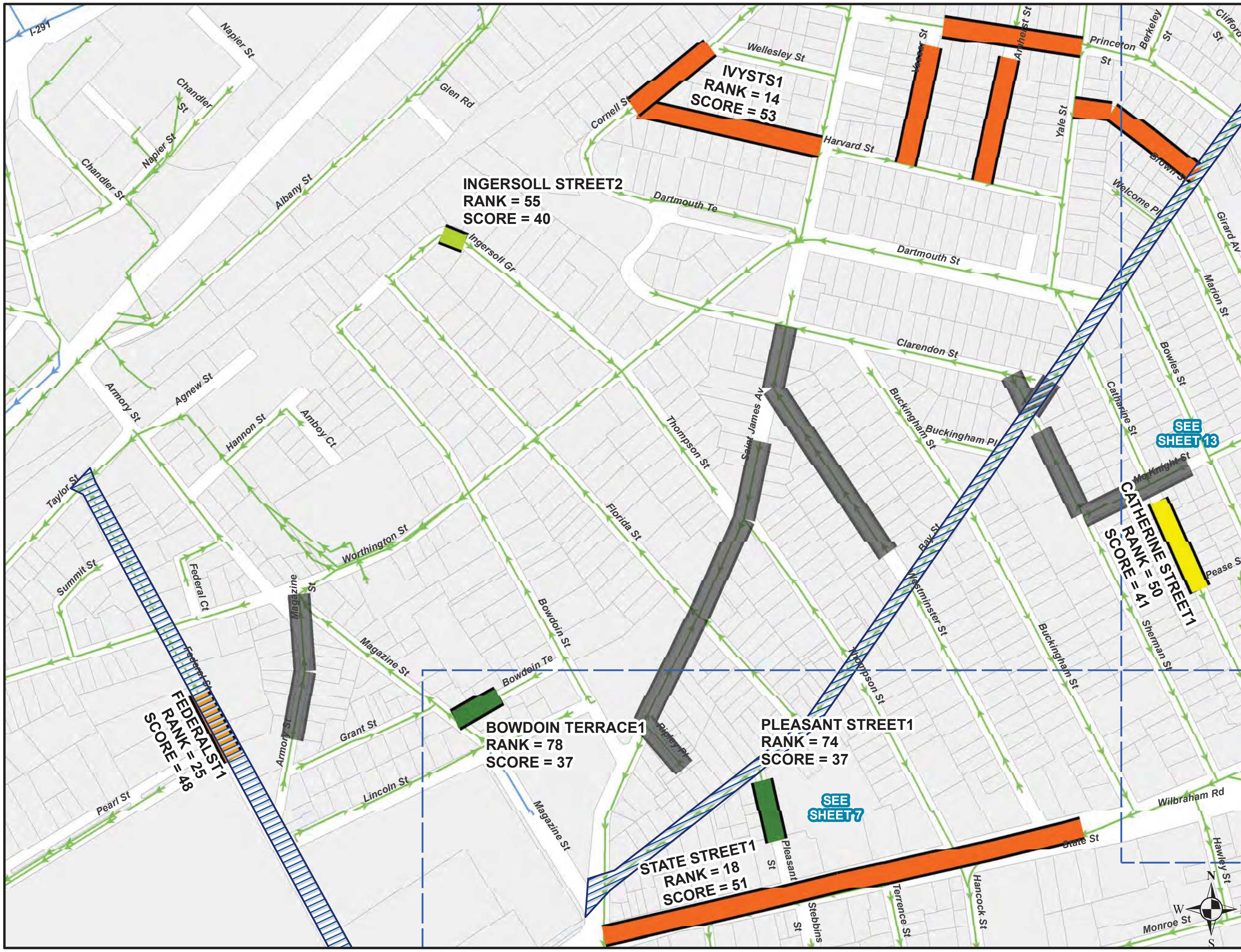

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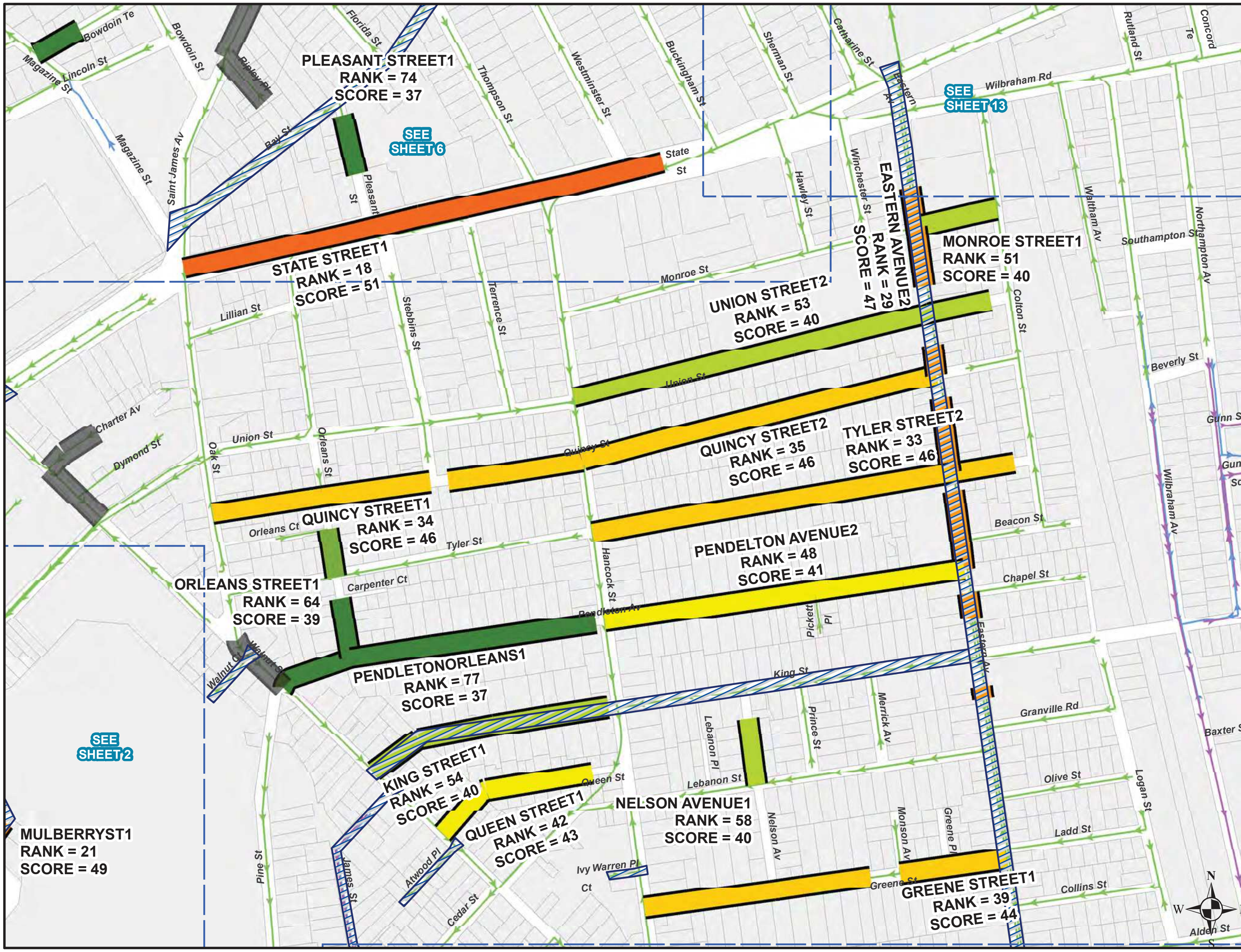

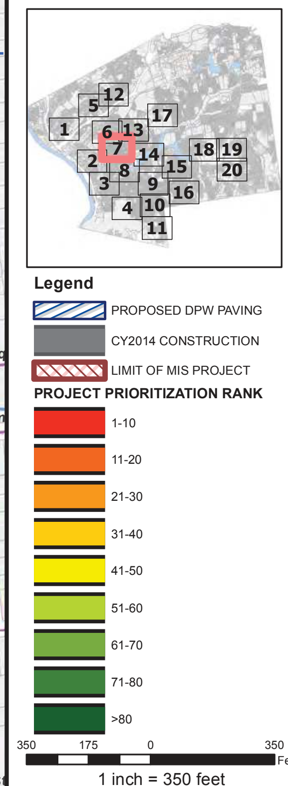

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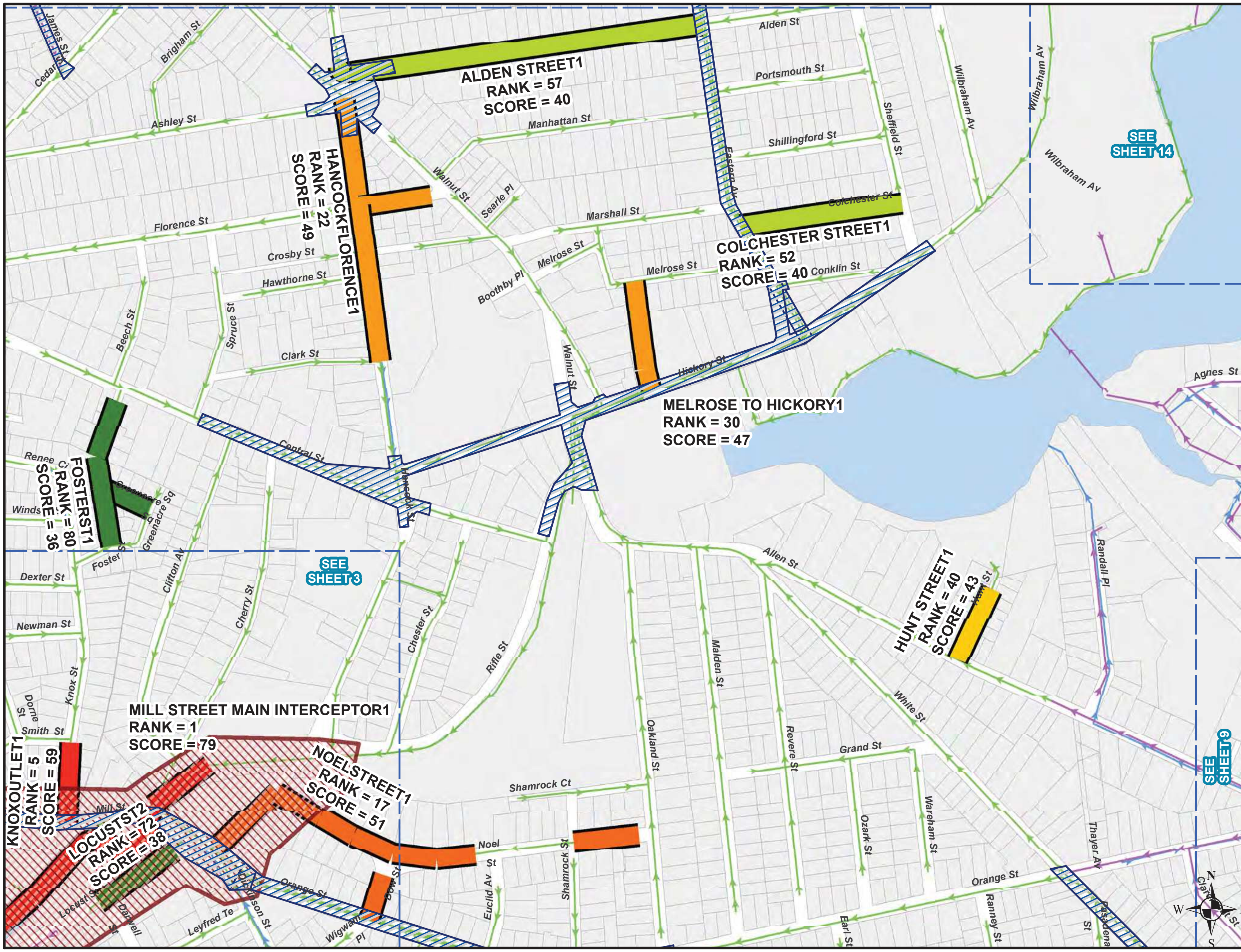

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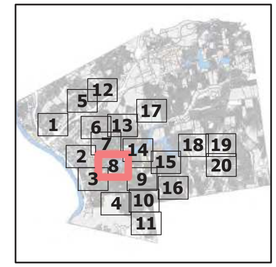

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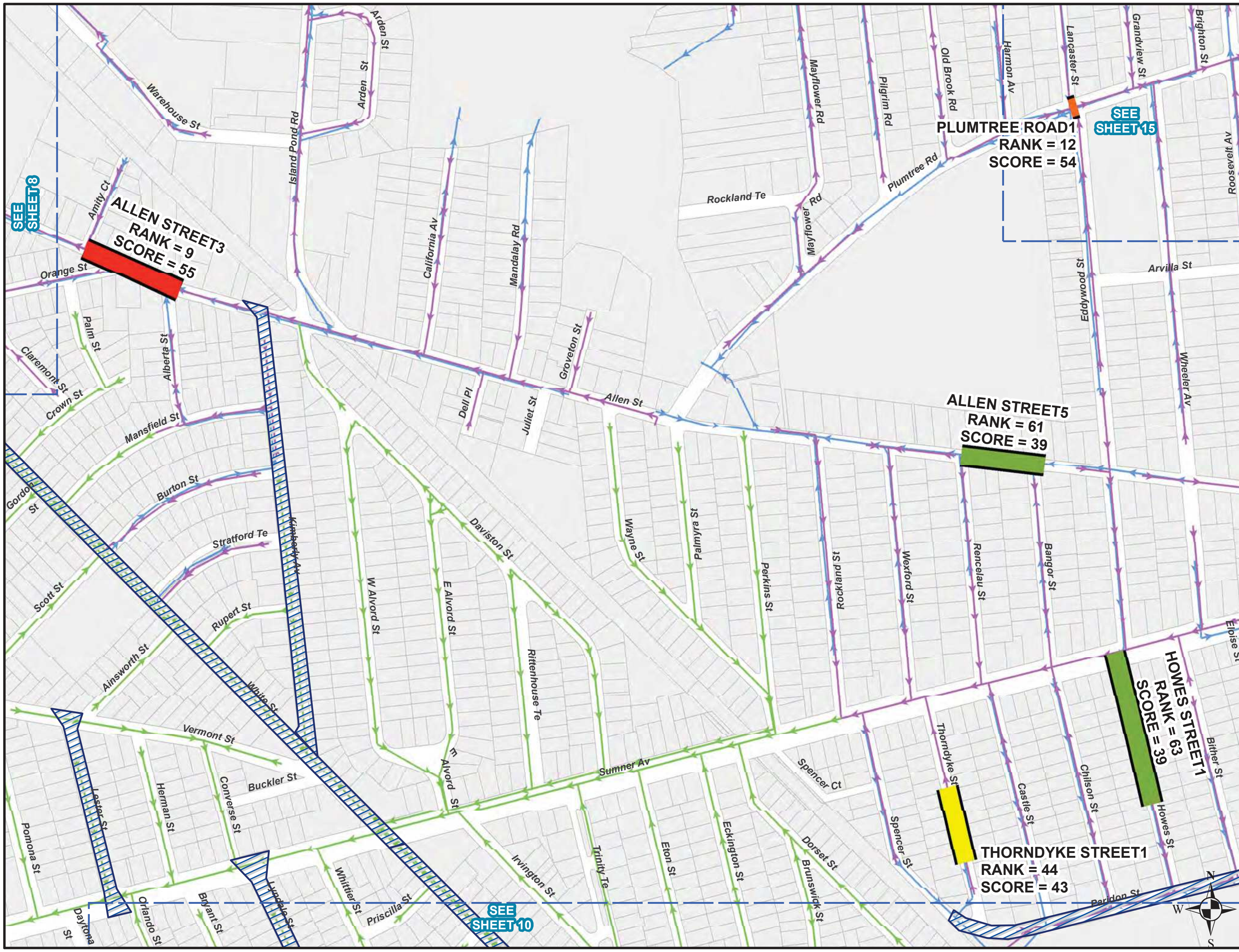

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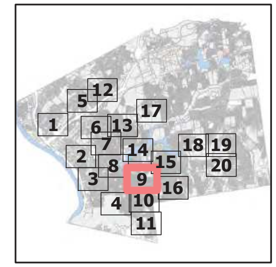

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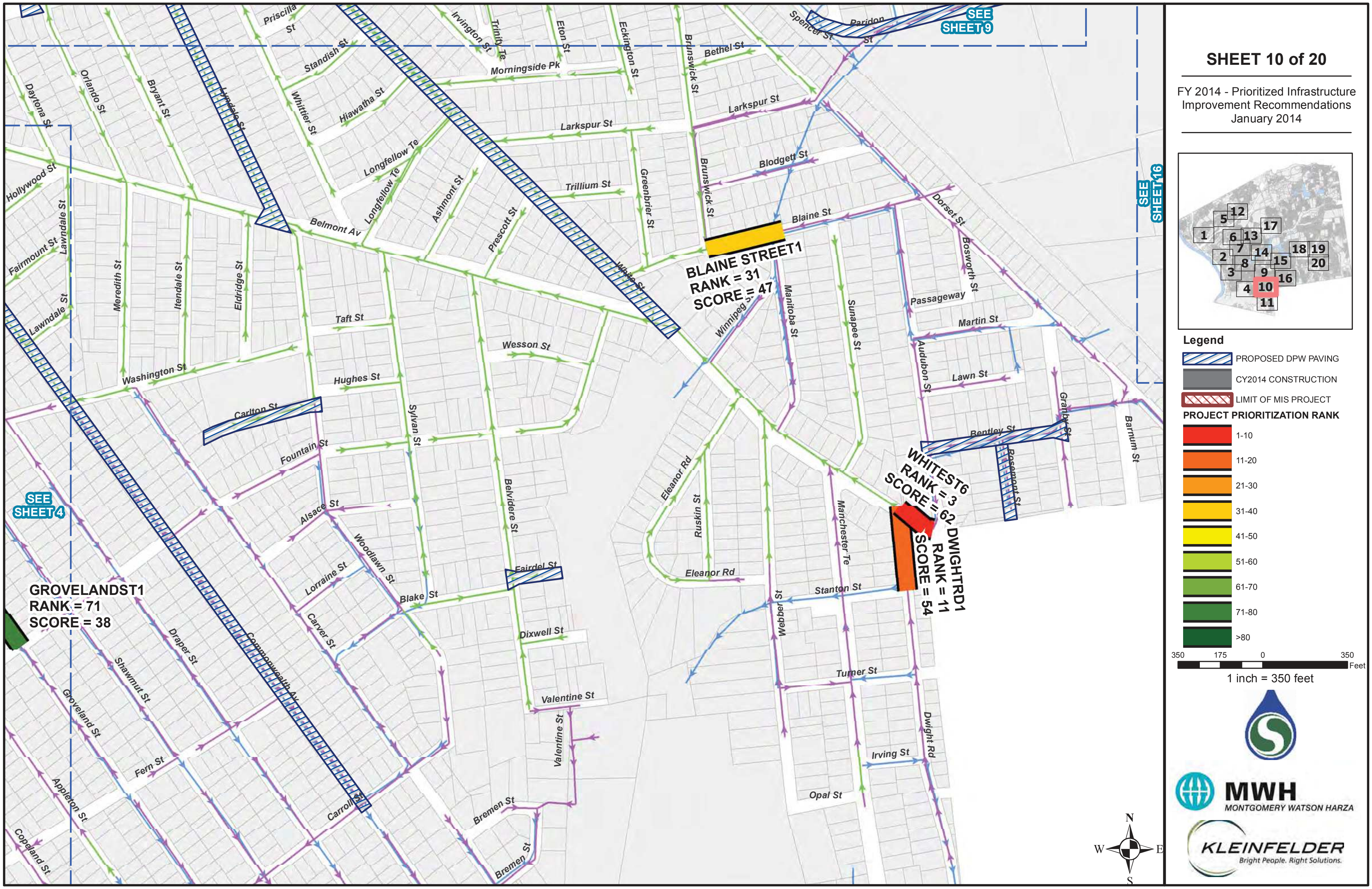

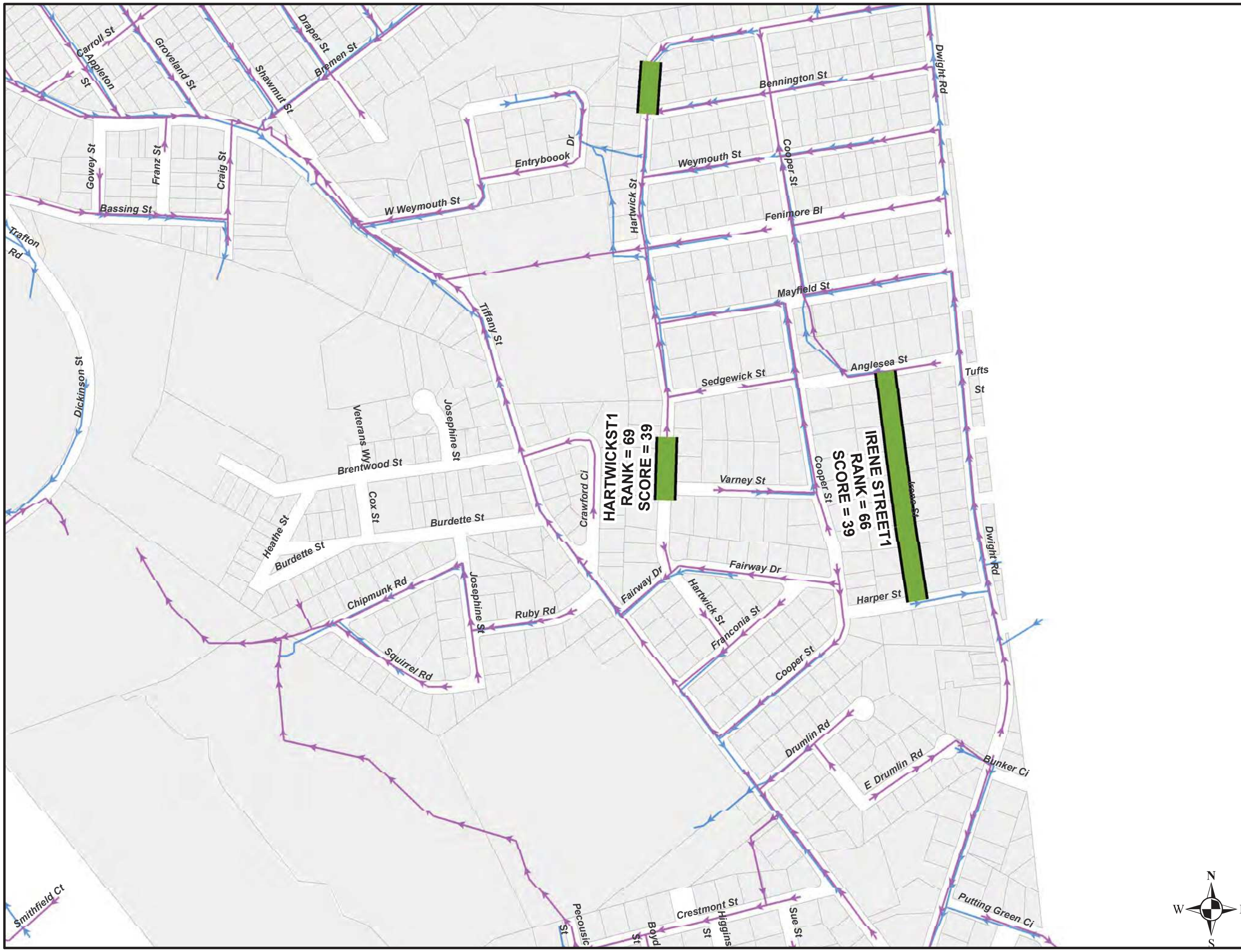

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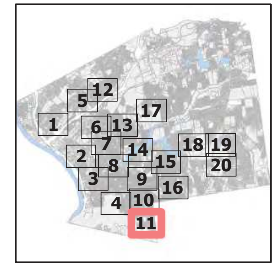

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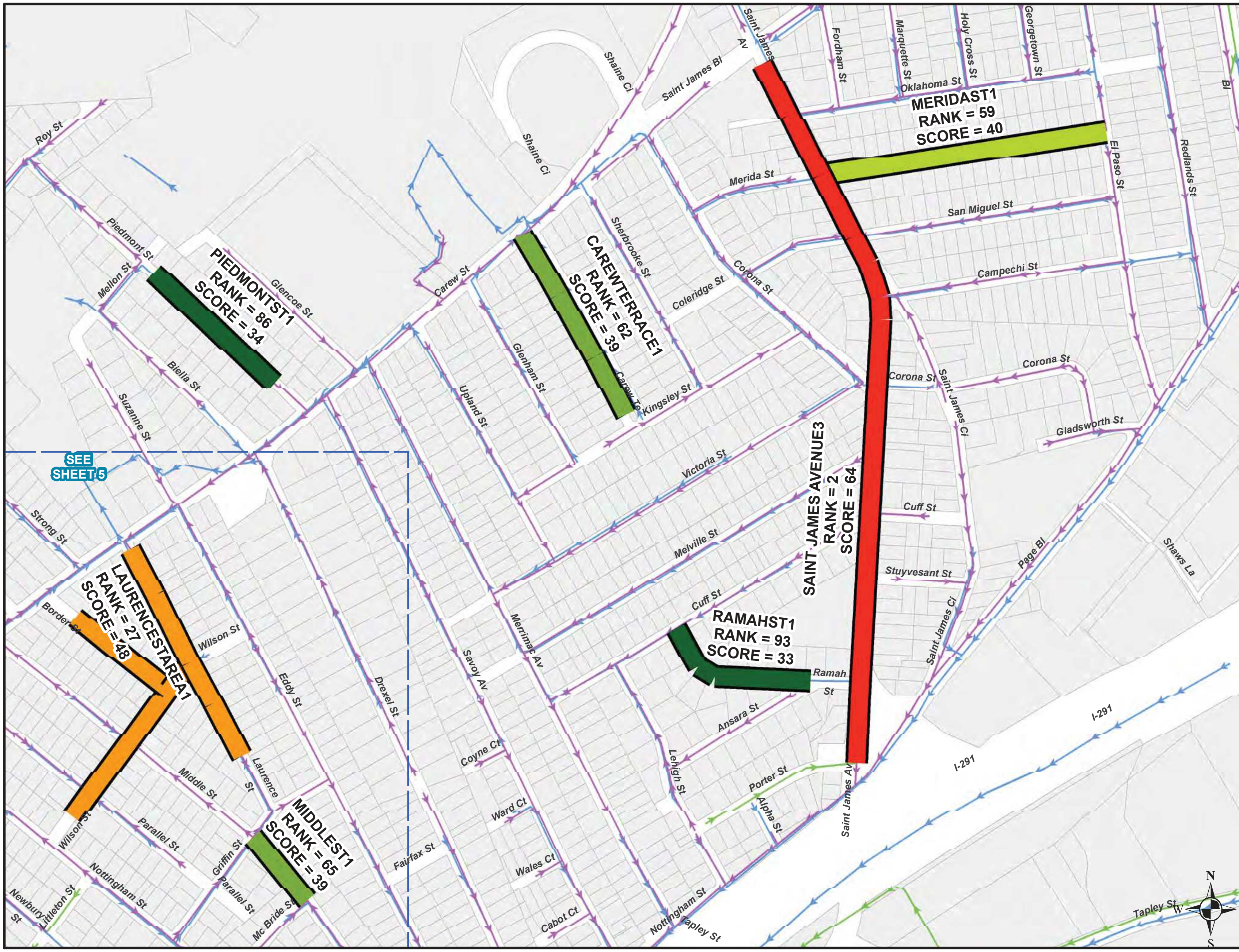

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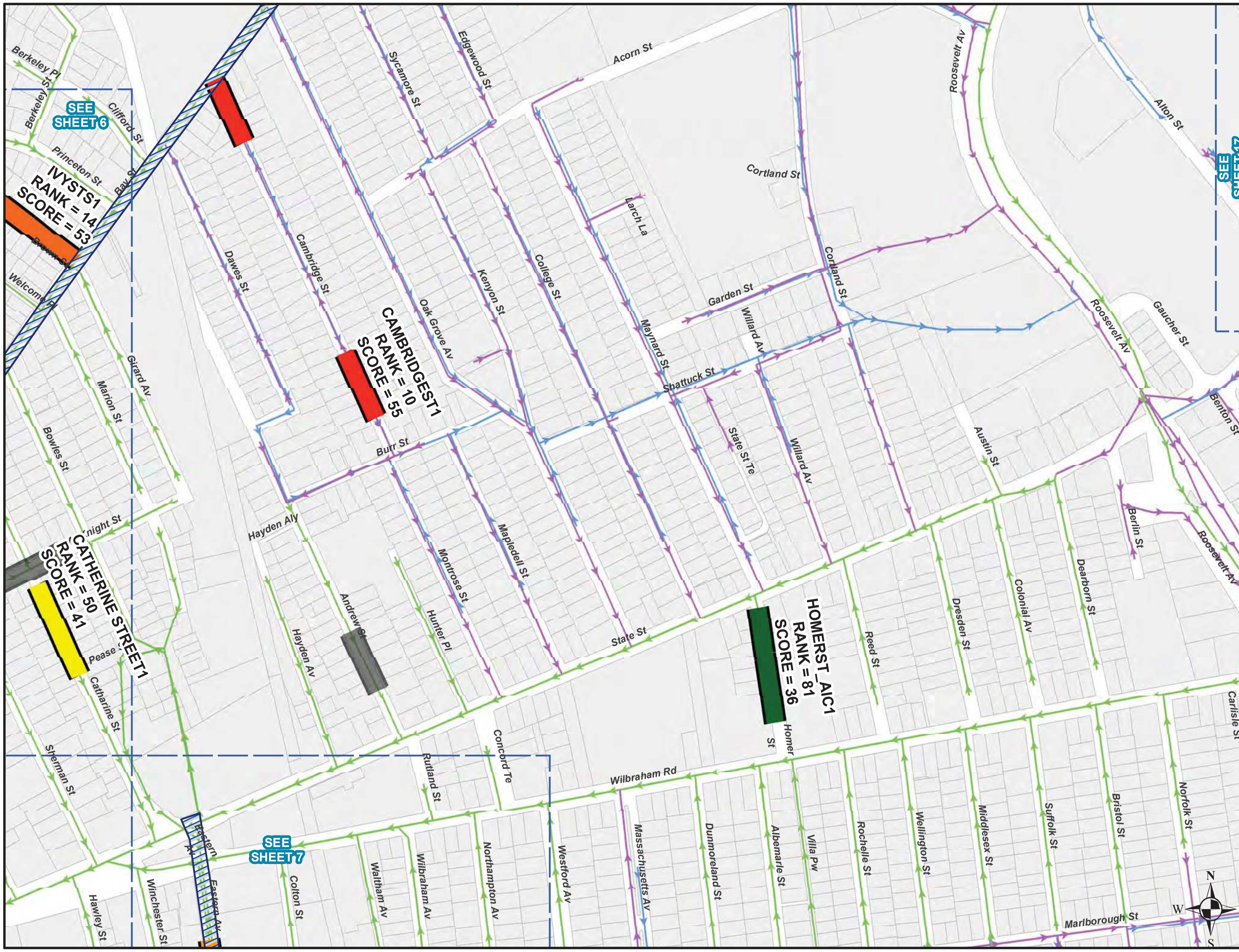

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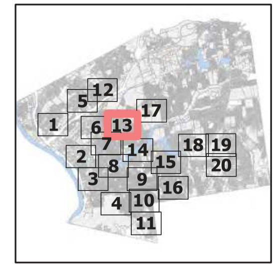

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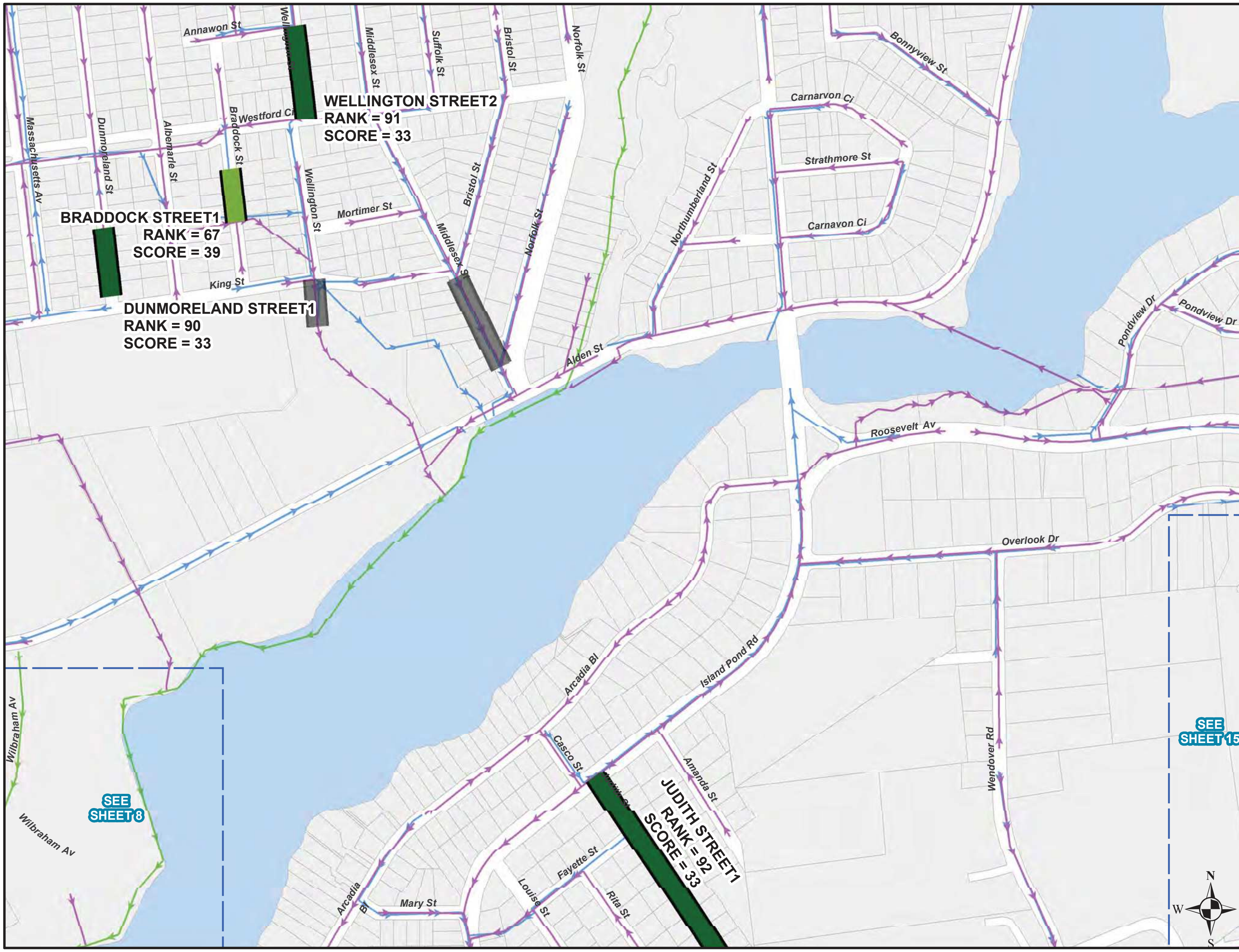

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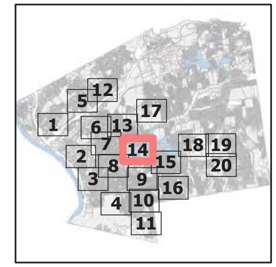

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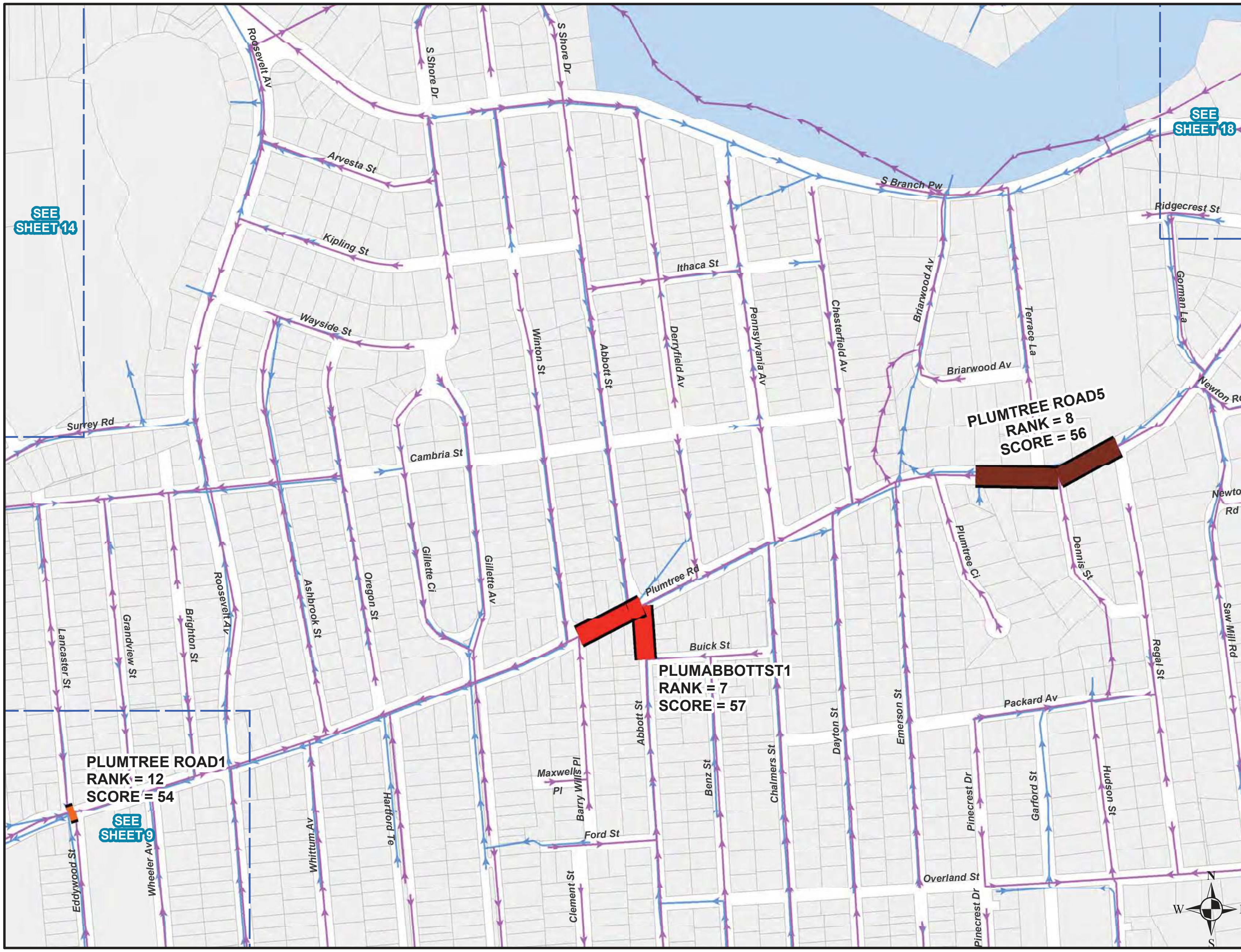

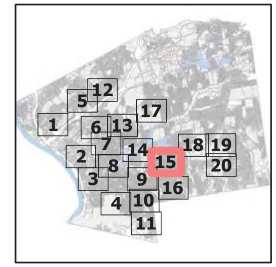

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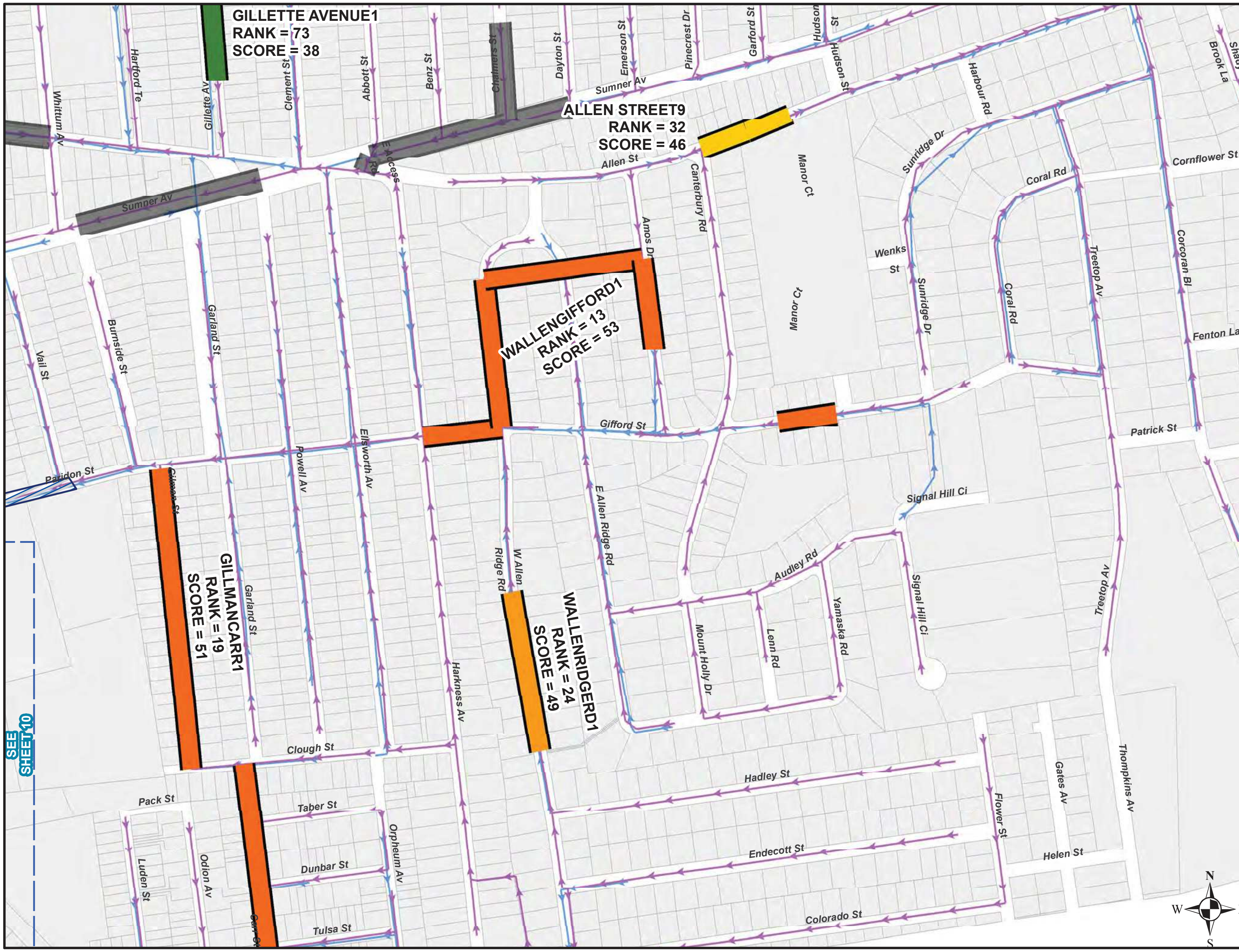

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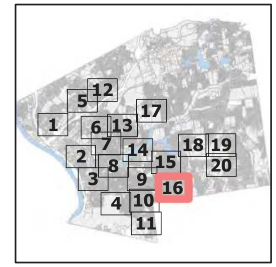

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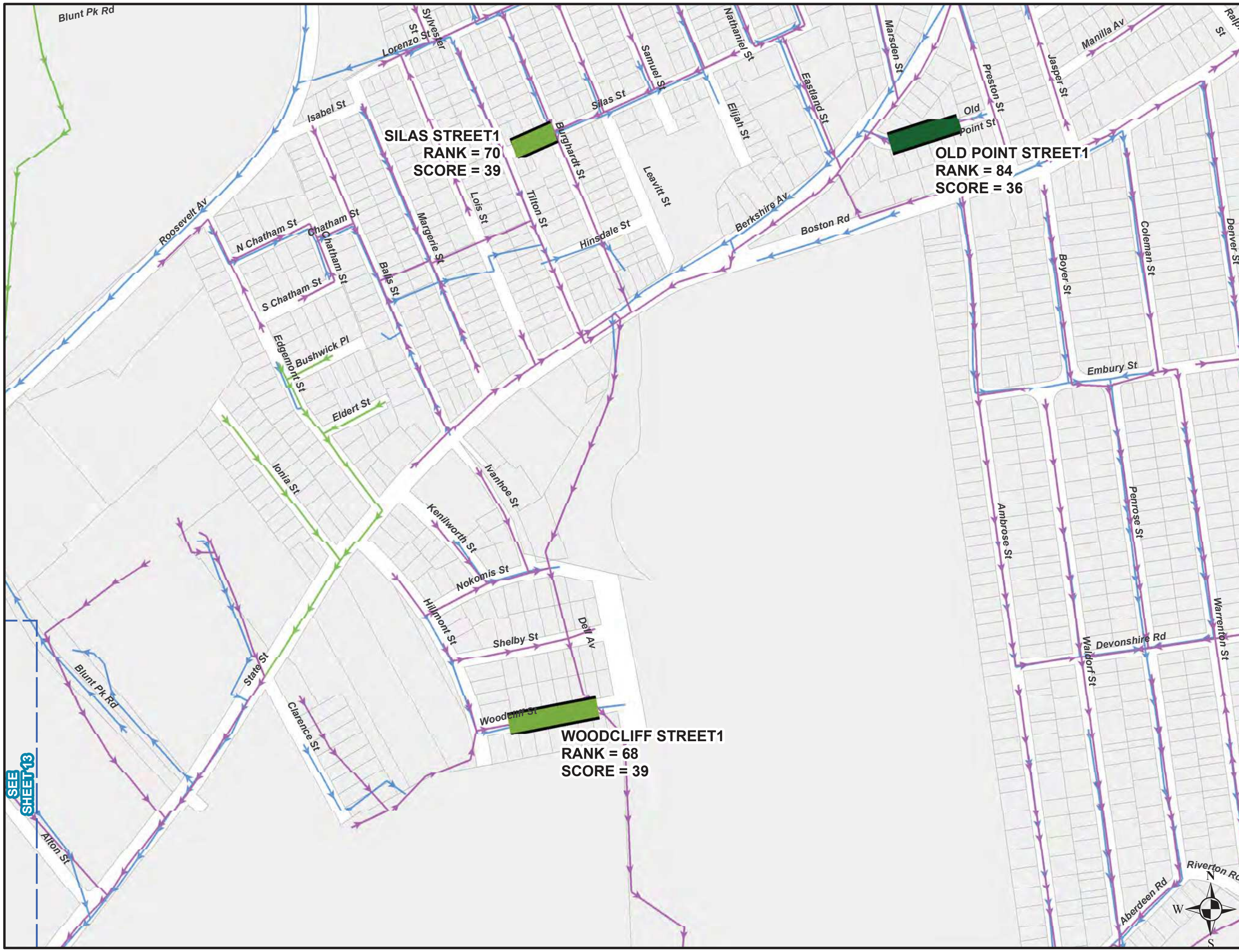

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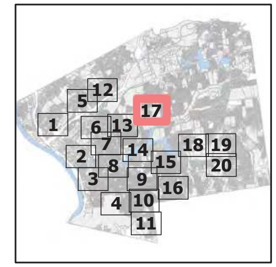

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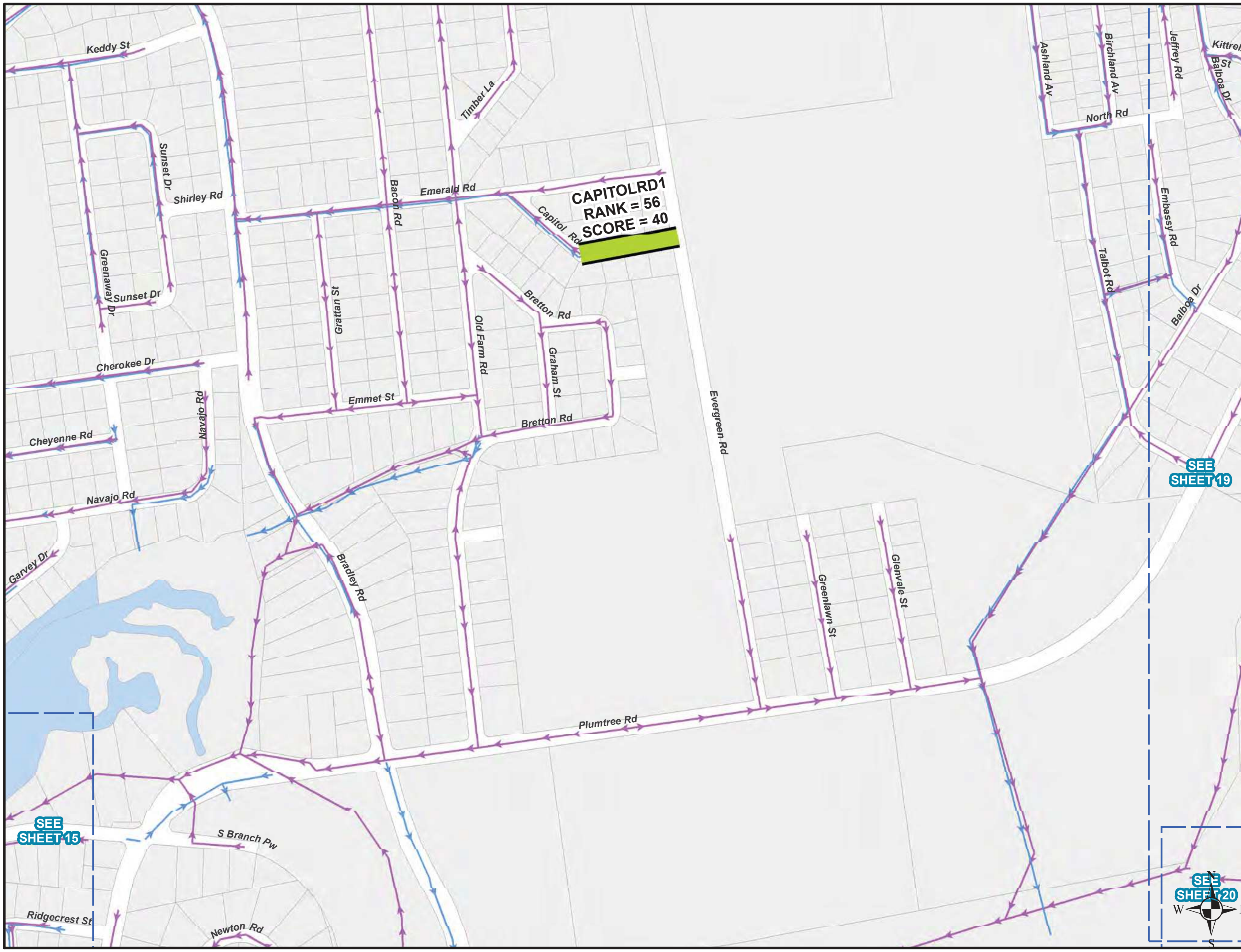

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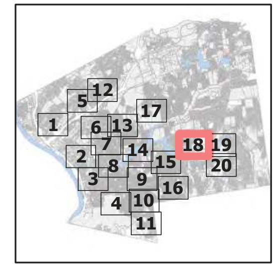

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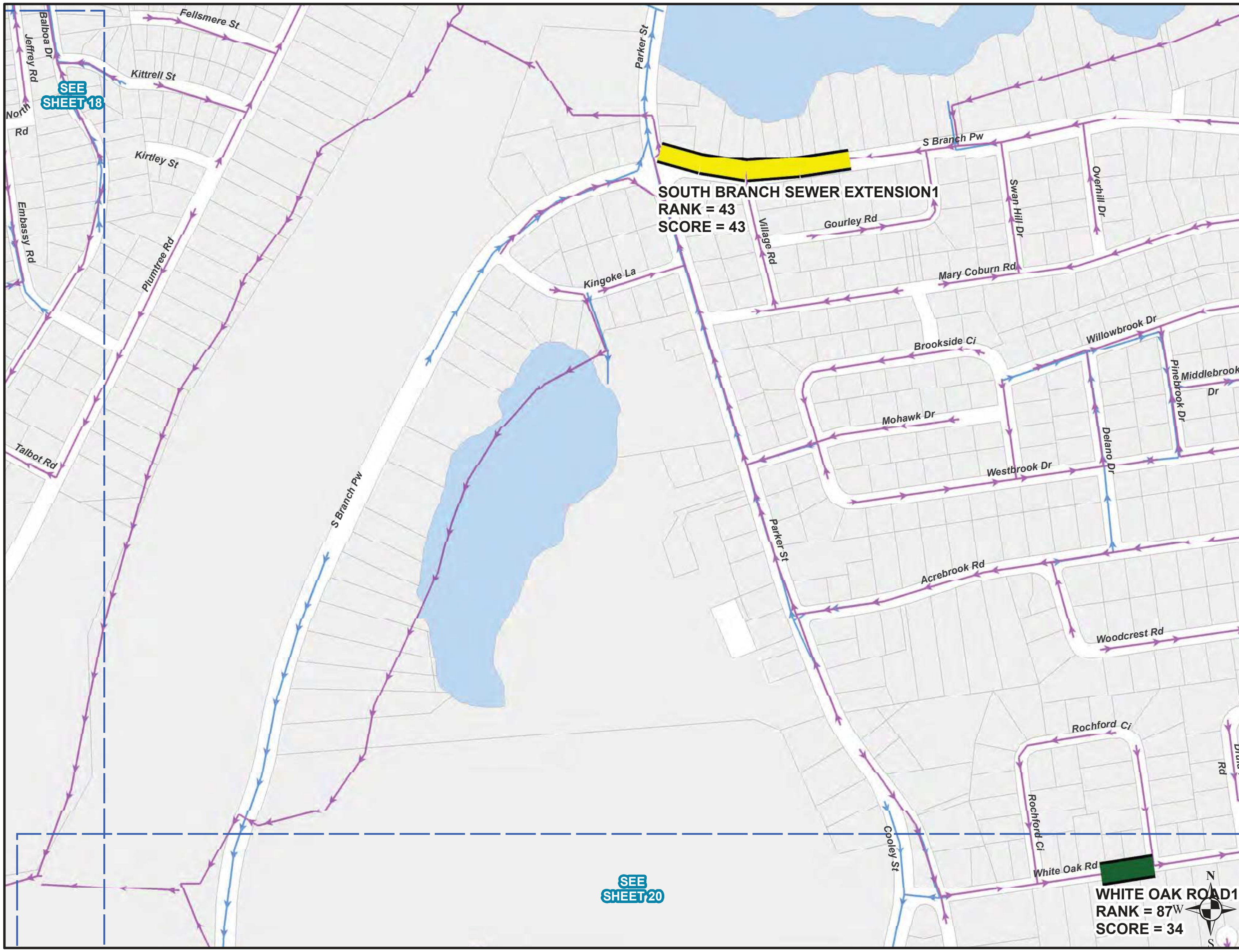

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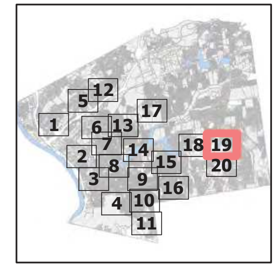

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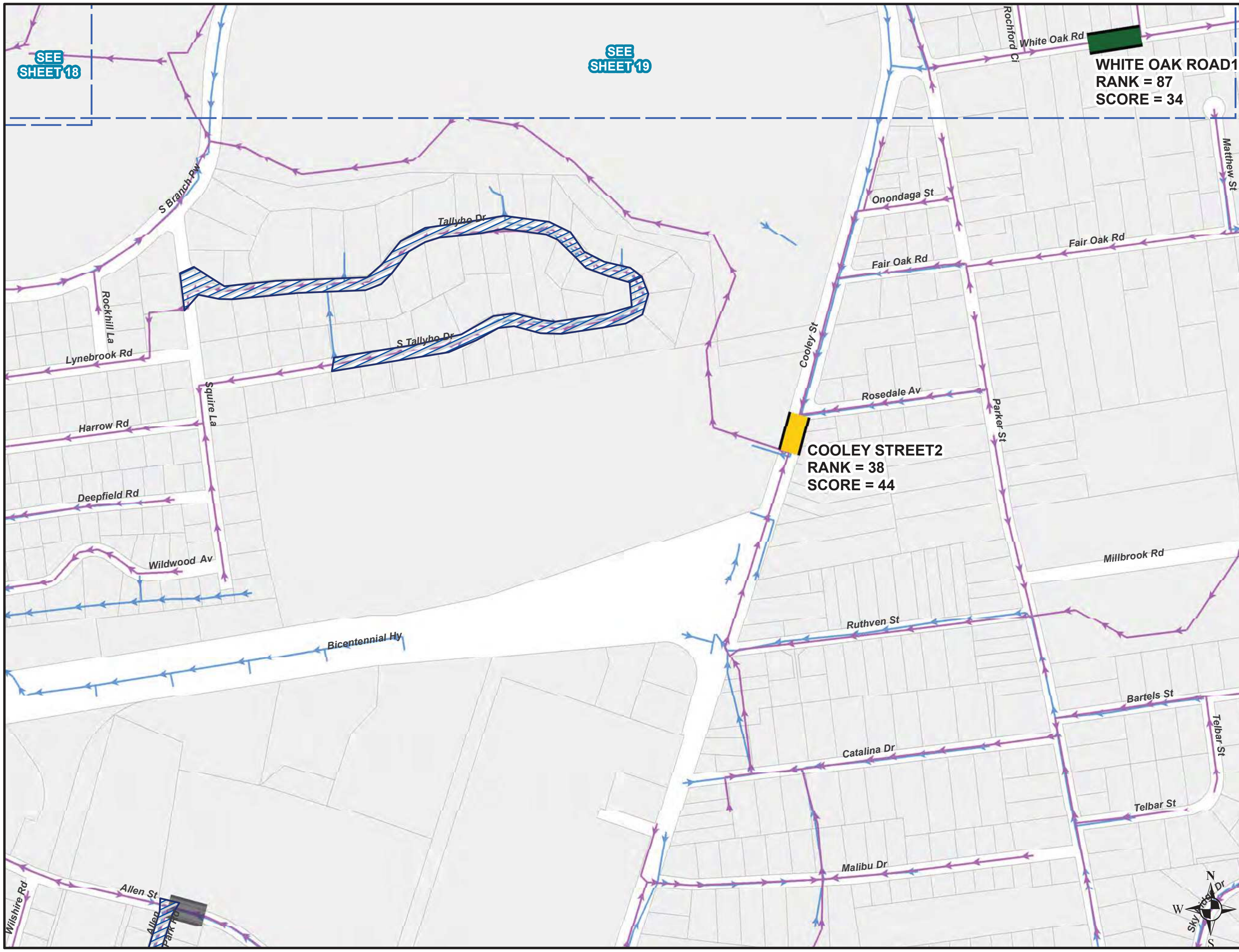

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Appendix B

EPA Green Infrastructure Literature

United States Environmental Protection Agency

Green Infrastructure Strategic Agenda 2013

U.S. Environmental Protection Agency

Photos courtesy of Abby Hall, EPA

Green Infrastructure Strategic Agenda 2013

Green infrastructure uses natural systems and/or engineered systems designed to mimic natural processes to more effectively manage urban stormwater and reduce receiving water impacts. These systems are often soil or vegetation-based and include planning approaches such as tree preservation and impervious cover reduction, as well as structural interventions such as rain gardens and permeable pavements. By maintaining or restoring the hydrologic function of urban areas, green infrastructure treats precipitation as a resource rather than waste, and can play a critical role in achieving community development as well as water quality goals.

EPA and its partner organizations have promoted the use of green infrastructure for many years as part of a comprehensive approach to achieving healthier waters. Green infrastructure reduces the volume of stormwater discharges by managing rainwater close to where it falls and removes many of the pollutants present in runoff, making it an effective strategy for addressing wet weather pollution and improving water quality. Green infrastructure can also provide a sustainable, local supply of water by harvesting or infiltrating precipitation.

Green infrastructure can be a cost-effective approach for improving water quality and can help communities to stretch their infrastructure investments further by providing multiple environmental, economic, and community benefits. This multi-benefit approach creates sustainable and resilient water infrastructure that supports and revitalizes urban communities. Creating more resilient systems will become increasingly important in the face of climate change. As more intense weather events or dwindling water supplies stress the performance of the nation's water infrastructure, green infrastructure offers an approach to increase resiliency and adaptability.

This strategy builds upon the previous 2008 and 2011 versions and outlines key objectives EPA will pursue to support community efforts to build green infrastructure. Through this strategy, EPA aims to increase national and local capacity to evaluate the role of green infrastructure and the benefits that green infrastructure can provide. The objectives of the strategy are organized within five major focus areas:

1. Federal coordination;
2. Clean Water Act regulatory support;
3. Research and information exchange;
4. Funding and financing; and
5. Capacity building.

All results and products of this Strategic Agenda will be posted to our website: www.epa.gov/greeninfrastructure.

I. Federal Coordination

Green infrastructure is a distributed approach to water management that advances many community priorities – from air quality management to urban renewal. As a holistic approach that crosses traditional boundaries between federal programs, green infrastructure can most effectively be implemented by aligning the priorities and investments of relevant federal agencies.

Goal: Green infrastructure practices are embedded in federal agency programs.

Objective I.1 Leverage existing federal partnerships.
Description: Identify opportunities to align federal programs to support and finance green infrastructure. Utilize existing Urban Waters and Partnership for Sustainable Communities programs to engage federal agencies and coordinate efforts.

Objective I.2 Continue federal dialogue on critical barriers and knowledge gaps.
Description: Continue the discussion with the federal agency workgroup initiated at the September 2012 White House meeting on green infrastructure.

Objective I.3 Demonstrate commitment to green infrastructure through federal projects.
Description: Identify federal building projects that include green infrastructure, including projects designed to comply with EPA's Section 438 Guidance. Consider federal awards program to promote green infrastructure on federal properties.

Objective I.4 Develop information on large-scale green infrastructure systems as a component of community resiliency and disaster relief.
Description: Provide technical assistance to determine how green infrastructure can be used in recovery/rebuilding.

Objective I.5 Continue to integrate source water protection into stormwater management strategies.
Description: Provide additional information on best practices for green infrastructure approaches that protect the integrity of ground water supplies.

II. Clean Water Act Regulatory Support

Recent policy memos have clarified EPA's support for green infrastructure provisions in NPDES permits and water enforcement agreements, but many permitting and enforcement professionals and members of the regulated community may be unfamiliar with this approach. Lacking familiarity with the technology, its performance, and associated performance measures, state and local permitting and enforcement professionals may be reluctant to include green infrastructure in wet weather permits and control plans.

Goal: Green infrastructure language in permitting and enforcement actions is common practice.

Objective II.1: Bolster efforts to incorporate green infrastructure into municipal separate storm sewer system (MS4) programs.
Description: Provide technical assistance to states in the development of permits that promote green infrastructure and include innovative stormwater management strategies.

Objective II.2: Propose changes to the national stormwater program to facilitate the use of green infrastructure in new development and redevelopment projects.
Description: The revisions being considered for the national stormwater program will likely include performance standards for new development and redevelopment projects based on the retention of stormwater runoff, which would facilitate the use of green infrastructure.

Objective II.3: Continue to ensure all water enforcement actions consider the use of green infrastructure.
Description: Continue to consider green infrastructure approaches in the development of orders and settlements related to SSOs, CSOs and MS4s and incorporate green infrastructure as part of injunctive relief where appropriate.

Objective II.4: Continue to work with stakeholders and municipalities to implement the integrated planning framework.
Description: Continue outreach efforts to communities interested in developing integrated wet weather plans and discuss opportunities to utilize green infrastructure solutions. Provide technical assistance to selected communities.

III. Research and Information Exchange

Knowledge gaps persist in the performance of watershed-scale systems of green infrastructure. Ongoing research and dissemination of information is necessary to broaden the number of communities adopting green infrastructure practices.

Goal: Data on the design, performance, costs, and benefits of green infrastructure is known and readily available.

Objective III.1: Conduct research on planning and evaluating green infrastructure systems.
Description: Compile, analyze, and maintain data and modeling tools related to green infrastructure effectiveness, costs and additional benefits. Develop information on options to quantify benefits, reduce risk, and generate more certainty. Develop further information on urban soils and vacant parcels, and suitability of these soils for infiltration practices. Develop studies and tools to assess the aggregate impacts of green infrastructure on watershed hydrologic response, water quality, and aquatic biota. Identify key research gaps and promote research to meet the highest priority needs.

Objective III.2: Widely share emerging information on green infrastructure performance, implementation, and maintenance.
Description: Work with partners to share information on the state of the art for design, operation and maintenance of green infrastructure techniques. Conduct webinars and develop reports to communicate design, cost, and O&M information.

IV. Funding and Financing

Funding wet weather programs presents many challenges for local communities. Green infrastructure provides opportunities to develop comprehensive and sustainable financing programs that draw from diverse sources and sectors.

Goal: Decrease the financial burden to communities of installing and maintaining green infrastructure.

Objective IV.1: Leverage Clean Water Act State Revolving Fund (CWSRF) to finance green infrastructure projects for stormwater management.
Description: Develop a white paper describing green infrastructure projects that are eligible for CWSRF funding and providing case studies.

Objective IV.2: Identify opportunities to reduce the cost of implementing green infrastructure.
Description: Identify and highlight through case studies opportunities for private investment in green infrastructure and public-private partnerships. Work with interested stakeholders to develop model partnership arrangements that allow cities to collaborate with the private sector in installing and maintaining green infrastructure.

Objective IV.3: Promote stormwater utilities as a sustainable funding source.
Description: Conduct pilot stormwater utility feasibility study to assess the impacts and benefits of fee programs to support green infrastructure and enhance stormwater management.

V. Partnerships & Capacity Building

Early adopters have demonstrated the viability of green infrastructure approaches for wet weather management. Many other communities are interested in green infrastructure but still require additional technical and institutional information to integrate green infrastructure into their current approach.

Goal: Communities across the country are networking and exchanging information on the best green infrastructure approaches.

Objective V.1: Support mentorships and peer-to-peer exchange among community partners.
Description: Match more experienced partners across EPA's 10 regions (including the 2011 model partner communities) with communities that are just starting to develop their programs.

Objective V.2: Provide targeted technical support where appropriate, highlighting green infrastructure's role in revitalizing underserved communities.
Description: Continue providing contractor and grant support through the green infrastructure technical assistance program and other relevant EPA programs.

Objective V.3: Collaborate with external partners to design and implement local green infrastructure projects.
Description: Use partnerships and leverage Agency programs to create opportunities for communities to build green infrastructure projects and develop integrated green programs. Implementing vehicles include Urban Waters, Partnership for Sustainable Communities, Brownfields program, the Great Lakes Restoration Initiative, and National Estuary Program.

Objective V.4: Increase awareness and understanding of green infrastructure among emerging engineering and design professionals.
Description: Foster the use of green infrastructure practices among the engineering and design community by supporting competitions for college and university students and for practicing professionals.

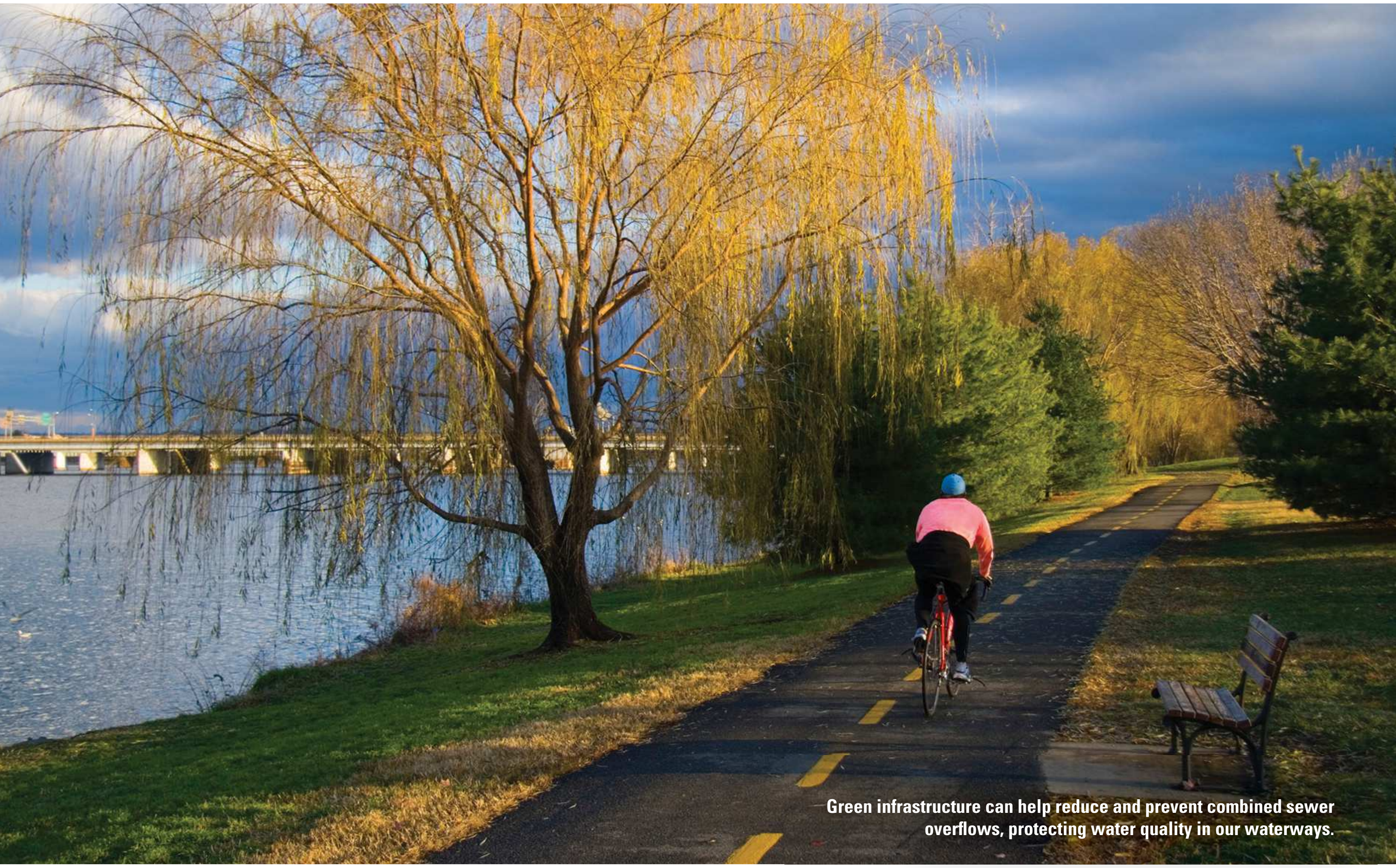
Objective V.5: Provide outreach support targeted at small-scale green infrastructure applications and homeowners.
Description: Continue developing materials for use by local governments that provide information for homeowners to evaluate the most practical practices and approaches.

Objective V.6: Develop and support fit-for-use integrated water management approaches.
Description: Share information about diversifying the water supply portfolio and recognize rainwater as a resource. Explore opportunities to decrease potable water use, increase water supply and availability, and reduce associated energy costs.

Photos: Pg 2-3, 7, Nancy Arazan, EPA; Pg 4-7, Abby Hall, EPA; Pg 7, Emily Ashton, ORISE.

United States Environmental Protection Agency

EPA 832F12013



Green infrastructure can help reduce and prevent combined sewer overflows, protecting water quality in our waterways.

Combined Sewer Overflows

This factsheet is the second in a series of six on integrating green infrastructure concepts into permitting, enforcement, and water quality standards actions.

Integrating Green Infrastructure Concepts into Permitting, Enforcement, and Water Quality Standards Actions

*This factsheet is the second in a series of six factsheets in the U.S. EPA Green Infrastructure Permitting and Enforcement Series (*http://water.epa.gov/infrastructure/greeninfrastructure/gi_regulatory.cfm#permittingseries*). This series describes how EPA and state permitting and enforcement professionals can incorporate green infrastructure practices and approaches into National Pollutant Discharge Elimination System (NPDES) wet weather programs, including stormwater permits, Total Maximum Daily Loads (TMDLs), combined sewer overflow (CSO) long-term control plans (LTCPs), and enforcement actions. This series builds upon EPA's continued investment in green infrastructure and low impact development. Existing EPA authority, guidance, and agreements enable EPA Regions and state agencies to work with permittees to include green infrastructure measures as part of control programs.*

For additional resources on green infrastructure, go to the EPA Green Infrastructure Web page: http://water.epa.gov/infrastructure/greeninfrastructure/index.cfm.

Key green infrastructure guidance issued to date can be found at: http://water.epa.gov/infrastructure/greeninfrastructure/gi_policy.cfm.

Combined Sewer Overflows (CSOs)

Introduction

Green infrastructure can reduce the volume of water going into combined systems during precipitation events, which may reduce numbers and volumes of overflows. Green infrastructure can also slow the delivery of wet weather flows to sewer systems, helping to mitigate peak flows while providing filtration through soil for some portion of the release into the sewer system, thereby reducing pollutant loads. The implementation of green infrastructure practices may allow communities to downsize certain grey infrastructure components of their CSO control plans. This may provide some CSO communities with significant cost savings.

EPA GUIDANCE: CONSIDER SOURCE CONTROLS

Existing EPA guidance states that, as part of the "Identification Control Alternatives" for inclusion in CSO LTCPs, CSO communities must consider source controls, which are defined specifically to include green infrastructure approaches (Combined Sewer Overflows Guidance for Long-Term Control Plan, EPA 832-B-95-002, at pp. 3-31 – 3-33).

Under the Clean Water Act and EPA's 1994 CSO Control Policy, most CSO communities are required to develop and implement a Long-Term Control Plan (LTCP) to restore and protect water quality. National Pollutant Discharge Elimination System (NPDES) permits and administrative or judicial orders establish requirements for developing and implementing LTCPs. There is also existing guidance on development and implementation of LTCPs (see sidebar below).

Existing Guidance on Development and Implementation of LTCPs

PERMITTING: http://cfpub.epa.gov/npdes/home.cfm?program_id=5

ENFORCEMENT: http://www.epa.gov/compliance/resources/policies/civil/cwa/csosso-guidelines-enf.pdf

CSO POLICY: http://cfpub.epa.gov/npdes/cso/cpolicy.cfm

Evaluating the Potential of Green Infrastructure for CSO Control

In many cases planning for the use of green and grey infrastructure will be most effective if both elements are integrated throughout the planning and engineering design processes. Therefore, it is recommended that communities carry out integrated green/grey planning to identify opportunities to use green infrastructure in cost-effective combinations with grey infrastructure. This can help lower upfront and/or operational costs. If, for example, a community does engineering analyses to plan grey infrastructure, sized to achieve high levels of control, and then adds green infrastructure as a layer near the end of the planning process, the community may conclude that green infrastructure does not appreciably increase the level of control. However, if planning specifically encompasses green and grey infrastructure together throughout the process, it is likely the planning will reveal many opportunities to use green infrastructure to keep water out of the system in some or all sewersheds. By capitalizing on opportunities to place green infrastructure in sewersheds, communities may be able to reduce the size of grey infrastructure controls.

This is not meant to imply that grey infrastructure controls are not needed; in most communities green infrastructure alone will not resolve CSO problems for large storms.

Depending on land uses, land owners, and other variables, some sewersheds are well-suited for green solutions whereas others may provide less opportunity. Therefore, stormwater reduction analyses typically should be considered sewershed by sewershed. Estimating the maximum or optimal amount of green infrastructure that can be implemented in a sewershed requires an analysis of land use and technical/environmental factors such as soil types and topography, as well as institutional considerations, such as the need to develop incentives to facilitate implementation of green infrastructure features on private property.

Development of CSO LTCPs involves analysis of the financial capability of the community and analysis of alternatives for reducing CSO frequencies, volumes, and pollutant loads. Historically, grey infrastructure approaches and operational enhancements have been the key components of LTCPs. Recently, there has been greater interest in using green infrastructure approaches, often in combination with grey infrastructure and operational enhancements, to meet CSO control needs. This approach may have the advantage of distributing the cost of control more broadly, rather than relying solely on utility ratepayers. For example, if a green streetscapes project is implemented it may be possible to cost-share between the stormwater or CSO authority and a transportation organization. In other cases a school or park district may cost-share with the local stormwater/CSO authority. Additionally, several recent CSO consent decrees have required the retrofitting of sizeable areas with green infrastructure as part of holistic approaches to CSO reduction.

(See Supplement 1).

Case Study of the Impacts of Trees and Green Roofs on Stormwater Runoff

Figure 1: A bioretention cell absorbs runoff.

Various organizations and communities have recently conducted studies to estimate the potential for reducing flows into combined sewer systems through systematic use of green infrastructure practices. In 2007, Casey Trees and LimnoTech, with funding from EPA, conducted a modeling study of the impacts of trees and green roofs on stormwater runoff in the Washington, DC area (http://caseytrees.org/programs/policyadvocacy/). The Casey Trees modeling estimated, upon completion of implementation of green infrastructure projects:

- For an average year, the intensive greening scenario would prevent over 1.2 billion gallons of stormwater from entering the sewer systems, resulting in a reduction of over 1 billion gallons in discharges to local rivers.
- For an average year, the moderate greening scenario would prevent over 311 million gallons of stormwater from entering the sewer systems, resulting in a reduction of 282 million gallons in discharges to local waterways.
- With the intensive greening scenario, installing 55 million square feet of green roofs in the Combined Sewer System (CSS) area would reduce CSO discharges by 435 million gallons, or 19%, each year.

The initial round of modeling focused only on green roofs and enhancing the urban tree canopy. Further work was then done to model the effects of other green infrastructure components in the Washington D.C. service area. Other communities and regional sewer authorities that have incorporated green infrastructure controls in their CSO planning include New York, Cincinnati, Louisville, , Omaha, San Francisco, Kansas City, and Cleveland.

Developing Quantitative Implementation Targets

Once a community has evaluated the potential of green infrastructure practices for CSO control, and determined green infrastructure practices can be a cost-effective component of an LTCP, it is important to identify the locations for green infrastructure implementation and to quantify the projected level of green infrastructure implementation. A community can identify what green infrastructure of what size/capacity can be put where in a sewershed, and can then determine what level of reduction that will achieve in terms of wet weather flows entering the sewer system. The new flow information can then be used in the sizing of grey infrastructure. See Supplement 3 for a summary of tools and calculators that are available to help quantify the impacts of green infrastructure.

Once a community has completed a desktop analysis identifying priority sewersheds for green infrastructure implementation, a more detailed analysis must be completed to establish a quantitative green infrastructure implementation target. A discussion of alternative analysis methodologies is beyond the scope of this document. In general, however, the methodology should first develop a set of green infrastructure scenarios, and then assess the outcomes associated with each scenario. The scenario that best meets the community's needs may be adopted as an implementation target. Ideally, the methodology should allow the community to compare the cost-effectiveness of each alternative in meeting CSO control targets, and the range of environmental benefits provided by each alternative. The checklist on Page 5 provides a general methodology for establishing a quantitative green infrastructure implementation target. Note that this is only one of many approaches that a community might take.

The implementation target identified may call for many decentralized green infrastructure practices. In a permit or enforcement action, it will be important to include appropriate provisions to ensure the decentralized practices (many of which will not be on land owned/controlled by the sewer authority) are properly installed, preserved over time, and maintained.

Many communities have identified municipally-owned properties and road right-of-ways, and other parcels that may be well-suited for green infrastructure practices, (e.g., corporate campuses, school campuses, and vacant parcels where there is no near-term demand for redevelopment). These communities have quantified the flow volumes that could be managed at these sites, and then incorporated the results into planning of the complementary grey infrastructure controls.

Also, important factors in some sub-watersheds may be the preservation or enhancement of natural green infrastructure, including features like riparian buffers, forest preserves, floodplains, wetlands, and parks. In estimating flows coming out of a sewershed, the capacity of such areas to absorb stormwater flows needs to be considered. It may be appropriate to incorporate the need to preserve, and in some cases enhance such areas in a LTCP.

In some urban areas, a city or sewer authority may determine that it will focus on relatively larger green infrastructure practices, perhaps at the block scale, and will set up ownership and operation of the sites and practices under the direct control of the city or sewer authority. An example of this would be where a city constructs "stormwater parks" to store and infiltrate wet weather flows (see Figure 2). With an approach like this, the capacity of the practice can be readily determined, much like a detention pond, and green infrastructure plans and commitments can reflect the number, locations, and sizing of the larger-scale green practices. Stormwater parks can be planned at strategic locations in the sewer network, and where they fit well into the fabric of the community area. Using larger scale green infrastructure practices, where the city or sewer authority retains control over the practices, may be advantageous for a community in terms of assuring the practices are properly built, preserved, and maintained.

Figure 2: Stormwater park at Saylor Grove in Philadelphia

Adaptive management approaches can be used during LTCP implementation to ensure green infrastructure measures are being implemented and are working to the degree expected (see further discussion below). Closely monitoring green infrastructure implementation and performance is important to ensure the projected levels of storage and control are being achieved. Mid-course adjustments can be made if necessary. The monitoring of implementation and performance coupled with the use of adaptive management approaches — making adjustments to future efforts based on lessons learned — can help alleviate possible uncertainty or perceived risks about implementing green solutions as part of a CSO control program.

A General Methodology for Establishing a Quantitative Green Infrastructure Implementation Target

- [ ] Select a sample set of sewersheds that are generally representative of the service area as a whole, in terms of land uses, land ownership, soils, and topography.
- [ ] Characterize existing land use/land cover in the subwatersheds; this can often be done using aerial photographs and/or a community's geographic information system (GIS) coverages.
- [ ] Create templates for the various land uses in the sewersheds (e.g., typical single family residential lot, typical commercial/office site). Estimate the pervious and impervious areas for the templates.
- [ ] Identify green infrastructure opportunities for the different land use categories (templates) in the sewersheds, taking into account space needs, soil types, and slopes.
- [ ] Estimate the total green infrastructure that could be implemented in the sewershed by extrapolating from the templates to the sewershed as a whole. This estimate should take into account current and future zoning and institutional considerations, such as acceptance by property owners of green infrastructure features on private property. The level of buy-in to the green infrastructure program on the part of local property owners is an important variable, and needs to be explicitly considered in CSO planning. The estimate should also consider public properties and parks that may be good candidates for green infrastructure practices.
- [ ] Examine the cost-effectiveness of green infrastructure approaches. Will the green solutions reduce upfront or operational costs? Experiment with various combinations of green and grey infrastructure to determine what combination results in the lowest costs.
- [ ] Estimate the green infrastructure opportunities for the CSO service area as a whole by extrapolating from the sample set of sewersheds studied.
- [ ] Estimate the stormwater volumes that can be kept out of the system by the green infrastructure, taking into account the level of estimated implementation and the size of the practices. Also consider if there should be a margin of safety to reflect actual green implementation that may vary from projections, especially for sites not under the direct control of the sewer authority.

Incorporating Green Infrastructure Approaches into Long-Term Control Plans

Green infrastructure components should be explicitly identified and accompanied by compliance schedules in LTCPs along with grey infrastructure components. A list of the items that should be included in a LTCP if a community chooses to utilize green infrastructure measures is provided in the checklist on Page 6.

The timing for green infrastructure implementation should be expressly considered in CSO planning. Some green infrastructure benefits will probably be realized sooner than those for grey solutions, while others may take longer. It is important to achieve a reasonable balance while keeping in mind the overall environmental objectives. Discussion of these items and how they will be addressed in the LTCP should be done jointly between the community carrying out implementation and the permitting/enforcement authority.

As a companion to LTCP implementation, CSO communities planning for significant green infrastructure implementation should:

- Develop strategies or standard operating procedures (SOPs) for green infrastructure implementation;
- Consider approaches for dealing with legal and institutional issues including updating codes and ordinances;
- Consider changes to fee structures to incentivize green infrastructure;
- Consider how they will work to systematically install green infrastructure on different types of sites, e.g., municipally-owned public sites, schools, park district sites, corporate sites, and residential properties. The issues that will be encountered in putting rain gardens in parks or schools will be very different from the issues to be dealt with in getting green roofs on public and private buildings.

SOPs can help communities plan for and implement effective approaches to place green infrastructure at different types of sites within their service area.

Preservation of green infrastructure sites and practices

In addition to including provisions for operation and maintenance of green infrastructure practices, permits, and enforcement actions also need to consider mechanisms to assure green infrastructure is preserved (i.e., that a site or green infrastructure practice is not changed or removed at some point in the future). For example, language in a general permit issued by Ohio EPA specifies that protection (preservation) of infiltration areas shall be by binding conservation easements that identify a third party management agency, such as a homeowner or condominium association, political jurisdiction, or third party land trust. See: http://www.epa.state.oh.us/dsw/permits/GP_ConstructionSiteStormWater_Darby.aspx.

Including Green Infrastructure in LTCPs

Green infrastructure components should be explicitly identified and accompanied by compliance schedules in LTCPs along with grey infrastructure components.

The following should be included in an LTCP with green infrastructure:

- [ ] The planned (and quantified) level of green infrastructure implementation (what will be installed where, e.g., number of infiltration practices to be installed and associated sizes/capacity);
- [ ] Key implementation steps (actions);
- [ ] Sequencing (ensure green and grey elements fit together; also in many cases it may work well to start in upstream areas and work toward downstream areas);
- [ ] Schedule;
- [ ] Methods and milestones for tracking and reporting on green infrastructure implementation (are the green infrastructure practices going in as planned and scheduled);
- [ ] Requirements to assure appropriate operation and management (O&M) of the green infrastructure;
- [ ] Methods for monitoring the performance and effects of green infrastructure implementation (e.g., are individual practices working as planned, are collections of practices in a sewershed keeping flows out of the sewer system as projected);
- [ ] Provisions for adaptive management/corrective actions if green infrastructure performance (at the site scale and/or the sewershed scale) does not meet expectations

Green for Grey Substitutions

In some cases much of the foundational planning and engineering work on CSO controls may have focused on grey infrastructure practices, but well into CSO planning work the idea of incorporating green infrastructure into the LTCP may have been raised. In these types of situations it may be appropriate in a permit or enforcement action to include provisions that would govern a possible substitution of green infrastructure control measures for grey infrastructure control measures. The Consent Decrees dealing with CSOs in the Kansas City, Missouri and Cleveland, Ohio areas are examples of agreements that include provisions for green for grey substitutions. Supplement 2 provides example language which addresses some of the issues that may be associated with green for grey substitutions.

Monitoring and Evaluating Green Infrastructure Performance

Permits and enforcement actions that include green infrastructure measures should include provisions for evaluating the performance and effects of installed green infrastructure control measures. These provisions would be an essential component of post-construction monitoring required for CSO control practices. It may also be appropriate to include requirements for corrective action implementation if green infrastructure practices do not perform as projected. Following is example language to address post-construction monitoring for green infrastructure practices: [http://www.ohioenvironmentallawblog.com/uploads/file/NEORSD%20Green%20infrastructure%20CO.pdf]

"The Sewer District shall submit a plan for performing green infrastructure post-construction monitoring ("GIPCM") at two scales: (a) site or practice scale; and (b) sewershed scale. The monitoring shall be planned to evaluate the performance and effectiveness of the green infrastructure control measures, as further defined below. Once approved by EPA and the State, the District shall implement the GIPCM program in accordance with the approved GIPCM plan. The District shall submit green infrastructure post-construction monitoring reports providing the results of the GIPCM programs to EPA and the State.

a. The site or practice scale GIPCM program shall evaluate the effectiveness of the green infrastructure control measures on a site-specific scale. The GIPCM plan shall set forth the ways the various types of green infrastructure control measures to be implemented (e.g., constructed wetland, etc.) will function to control wet weather flows (e.g., through storage, infiltration, and/or evapotranspiration), and the monitoring/assessment methods that will be used to evaluate the performance and effectiveness of the various types of practices. The GIPCM plan shall set forth the District's methods and procedures for evaluating the performance of green infrastructure control measures on a site-specific scale, such as monitoring practices during and after rain events to gauge storage and/or infiltration performance. The GIPCM plan shall establish procedures for conducting performance evaluations on the fully constructed and operating green infrastructure control measures. Under the site-specific program, performance evaluations shall assess the effectiveness of the practices in terms of the functions the green infrastructure control measure was intended to fulfill (e.g., storage, infiltration). Each site-specific green infrastructure control measure (or a representative sample if similar practices are installed at similar sites) shall be monitored for a minimum of 12-months immediately following implementation.

b. The sewershed-specific GIPCM program shall set forth the steps the District shall take to evaluate the performance and effectiveness of green infrastructure measures on a sewershed scale. Examples of such methods and procedures include collecting rainfall and wet weather flow data sufficient in scope and detail to allow: (i) characterization of the performance of the green infrastructure measures in a sewershed, and (ii) hydrologic adjustment of the sewershed portion of the collection system model to determine the impacts of the green infrastructure measures on system performance within the subject sewershed. The District shall adjust the hydrologic model parameters directly related to the green infrastructure control measures as necessary to accommodate changes in model parameterization caused by shifts in runoff hydrology from the green infrastructure measures. The District shall then use both the appropriate CSO model without the green infrastructure measures, and the model that includes the green infrastructure measures, to simulate the sewershed's typical year performance both with and without the green infrastructure measures in order to demonstrate the CSO volume reduction.

c. If the green infrastructure post-construction monitoring report submitted by the District fails to demonstrate that the green infrastructure control measures have met the performance criteria specified for such control measures, then within 180 days of submission of the report, the District shall submit to EPA and the State a corrective action proposal. The corrective action proposal shall define the green or grey infrastructure enhancements/expansions to be carried out to address performance shortcomings and ensure the performance criteria are met. The proposal shall include a schedule for completion of all corrective action measures and an updated post-construction monitoring plan to evaluate whether the corrective actions have resulted in the performance criteria being met. The performance criteria for the green infrastructure sites/practices must be achieved within [XX] years of entry of the Consent Decree."

Green street projects raise the possibility of cost sharing between the stormwater or CSO authority and the transportation department.

Green Infrastructure Permitting and Enforcement Series

This series on integrating green infrastructure concepts into permitting, enforcement, and water quality standards actions contains six factsheets plus four supplemental materials that can be found at ***http://water.epa.gov/infrastructure/greeninfrastructure/gi_regulatory.cfm#permittingseries****.*

Factsheets

1. Potential Challenges and Accountability Considerations
2. Combined Sewer Overflows
3. Sanitary Sewer Overflows
4. Stormwater
5. Total Maximum Daily Loads
6. Water Quality Standards

Supplemental Materials

1. Consent Decrees that Include Green Infrastructure Provisions
2. Consent Decree Language Addressing Green for Grey Substitutions
3. Green Infrastructure Models and Calculators
4. Green Infrastructure in Total Maximum Daily Loads (TMDLs)

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For additional resources on green infrastructure, go to the EPA Green Infrastructure Web page: http://www.epa.gov/greeninfrastructure/.

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Greening CSO Plans:

Planning and Modeling Green Infrastructure for Combined Sewer Overflow (CSO) Control

U.S. Environmental Protection Agency

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Photo courtesy of Abbey Hall, U.S. EPA

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Table of Contents

Chapter 1: Introduction

Purpose of this Resource

This technical resource is intended to assist communities in developing and evaluating Combined Sewer Overflow (CSO) control alternatives that include green infrastructure. It is designed to provide municipal officials as well as sewer authorities with tools to help quantify green infrastructure contributions to an overall CSO control plan. This document is the result of a joint effort between EPA's Office of Water (OW) and Office of Research and Development (ORD), and is intended for use by both policy-oriented as well as technical professionals working to incorporate green infrastructure into CSO Long Term Control Plans (LTCPs). This resource contains three main parts:

- General overview of the regulatory and policy context for incorporating green infrastructure into CSO control programs.
- Description of how municipalities may develop and assess control alternatives that include green infrastructure.
- Brief demonstration of a modeling tool, the Storm Water Management Model v. 5.0 (SWMM5), that can help quantify green infrastructure contributions to an overall CSO control plan.

Chapter 1 describes how green infrastructure approaches fit into the Federal regulatory framework for CSO control. Chapter 2 highlights general opportunities for integrating green infrastructure into CSO LTCPs. Chapter 3 explains how to develop and evaluate control alternatives that incorporate green infrastructure practices. Chapter 4 presents a case study demonstrating how a specific model, SWMM5, may quantify green infrastructure contributions to a total CSO control program.

Environmental and Public Health Impacts of CSOs

Across the United States, more than 700 cities rely on combined sewer systems (CSSs) to collect and convey both sanitary sewage and stormwater to wastewater treatment facilities. Most of these communities are older cities in the Northeast, the Great Lakes region, and the Pacific Northwest. When wet weather flows exceed the capacity of CSSs and treatment facilities, stormwater, untreated human, commercial and industrial waste, toxic materials, and debris are diverted to CSO outfalls and discharged directly into surface waters. These CSOs carry microbial pathogens, suspended solids, floatables, and other pollutants, and can lead to beach closures, shellfish bed closures, contamination of drinking water supplies, and other environmental and human health impacts. For many cities with combined sewer systems, CSOs remain one of the greatest challenges to meeting water quality standards.

Rain barrel captures roof runoff in Santa Monica, CA.

In 1994, EPA published the CSO Control Policy (59 FR 18688 (April 19, 1994) available at [http://www.epa.gov/npdes/pubs/owm0111. pdf](http://www.epa.gov/npdes/pubs/owm0111.pdf)). The CSO Control Policy provides guidance to municipalities and State and Federal permitting authorities on controlling discharges from

CSOs through the National Pollutant Discharge Elimination System (NDPES) permit program under the Clean Water Act. In 2000, Congress amended section 402 of the Clean Water Act to require both NPDES permits and enforcement orders for CSO discharges to conform to the CSO Control Policy (33 USC § 1342(q)). Under their NPDES permits, communities are required to implement nine minimum controls (NMC) and to develop and implement Long Term Control Plans (LTCPs). Many communities are still searching for cost effective ways to implement their LTCPs.

Despite the progress achieved to date, significant infrastructure investments are still needed to address CSOs. Although funding assistance is available from federal and state sources, local ratepayers ultimately fund most CSO control projects. Therefore, CSO control programs represent a significant municipal investment that competes with other local programs.

Climate change could further amplify investments required to mitigate CSOs. The frequency and severity of CSO events is largely determined by climatic factors, including the form, quantity, and intensity of precipitation. The Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) concluded that changing trends in climate are evident from historical observations (IPCC, 2013[1]). In the United States, observed climate change in the 20th century varied regionally, but generally included warming temperatures and an increased frequency of heavy precipitation events. Anticipated changes in the 21st century also vary regionally and are not yet certain, but research suggests continued warming and changes in precipitation throughout much of the United States (Christensen et al., 2007)[2]. Though the extent of the risk is unknown, these changes could significantly affect the efficacy of CSO mitigation efforts.

Available Controls

CSO controls may be grouped into four broad categories: operation and maintenance practices, collection system controls, storage facilities, and treatment technologies. Most of the early efforts to control CSOs emphasized what we refer to in this document as "gray infrastructure," which describes traditional practices for stormwater management that involve pipes, sewers and other structures involving concrete and steel. One of the most commonly implemented types of gray infrastructure is off-line storage. Off-line storage facilities store wet weather combined sewer flows in tanks, basins, or deep tunnels located adjacent to the sewer system until a wastewater treatment plant (WWT) of a publicly owned treatment works (POTW) has the capacity to treat the stored wastewater.

CSO Control Technologies:

1. Operation and maintenance practices
2. Collection system controls
   - Conventional Approaches, and
   - Green Infrastructure Approaches
     - Retention, and
     - Runoff Control
3. Storage facilities
4. Treatment technologies

[1] IPCC, 2013: Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S. K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

[2] Christensen, J.H., B. Hewitson, A. Busuioc, A. Chen, X. Gao, I. Held, R. Jones, R.K. Kolli, W.-T. Kwon, R. Laprise, V. Magaña Rueda, L. Mearns, C.G. Menéndez, J. Räisänen, A. Rinke, A. Sarr and P. Whetton, 2007: Regional Climate Projections. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Green Infrastructure Controls

Green infrastructure practices mimic natural hydrologic processes to reduce the quantity and/or rate of stormwater flows into the the combined sewer system (CSS). By controlling stormwater runoff through the processes of infiltration, evapotranspiration, and capture and use (rainwater harvesting), green infrastructure can help keep stormwater out of the CSS. Green infrastructure also supports the principals of Low Impact Development (LID), an approach to land development (or re-development) that works with nature to manage stormwater as close to its source as possible.

© Alisha Goldstein

Drain collects runoff from impervious surface and directs it to rain gardens in Saint Paul, MN.

Green infrastructure can be utilized at varying scales—both at the site and watershed level. For example, small source control practices such as rain gardens, bioswales, porous pavements, green roofs, infiltration planters, trees, and rainwater harvesting can fit into individual development, redevelopment or retrofit sites. Larger scale management strategies such as riparian buffers, flood plain preservation or restoration, open space, wetland and forest preservation and restoration, and large infiltration systems can be used at the subwatershed or watershed level.

Multiple Benefits of Green Infrastructure

Green infrastructure can contribute to CSO control while providing multiple environmental and social benefits. Although green infrastructure alone is often unlikely to fully control CSOs, it may be able to reduce the size of more capital-intensive, "downstream" gray infrastructure control measures, such as storage facilities or treatment technologies. It may also reduce operating and energy expenditures due to the passive nature of typical green infrastructure practices. Green infrastructure can improve community livability, air quality, reduce urban heat island effects, improve water quality, reduce energy use, and create green jobs. Larger scale green infrastructure strategies can also increase recreational opportunities, improve wildlife habitat and biodiversity, and help mitigate flooding. For further information on the multiple benefits of green infrastructure, see: http://water.epa.gov/infrastructure/greeninfrastructure/index.cfm.

EPA recognizes the particular importance of ensuring resilient water infrastructure in the face of climate change. Green infrastructure is one useful approach. Green infrastructure can provide flexibility in addressing uncertainties surrounding future droughts and increased precipitation resulting from climate change. It may also be incrementally and relatively rapidly expanded and adapted as necessary. EPA already has a number of resources and tools available to communities to help assess and address the impacts of climate change. The National Water Program Climate Change Strategy lays out goals and actions for protecting our nation's water resources, and EPA has already made significant progress in the areas of improving resiliency in water infrastructure, watersheds and wetlands, coastal and ocean waters, and water quality (http://water.epa.gov/scitech/climatechange/2012-National-Water-Program-Strategy.cfm). EPA's Climate Ready Water Utilities program assists the water sector, including drinking water, wastewater, and stormwater utilities, in addressing climate change impacts and has a number of resources and tools available to water utilities and the public at http://water.epa.gov/infrastructure/watersecurity/climate/. EPA also has publicly available resources and tools to assist water utilities in addressing energy efficiency at http://water.epa.gov/infrastructure/sustain/energyefficiency.cfm.

Figure 1-1. Green infrastructure practices commonly used in urban areas.

Green Infrastructure Practice	Description
 **Disconnection**	Disconnection refers to the practice of directing runoff from impervious areas such as roofs or parking lots onto pervious areas such as lawns or vegetative strips, rather than directly into storm drains.
 **Rain Harvesting**	Rain harvesting systems collect runoff from rooftops and convey it to a cistern tank where the water is available for uses that do not depend on potable water, like irrigation.
 **Rain Gardens**	Rain gardens are shallow depressions filled with an engineered soil mix that supports vegetative growth. They are designed to store and infiltrate captured runoff, and retain water for plant uptake. They are commonly used on individual home lots to capture roof runoff.
 **Green Roofs**	Green roofs (also known as vegetated roofs or ecoroofs) are vegetated detention systems placed on roof surfaces that capture and temporarily store rainwater in a soil medium. They typically have a waterproof membrane, a drainage layer, and a lightweight growing medium populated with plants that absorb and evaporate water
 **Infiltration Trench**	Infiltration trenches are gravel-filled excavations that are used to collect runoff from impervious surfaces and infiltrate the runoff into the native soil. Some systems are designed to filter runoff and reduce clogging by routing water across grassed buffer strips.
 **Street Planters**	Street planters are typically placed along sidewalks or parking areas. They consist of concrete boxes filled with an engineered soil that supports vegetative growth. Beneath the soil is a gravel bed that provides additional storage as the captured runoff infiltrates into the existing soil below. Street planters also can be designed with underdrains to avoid ponding on sites with inadequate infiltration capacity.
 **Porous Pavement**	Permeable pavement and paver systems are excavated areas filled with gravel and paved over with a permeable concrete or asphalt mix. They may also be overset with a layer of pavers. Rainfall passes through the pavement or pavers into the gravel storage layer below where it can infiltrate at natural rates into the site's native soil.

Chapter 2: Integrating Green Infrastructure into the Federal Regulatory Framework for CSO Control

The 1994 CSO Policy provides guidance to EPA and State NPDES authorities on how to develop NPDES permits for CSO discharges, as well as how to conduct enforcement actions against violators with CSOs. Although the processes and practices for meeting the CWA and CSO Policy requirements with gray infrastructure are generally well understood, the process for meeting them with a combination of gray and green infrastructure is less well defined.

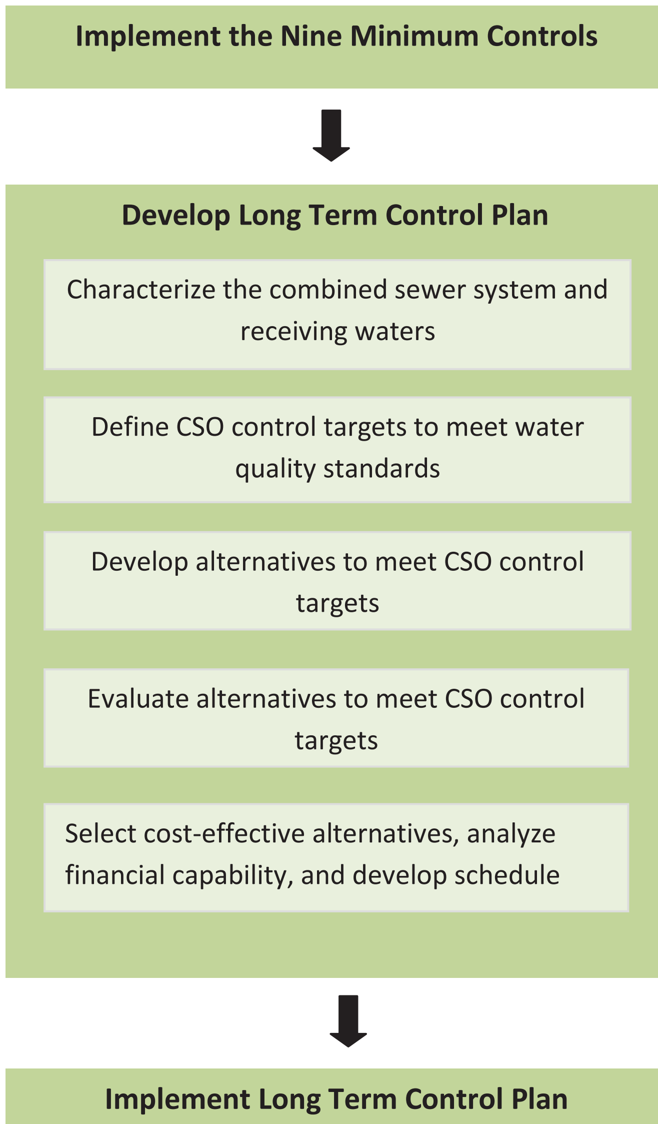

Figure 2-1. The process for meeting federal requirements for CSO controls generally follows the series of steps shown here.

Implementing the CSO Control Policy

Phase I: Green Infrastructure and the Nine Minimum Controls

The Nine Minimum Controls (NMCs) are minimum technology-based requirements that municipalities must take to address combined sewer overflows:

Nine Minimum Controls:

1. Proper operation and regular maintenance programs for the sewer system and the CSOs
2. Maximum use of the collection system for storage
3. Review and modification of pretreatment requirements to assure CSO impacts are minimized
4. Maximization of flow to the publicly owned treatment works for treatment
5. Prohibition of CSOs during dry weather
6. Control of solid and floatable materials in CSOs
7. Pollution prevention
8. Public notification to ensure that the public receives adequate notification of CSO occurrences and CSO impacts
9. Monitoring to effectively characterize CSO impacts and the efficacy of CSO controls

Green infrastructure approaches are adaptable in several components of the NMCs. For example, green infrastructure practices can retain and control runoff for a period of time before slowly releasing it to the sewer system. Green infrastructure practices can also increase available storage capacity in the collection system, which reduces the likelihood of overflows and maximizes the amount of stormwater treated at a publicly owned treatment works (POTW). The full text of EPA's 1995 Guidance for Nine Minimum Controls is available at http://www.epa.gov/npdes/pubs/owm0030.pdf.

Phase II: Developing the Long Term Control Plan

CSO communities are generally required under their NPDES permits to develop and implement a Long Term Control Plan (LTCP). LTCPs set out plans for specific measures to meet the requirements of the Clean Water Act, including the attainment of water quality standards. Detailed information on developing and implementing LTCPs can be found at http://cfpub.epa.gov/npdes/cso/guidedocs.cfm?program_id=5.

The first two steps in developing an LTCP include characterization of the CSS and receiving waters, and the development of CSO control targets to meet water quality standards (WQS). These two steps are independent of the types of controls under consideration. Regardless of the types of controls considered, pursuant to the CSO Control Policy, CSO communities are expected to develop a LTCP that adopts either the demonstration or presumption approach to define targets for CSO control that achieve compliance with the Clean Water Act (CWA).

Once a community defines CSO control targets, they may develop and evaluate control alternatives to meet these targets. The 1995 EPA Guidance for Long Term Control Plans identifies four categories of CSO control measures, and includes specific green infrastructure measures in the category labeled “Source Controls” (1995 EPA Guidance for LTCPs, Section 3.3.5.1). The measures discussed in this guidance include permeable pavements, flow detention, downspout disconnection, and infiltration-based practices. The guidance also recognizes that, “since source controls reduce the volumes, peak flows, or pollutant loads entering the collection system, the size of more capital-intensive downstream measures can be reduced or, in some cases, the need for downstream facilities eliminated.”

Elements of a Long Term CSO Control Plan:

1. Characterization, monitoring, and modeling of the Combined Sewer System (CSS)
2. Public Participation
3. Consideration of sensitive areas
4. Evaluation of alternatives
5. Cost/performance considerations
6. Operational plan
7. Maximization of treatment at the existing POTW treatment plant
8. Implementation schedule for CSO controls
9. Post-construction compliance monitoring program

The complete CSO Control Policy is available at:
http://cfpub.epa.gov/npdes/cso/guidedocs.cfm?program_id=5

Implementing the Long Term CSO Control Plan

Regardless of the type of controls included, LTCPs are expected to result in compliance with the requirements of the CWA. To assess progress toward compliance, the CSO Policy requires development of a post-construction compliance-monitoring program that adequately measures and evaluates the effectiveness of CSO controls, protects designated uses, and complies with water quality standards (WQS).

For LTCPs incorporating green infrastructure approaches, an **adaptive management** approach can be employed during the implementation process. Adaptive management means monitoring and evaluating green infrastructure projects and practices as work proceeds, and adapting or revising plans and designs as appropriate based on lessons learned. Evaluating practices as work proceeds can often be a more effective approach than adopting a monitoring program confined to the post-construction phase.

Photo: Permeable paver retrofits help to infiltrate urban runoff in a Chicago alley. © Abby Hall, U.S. EPA.

Importance of Monitoring

As the previous section suggests, the installation of green infrastructure controls may occur incrementally over time. By monitoring the effectiveness of green infrastructure controls as they are installed, municipalities can compare observed performance to modeled performance. If necessary, they can modify designs of remaining planned projects to meet a CSO control goal, or retrofit existing practices as necessary.

Green Infrastructure in EPA Enforcement

Given the multiple environmental, economic and social benefits associated with green infrastructure, EPA has supported and encouraged the implementation of green infrastructure for stormwater runoff and sewer overflow management to the maximum extent possible. EPA enforcement in particular has taken a leadership role in the incorporation of green infrastructure remedies in municipal Clean Water Act (CWA) settlements. Many cities have used green infrastructure to effectively manage stormwater. Runoff reductions from green infrastructure are demonstrable, may be less expensive than traditional stormwater management approaches in many cases, and provide a wide variety of community benefits (http://water.epa.gov/infrastructure/greeninfrastructure/index.cfm). Based on this evidence, EPA enforcement has incorporated green infrastructure as part of injunctive relief, the measures and actions legally required to bring an entity back into compliance with the law, in a growing number of municipal CWA cases. Although communities are given discretion over how they want to comply with the CWA, EPA encourages the use of green infrastructure wherever appropriate. It has become common practice for green infrastructure to be included as injunctive relief in many municipal CWA settlements.

Many recently settled green infrastructure matters include an option for communities to study the feasibility for green infrastructure approaches, and to propose the replacement of specific gray infrastructure projects with green infrastructure on a case by case basis as a result of a feasibility analysis. Other settlements call for a commitment to a certain level of green infrastructure implementation up front while still offering the opportunity to scale up green infrastructure in the future, as appropriate.

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A green roof captures stormwater in Chicago, IL. Under a U.S. EPA Consent Decree, the Metropolitan Water Reclamation District of Greater Chicago (MWRD) is required to develop a detailed Green Infrastructure Program.

➢ More Enforcement Resources

An index of recent enforcement actions incorporating green infrastructure is available on EPA's website here: http://water.epa.gov/infrastructure/greeninfrastructure/gi_regulatory.cfm#csoplans

For more information on incorporating green infrastructure in EPA enforcement actions, see the U.S. EPA Green Infrastructure *Permitting and Enforcement Factsheet Series* here: http://water.epa.gov/infrastructure/greeninfrastructure/gi_regulatory.cfm#permittingseries

Chapter 3: Quantifying Green Infrastructure Controls as a Component of CSO Long Term Control Plans

Once a community defines its CSO control targets, the next step is to develop a set of alternative CSO control programs, and to evaluate these alternatives in order to select a preferred program. The development and evaluation processes are closely linked, and rely on many of the same factors, including sizing, cost, performance, and siting considerations. In assessing the performance of different control scenarios, Hydrologic and Hydraulic (H&H) models are often used to simulate how a municipal collection and conveyance system will respond to infrastructure changes. H&H models can evaluate the impact of a variety of infrastructure changes, such as the addition of off-line storage or construction of a tunnel to convey and store wet weather flows. More recently, these models have been adapted to simulate the effects of green infrastructure in a CSO service area.

Quantifying Green Infrastructure Implementation

Before beginning to model the effects of green infrastructure, it is important to understand the *amount* and *types* of green infrastructure that can be implemented, realistically and cost-effectively, in a given catchment. If green infrastructure opportunities are over-estimated, model results will over-estimate the potential for CSO reductions. Over-estimation of the degree of green infrastructure implementation can also lead to under-sizing gray infrastructure components downstream.

Green infrastructure opportunities within a catchment largely depend on soil characteristics, topography and land use. For example, if there are a large number of sizable industrial and/or commercial properties within a given catchment, there may be opportunities to add green roofs to both existing and future rooftops. Single-family residential lots with sufficient yard area offer opportunities to capture runoff off from rooftops, patios, driveways, and streets using residential rain gardens. Planned road improvements present opportunities to include green infrastructure practices in the redesign/reconstruction of right-of-way areas. Estimating the maximum or optimal amount of green infrastructure implementation also requires consideration of institutional factors that will affect the degree of implementation.

"It is important to understand the amount and types of green infrastructure that can be implemented, realistically and cost effectively, in a given catchment."

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Curbside raingarden installation in Portland, Oregon.

Any proposal for the incorporation of green infrastructure into an LTCP should include, at a minimum, robust analyses in the following two areas:

1. **Community and Political Support for Green Infrastructure**
The municipality or sewer authority responsible for implementing the LTCP should solicit initial buy-in from the community and relevant political powers. Developing a substantial green infrastructure program will involve iterative interaction with both the community and local government officials. Meaningful local buy-in is essential for long-term success.

2. **Realistic Potential for Green Infrastructure Implementation**
The municipality or sewer authority responsible for implementing the LTCP should adequately investigate local factors that may limit the implementation of green infrastructure, including physical factors (e.g. soils, topography and land availability), regulatory factors (e.g. codes and ordinances), and social and political factors (e.g. ability to enact incentives and/or regulatory drivers for green infrastructure).

When simulating the performance of green infrastructure measures using H&H modeling, the technical characteristics utilized for each type of green infrastructure measure should reflect those likely to be **realistically** achieved, given both costs and physical, regulatory and/or social and political factors.

Factors to consider when evaluating the degree of green infrastructure implementation potential within a catchment should minimally include:

Soil characteristics. Many green infrastructure practices rely on infiltration as a means of stormwater disposition. Areas with very tight soils (e.g., clay soils not conducive to infiltration of water) will reduce the infiltration potential of many green infrastructure measures. In some situations it may be appropriate to amend soils to enhance storage and infiltration, and to promote plant growth.

Land Use and Ownership. How much land is residential, commercial, and industrial? What are the lot sizes? Are there vacant lots? Who owns them? How much land in the catchment is publicly owned or controlled (e.g., are there parkways in the public right-of-way)? What is the configuration of the existing street drainage system? Weaving green infrastructure into the existing landscape requires an understanding of current land use, as well as the local codes, plans and ordinances that will shape future land use patterns. Since impervious cover tends to vary across land use type, parcel-level land use data can help estimate green infrastructure potential. Detailed land use data can also determine what types of green infrastructure approaches are most appropriate for a given catchment. Commercial or publicly owned buildings, for example, may be better suited for green roof installations. Industrial parks with large minimum lot sizes exhibit potential for larger retention basins or constructed wetlands.

Local Buy-in. Will landowners be receptive or resistant to green infrastructure practices in the neighborhood or on their property? How will green infrastructure fit into the existing fabric of the neighborhood? Drawing on the knowledge and experience of community leaders, as well as key groups such as home owner associations, land trusts, etc., will help inform outreach strategies.

Seattle's Street Edge Alternatives (SEA) program installed curbside stormwater features in residential neighborhoods.

Topography. Green infrastructure practices should ideally be located on slopes of less than 5%. Steeper terrain tends to make implementation more difficult and less cost-effective. For example, detention basins built on slopes over 5% are often difficult to design, plant and berm effectively. In response many communities prohibit the construction of green infrastructure in areas with slopes greater than 25%. GIS software can help identify and map steeper slopes, as well as areas with low infiltration potential (i.e., poorly drained soils).

Financing and Institutional Factors. Are there financial incentives to promote green infrastructure practices on private property? What incentives would effectively encourage property owners to construct and maintain green infrastructure practices? Do codes and ordinances require green practices at existing sites or redevelopment sites? What is the budget for green infrastructure implementation on public properties? Are there institutional barriers or impediments to requiring or incentivizing green infrastructure? Does the jurisdiction have the legal authority and the institutional capacity to require or incentivize green infrastructure?

Redevelopment Rate. Will there be redevelopment and reuse of many parcels, allowing new green infrastructure practices to be constructed as part of the redevelopment process? Some localities require new and re- development to meet onsite retention standards. If this is the case, the CSO authority may use redevelopment rates to predict degree of new green infrastructure installation over time. If mandatory requirements do not exist, communities may consider incentives that encourage developers to install green infrastructure.

Green Infrastructure on Private Property. Privately-owned properties such as corporate campuses or shopping malls can be good locations for green infrastructure practices in terms of the availability of space and/or the location in a sewershed. However, implementing green infrastructure on private property as part of a CSO control plan presents special challenges. Questions can arise as to who is responsible for maintenance, as wells as weather the sewer authority has the right to come onto the property for inspections or maintenance. In some cases, easements, deed restrictions, covenants, stormwater development standards, or other programmatic elements can be used to retain benefits gained. If a sewer authority is planning green infrastructure on private property as part of the long-term control plan, careful consideration of maintenance and preservation measures is essential; otherwise, model results could overestimate the actual flow reductions that will be achieved through green infrastructure practices.

Opportunities Presented by Partnerships. Opportunities for partnerships can help CSO communities plan what green infrastructure measures can be placed where. In some cases, CSO communities may be able to capitalize on opportunities presented by partners to work collaboratively on projects. Such partnerships potentially could include:

- **Public-public partnerships**– For example, the sewer authority could work with the streets department, park district or school district to implement green infrastructure in streets, at parks or on school grounds. Partnership opportunities may make public sites available for green infrastructure implementation, and/or there may be opportunities to share green infrastructure maintenance responsibilities across different departments or jurisdictions. Integrating green infrastructure into Capital Improvement Plans can allow different government departments to identify the most impactful and/or cost effective opportunities for green practices. For example, coordinating green infrastructure efforts with scheduled Department of Transportation improvements provides an opportunity to implement green streets at a much lower cost than traditional stormwater retrofits.
- **Public-private partnerships**—The CSO authority may engage the private sector in construction financing efforts to support the installation of green infrastructure. They might also partner with local Business Improvement Districts (BIDs) or other private entities to support the maintenance and operation of existing green infrastructure practices.
- **Partnerships with non-profits and neighborhood groups** – Working with not-for-profit organizations and community groups can help garner input from citizens on green infrastructure planning, gaining public acceptance, recruiting volunteers, and providing a sense of ownership once the practices are in place.

Green Infrastructure Planning on Multiple Scales

The process of analyzing green infrastructure strategies for site-specific conditions should be carefully planned and scaled. For example, a regional sewer district might first assess which sewersheds provide the most opportunity for green infrastructure, and then focus on identifying what type of green infrastructure can realistically and cost-effectively be implemented in those areas.

Another approach is to categorize sewersheds into groups, based on land use, soils, and topography, and then develop green infrastructure templates for the various types/categories of sewersheds. Geographic Information Systems (GIS) can help integrate land use, ownership, soil and slope data into a simple ranking system. A basic GIS ranking model estimates green infrastructure implementation potential across a given service area using local spatial data. Specific factors that can be brought into a ranking analysis include:

- open space
- slope
- soil characteristics
- publicly owned parking lots/buildings
- commercial/industrial ownership
- residential housing (for downspout disconnection)
- existing vegetation

Examples of Green Infrastructure Planning

Several CSO communities have planned for green infrastructure as part of their stormwater runoff management strategies. Four different approaches are presented below.

Planning Case Study #1: Northeast Ohio Regional Sewer District

The Northeast Ohio Regional Sewer District (NEORSD) performed a systematic evaluation of where to best implement green infrastructure measures within their service area. Under the terms of a Consent Decree agreement with U.S. EPA and the State of Ohio, NEORSD committed to implementing green infrastructure as part of its CSO control program. The District needs to plan for the construction of green infrastructure to meet a performance criterion of reducing CSOs by 44 million gallons in a typical year, beyond the reductions achieved by planned gray infrastructure control measures. NEORSD performed a geographic screening of neighborhoods within the combined sewer service area using a *Green Infrastructure Index* to identify locations most suitable for green infrastructure projects. Factors involved in the *Index* ranking are described in the NEORSD Green Infrastructure Plan here: http://neorsd.org/projectcleanlake.php.


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Permeable pavers infiltrate street runoff in Portland, OR.

NEORSD's *Green Infrastructure Index* has two separate components. The first component, referred to as the Baseline Index, provides a numeric score that characterizes general opportunities, space, and potential effects of green infrastructure projects. The second component is specific to the 44 million gallon performance criterion, and provides a numeric score that characterizes projected impacts of green infrastructure on CSO volume reduction. The *Green Infrastructure Index* repressents a sum of these two scores. Factors taken into account in the Index include development and redevelopment opportunities, soils, open space and imperviousness, partnership opportunities, and environmental justice. The District assessed CSO volume reductions for the second component by running H&H model simulations where directly connected impervious areas (DCIAs) were reduced by fixed amounts. After determining which sub-catchments received the highest combined GI Index scores, staff identified 38 “priority” sub-catchments across the district.

The District then developed, evaluated, and prioritized green infrastructure projects in each priority sub-catchment. Using a ranking-based tool such as NEORSD’s *Green Infrastructure Index* can provide a systematic approach for identifying the most promising sewersheds and most appropriate practices within a given service area.

Planning Case Study #2: San Francisco Public Utilities Commission

The San Francisco Public Utilities Commission also used a GIS-based analysis to identify maximum potential for specific green infrastructure practices across its sewershed based on physical constraints (see Section 3.2 and Table 6 of http://sfwater.org/modules/showdocument.aspx?documentid=560). The results of this analysis estimated a maximum of 38% of the total city area was available for conversion to green roofs, downspout disconnection, bioretention, urban trees, and permeable pavement. Modeling scenarios for San Francisco later incorporated goals related to this maximum potential for green infrastructure. A watershed-based planning process called *The Urban Watershed Assessment* will use this information to inform San Francisco’s Sewer System Improvement Program (SSIP).

Planning Case Study #3: Metropolitan Sewer District of Greater Cincinnati

The Metropolitan Sewer District of Greater Cincinnati (http://msdgc.org/) conducted a green infrastructure planning effort in a single pilot area, the Lick Run sub-sewershed. Lick Run is a 2,600 acre sub-sewershed with primarily single-family residential, commercial and undeveloped/open space. The District selected Lick Run for evaluation because its drainage area contains a mix of topography, land use, and surficial soil characteristics. In total, approximately 24% of the sewershed is impervious. The analysis focused on three classes of impervious areas: roofs, parking lots/driveways, and streets.

GIS polygons representing roof footprints facilitated analysis of green roof potential. Both green roofs and roof top cisterns were considered for larger commercial, industrial, and multifamily residential buildings. For smaller single-family residential buildings, downspout disconnection to a rain garden was the selected green infrastructure practice. GIS data was unavailable for parking lots and sidewalks, so boundaries had to be delineated by hand from aerial photos. Bioretention and permeable pavement were the selected alternatives for these impervious surfaces. For roadways, GIS data was only available as street centerlines. As such, the District estimated associated impervious area for roads based on width estimates for each street type. Curbside bioretention and infiltration swales were the chosen practices for local roads where road narrowing was feasible.

The district created a range of scenarios in which green infrastructure practices would manage 10-35% of roadways, 20-50% of rooftops, and 25-50% of parking lots and sidewalks. Once the inputs were appropriately set up, they ran a CSO model individually for three separate rainfall events, using a continuous simulation of a typical year in order to characterize the effects of the various levels of green infrastructure implementation.

Planning Case Study #4: City of Toledo

The City of Toledo, Ohio kicked off a significant green infrastructure retrofit project by first installing and monitoring bioswales along a residential street (http://www.estormwater.com/maywood-avenue-storm-water-volume-reduction-project). The City conducted monitoring of runoff from the street before and after installing bioswales, and then monitored a nearby non-retrofitted street for comparison purposes. The monitoring study provided data on the amount of stormwater stored or infiltrated at both test sites. The City then used this data to calibrate its stormwater management model (SWMM). Finally, the City used this model to simulate flow reductions provided by the green street upgrades. Long-term simulations using the SWMM model indicate an annual average reduction of runoff volume from the bioswales of approximately 64%. Long-term simulation results showed that during the fifth-largest storm event bioswales removed 70,000-80,000 gallons of flow from the CSS. Toledo was also able to calculate a cost per gallon of stormwater removed by the bioswales. With this data the city is now able to evaluate the cost effectiveness of implementing bioswales as an element of its CSO control program.

After green infrastructure implementation sites and control measures have been selected, hydrologic and hydraulic (H&H) modeling can be used to quantify how green infrastructure will change runoff characteristics and, in combination with gray infrastructure, help reduce CSOs. More details about the methods for using H&H models for these purposes will be covered in the following section of this report. Note that green infrastructure planning and H&H modeling is an iterative process. For example, hydrologic modeling reflecting green infrastructure practices might reveal opportunities to downsize downstream gray infrastructure. H&H modeling can thus help evaluate varying combinations of green and gray infrastructure to identify what combination of alternatives is most cost-effective.

Using Green LTCP-EZ, a Simplified Tool for Small Communities

Once analyses such as those mentioned above identify what green infrastructure practices can realistically be implemented in a given service area, modeling work can simulate the effects of the green infrastructure on reducing flows into the system. One tool that communities can use for developing a CSO long-term control plan that includes green infrastructure is the *Green LTCP-EZ Template*. This tool was developed by EPA and is posted on the Agency's website here: http://water.epa.gov/infrastructure/greeninfrastructure/upload/final_green_ltcpez_instructions withpoecacomments.pdf.

The *Green LTCP-EZ Template* is a planning tool for communities that wish to develop an LTCP to address CSOs using, at least in part, green infrastructure. The template provides a framework for organizing and completing an LTCP. Schedules 5A and 5B of the template lay out a process for communities to evaluate the ability of a set of widely used green infrastructure runoff controls, as well as pipe network CSO controls to meet a CSO reduction target.

Schedule 5A estimates the number of green infrastructure practices required to meet a runoff reduction goal. The schedule estimates the number of practices that will need to be implemented to achieve the level of CSO control required for Clean Water Act compliance, but it does not assess the capacity of the landscape to accommodate those practices. While the actual volumetric reductions achieved by using different green infrastructure practices

The volume of runoff reduction achieved for each practice category is calculated using a variation of the following equation for volume of runoff reduction:

$$V = kAP24RR$$

V = runoff reduction volume (gallons or million gallons [MG])
k = unit conversion factor
A = area of impervious surface managed (acres)
$P24$ = depth of 24-hour design storm rainfall (inches)
RR = average volumetric reduction rates (per practice)

Five general green infrastructure controls are considered in the 5A Schedule:

- Green roofs
- Bioretention
- Vegetated swales
- Permeable pavement
- Rain barrels and cisterns

will vary based on local conditions as well as sizing and design considerations, Green LTCP-EZ uses a simplified approach that includes practice-specific volumetric reduction rates to provide an estimate of the volumetric reductions achieved through implementation of green practices. Before making a final determination on the approach to control overflows, the user would need to ensure that the green infrastructure practices are suitable for a given catchment.

Green LTCP-EZ is suitable for small communities and situations that are relatively simple to assess. However, Schedules 5A and 5B may be a resource for others as well in that they are an example of a way to quantify the ability of green infrastructure practices to keep water out of a CSS.

To further quantify the impacts of green infrastructure on CSO frequency and volume in a sewershed, more complex hydrologic & hydraulic (H&H) modeling tools are needed that simulate the processes involved in stormwater runoff across the landscape as well as those involved in routing of storm and wastewater through CSS infrastructure and outfalls.

Using Hydrologic & Hydraulic Models in Planning CSO Control Programs

H&H models are frequently developed and used to simulate how a municipal sewer system will respond to rainfall events. Models are mathematical approaches that calculate estimated water flows through a sewer system. Simulation models are critical for CSO planning because they can project the effects of alternative control scenarios and identify the combination of control measures likely to result in the achievement of CSO control goals.

H&H models are particularly well suited to municipalities with large, complex, combined sewer areas. H&H models include detailed representations of catchments, conveyance systems, and storage and treatment facilities, and simulate how these elements respond to local meteorological data.
In general, H&H models are developed in two stages: the baseline stage, and the future scenarios stage. Prior to assessing alternative future scenarios, the current situation or baseline condition is modeled. Observed results are then compared to simulated results in order to calibrate and validate the model. Several H&H models are available today (see Green Infrastructure Permitting and Enforcement Series, Supplement 3 “Green infrastructure Models and Calculators” at http://water.epa.gov/infrastructure/greeninfrastructure/upload/EPA-Green-Infrastructure-Supplement-3-061212-1-PJ.pdf.

Once a model is built and tested with existing conditions, a community can then run the model and add in various proposed control devices with varying capacities and capabilities at different locations. The model will estimate how the system will perform, and what the resultant CSO event frequencies and discharge volumes will be under various alternative scenarios. There are a variety of approaches to developing alternative scenarios. Communities can then select a cost-effective combination

The H’s in H&H Models:

Hydrology
Where does rainwater go and how much will flow into the sewer network?

Hydraulics
What will be the volume and velocity of flow in the sewer network? How will the constructed infrastructure manage and treat the flows?

What Models Can Estimate for Proposed Control Devices:

- How the system will perform
- Resultant CSO event frequencies
- Resultant CSO discharge volumes

of control measures by finding combinations that meet established goals (e.g., no more than four CSO events in a typical year) at the lowest cost.

There are two key components to an H&H model:

- *Hydrology* - The hydrologic component of an H&H model looks at the catchment areas – how big are they, what are the soils like, what land uses they contain – in order to estimate *how much* runoff will drain into the sewer system over *what time frame* when there is a precipitation event. For precipitation that falls on the land surface, hydrologic models predict how this water will redistribute into the soil, groundwater, and atmosphere; and how much will flow into the sewer network. For the purposes of CSO modeling, the final output of interest from hydrological modeling is the volume and timing of water that flows into the CSS through storm drains.

- *Hydraulics* - The hydraulic component of the model is used to simulate how the flows in a sewer system will move through the sewer network. Information from the hydrology component of the H&H model is an input to the hydraulic component of the model. Once flow is delivered to a sewer or another conveyance such as a channel, hydraulic modeling is used to estimate the volume and velocity of flow through the sewer. The complete drainage network needs to be represented in the hydraulic modeling, including factors such as storage facilities or inflatable dams, to simulate the movement of water through all the connected channels as it is transported to the wastewater treatment plants, or to overflow outfalls if the volume of flows exceeds capacity of the system. In CSO contexts, an output of interest from hydraulic modeling is the frequency and volume of these overflows.

The results that emerge from H&H model runs reflect the volume and timing of stormwater runoff that enters the CSS as predicted by the hydrology model, as well as ways the CSO infrastructure system components will store, convey, and treat flows, as simulated by the hydraulic model.

A **dynamic H&H model** is necessary for accurately describing the temporal and spatial variability of an urban catchment's response to rainfall events. Dynamic models can simulate varying conditions over time by calculating the system's state iteratively in short time steps. Commonly used dynamic models are listed below.

Examples of Dynamic H&H Models:

- EPA's SWMM http://www.epa.gov/nrmrl/wswrd/wq/models/swmm/
- Related commercial products such as Info-SWMM (http://www.innovyze.com/products/infoswmm/), PCSWMM (http://www.chiwater.com/Software/PCSWMM.NET/index.asp), XP-SWMM (http://www.xpsoftware.com/products/xpswmm/), and MikeSWMM (http://www.dhisoftware.com/mikeswmm/index.htm)
- InfoWorks (http://www.innovyze.com/products/infoworks_cs/)
- Mike Urban (http://www.dhisoftware.com/Products/Cities/MIKEURBAN.aspx)
- SewerGems (http://www.bentley.com/en-US/Products/SewerGEMS/)

For more information on dynamic models is available reference:
http://water.epa.gov/infrastructure/greeninfrastructure/gi_modelingtools.cfm

Many communities in the U.S. use dynamic models when planning their CSO control programs to demonstrate how specific control measures will alter the frequency and volume of CSO events.

CSO control measures that are modeled using H&H models can include gray infrastructure modifications such as increasing sewer line capacity, addition of storage or treatment devices, and/or expansion of treatment plant capacity. Gray infrastructure controls are typically reflected in the hydraulic component of the model. One can use these models to predict effects on untreated discharge volumes during CSO events if defined gray infrastructure controls are put in place. Many CSO communities already have experience modeling gray infrastructure control measures.

H&H models can also be used to evaluate green infrastructure control practices. In some cases modelers can use green infrastructure to represent stormwater storage. An example of this might be a constructed wetland basin. Where proposed green infrastructure control measures provide a storage function for a defined storm size, modelers can route runoff through a storage node. However, in many cases green infrastructure can perform functions beyond providing storage. For example, practices such as rain gardens can allow for infiltration and evapotranspiration, which increase the performance of the practice in terms of keeping water out of the sewer system. Functions of green infrastructure can also be reflected in the hydrology component of the model. Care must be taken to appropriately quantify the effects of green infrastructure practices in terms of flow quantities and timing in order for the H&H model to produce reliable results. Three case studies at the conclusion of this section point to specific examples of modeling the contribution of green infrastructure practices to CSO reductions.

The hydrology component of the model, if set up to reflect planned green infrastructure practices in a catchment, can also provide information on flow quantities and timing that can be useful in sizing gray infrastructure components downstream. In other words, if green infrastructure practices are integrated into modeling prior to planning the gray infrastructure measures, gray infrastructure will be “right-sized”. Running the model with planned green and gray infrastructure measures can estimate the combined effects of the green and gray together, providing a way to determine if CSO control goals will be met.

The Role of Monitoring

Monitoring is an essential part of integrating green infrastructure into the CSO control plan process. Whenever possible, monitoring should be performed to validate CSO models. For example, the Metropolitan Sewer District of Greater Cincinnati (MSDGC) conducted monitoring of CSO flows and discharges during a year that closely resembled a typical rainfall year. Using this data the District was able to compare actual CSO results with model predictions to validate their model. For more information on MSGD’s monitoring effort, see: http://projectgroundwork.org/.

Monitoring should also play a role as green infrastructure implementation proceeds. Conducting monitoring during implementation allows for assessment of whether practices are performing as anticipated. If monitoring data indicates control measures are not performing as anticipated, adjustments to factors in the model might be needed. Monitoring during the implementation process can also reveal what practices or designs are working or not working well. This information can inform an adaptive management strategy to either modify or enhance future activities to help ensure CSO control goals are met.

Examples of Communities Using H&H Models to Estimate Green Infrastructure Contributions to CSO Reductions

As illustrated by the case studies described above, a growing number of municipalities have used H&H models to estimate the extent to which proposed green infrastructure measures will reduce CSOs. In most cases, land cover or storage parameters in an existing H&H model were adjusted to reflect green infrastructure measures. Examples of other ways in which municipalities have represented green infrastructure within models include:

- Making broad changes to the representation of catchment hydrology (e.g., defining separate catchments to represent areas treated with green infrastructure);
- Conversion of directly connected impervious areas to disconnected impervious areas;
- Modifying depression storage value parameters;
- Adjusting the amount of storage in individual nodes.

In some cases, modelers evaluated the impact of specific green infrastructure practices by creating a more detailed representation of the system. Details can include defining catchments for individual practices, and reflecting changes in infiltration, evapotranspiration, and storage components. Some of these efforts used separate platforms or evaluations for catchment areas, whereas others performed this evaluation within the primary collection system model. In all cases, the goal was to reflect how stormwater volumes and timing have changed or would change as the result of green infrastructure implementation in the hydrology component of the H&H model. Several communities, three of which are described below, have used modeling as an important tool in their green infrastructure planning.

Modeling Case Study #1: Metropolitan Sewer District of Greater Cincinnati

The Metropolitan Sewer District of Greater Cincinnati (MSDGC) modified its existing model, which was based on MikeSWMM, to model the effects of green infrastructure implementation in the Lick Run sewershed. Modelers extracted this smaller sewershed from the larger system-wide model to streamline the modeling effort. They then redefined the catchment to better distinguish various land use categories and improve hydrologic parameters. Lastly, they recalibrated the model using existing historic flow data.

With the updated baseline model set up and calibrated, staff introduced the effect of green infrastructure practices by removing green infrastructure-managed areas from the baseline model catchments and adding them to newly created catchments. Changes in the hydrology component of the model to reflect green infrastructure practices included the following: Modifications to amount of impervious surface area, addition of depression storage areas, addition of parallel pipes to represent a daylighted stream, and removal of impervious area from the catchment area for downspout disconnection. Scenarios were evaluated using two approaches. The first approach used variations in the amount of managed impervious area, and the second used variations in the amount of captured volume and the release rate associated with each type of practice. Modeling results considered a range of green infrastructure implementation scenarios based on storm sewer separation and stream daylighting, detention basins, and downspout disconnection. Suggested reductions of CSO volume ranged from 39 to 46 percent control of CSO events for a typical rainfall year. (See Table 3.04-1 in http://projectgroundwork.org/downloads/cfac/Lick_run_strategic_integration_plan_July2011_Final_Full_Report.pdf).

Modeling Case Study #2: San Francisco Public Utilities Commission

The San Francisco Public Utilities Commission (SFPUC) modified its baseline collection system model, which is based on the InfoWorks Collection System software including SWMM, for estimating the hydrology and runoff portion of its CSS model. Modelers altered impervious area to represent select green infrastructure practices (e.g., green roofs, street trees, bioretention, and permeable pavement). Manning roughness number and depression storage values, which are used in the runoff calculation, were altered for the areas where green infrastructure practices were added in the model, except for the downspout disconnections that were excluded by removing roof top areas from the catchment. The results of the modeling based on SFPUC's 30-year target for green infrastructure implementation would reduce annual CSO amounts by 200 to 400 million gallons or 14 to 27 percent. See http://sfwater.org/modules/showdocument.aspx?documentid=560.

Modeling Case Study #3: Milwaukee Metropolitan Sewerage District

To evaluate the potential for green infrastructure to reduce average annual stormwater runoff and peak flows that typically result in CSOs, the Milwaukee Metropolitan Sewerage District (MMSD) conducted numerous modeling exercises (http://v3.mmsd.com/assetsclient/documents/sustainability/SustainBookletweb1209.pdf). MMSD developed a hydrologic simulation program Fortran (HSPF) model to represent five- to six-acre residential and commercial city blocks. The model initially established baseline conditions, then evaluated the impact of green infrastructure practices. Modeled results indicated that introducing green infrastructure in residential areas could reduce peak flows by 5 to 36 percent. After initial modeling showed reduced stormwater flows into the combined system within the hydrology component of the H&H model, MMSD was able to use the hydraulic component of its model to simulate the overall response of the District's conveyance and treatment system. MMSD's modeling confirmed the potential of green infrastructure to have a significant impact on average annual CSO volumes (12 to 38 percent).

These and other case studies provide examples of how H&H model can be set up to reflect green infrastructure practices. EPA's new SWMM Version 5.0 can incorporate a variety of green infrastructure practices *explicitly* rather than making indirect modifications to reflect the effects of green infrastructure practices. Chapter 4 contains a step-by-step, detailed case study describing how SWMM version 5.0 can model the effects of green infrastructure implementation in a theoretical sewershed. Chapter 4 also includes information on how to compare model results to a baseline simulation in order to quantify the degree to which green infrastructure practices contribute to total reduction of CSO events.

> *"A growing number of municipalities have used H&H models to estimate the extent to which proposed green infrastructure measures will reduce CSOs."*

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Volunteers maintain a curbside planter capturing street runoff in Gresham, Oregon.

Chapter 4: Detailed Case Study of Incorporating Green Infrastructure into a CSO Model using SWMM v. 5.0

This chapter presents a hypothetical case study developed by EPA to illustrate how a community might use H&H modeling to explore tradeoffs between gray and green infrastructure for CSO control. H & H modeling can assist with scoping, planning and prioritization of different green infrastructure control scenarios. This case walks the reader through four major steps: 1) characterizing the CSS, 2) defining a baseline scenario, 3) developing a gray infrastructure control scenario, 4) developing green infrastructure alternatives, and 5) analyzing alternative gray/green CSO control scenarios.

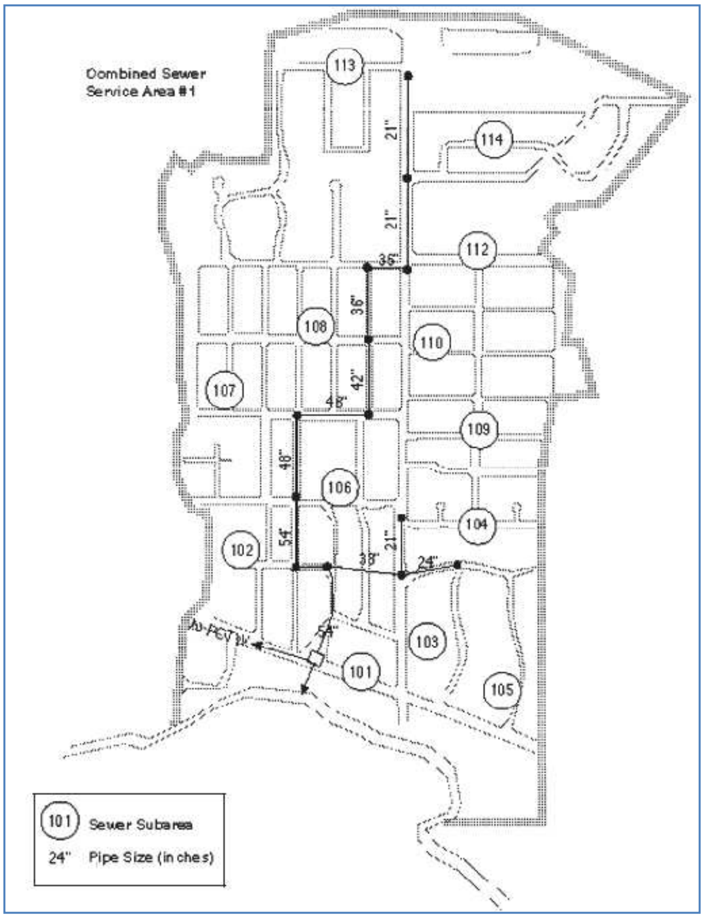


Figure 4-1. Hypothetical sewershed modeled in the case study.

This same theoretical system was used in the 1999 EPA publication "Combined Sewer Overflows - Guidance for Monitoring and Modeling" (EPA 832-B-99-002; http://www.epa.gov/npdes/pubs/sewer.pdf). Readers can refer to that report for a detailed discussion of how one selects, builds, and calibrates a CSS H&H model. It also contains information specific to the current case study - soil infiltration properties, land surface characteristics, the layout, size, and slope of the sewer pipes, and the average dry weather sanitary flows generated.

The original case study in the 1999 publication modeled the baseline condition of an existing overflow structure with no controls in place. This example will now be extended to consider both gray and green infrastructure approaches for reducing CSO frequency and volume. The H&H software used in this case study is the freely available EPA Storm Water Management Model v. 5 (SWMM5), although any of the other modeling packages listed in Chapter 3 could also be used.

Step 1: Characterize the System

Figure 4-1 is a map of a hypothetical CSS that covers a 500-acre service area. There is a diversion structure located at the bottom of the system that sends excess flows to a receiving stream. Larger systems can be comprised of several such sewersheds that might be tied into one or more interceptor lines with various overflow points before ending at a treatment works.

Figure 4-2 shows the SWMM5 representation of the sewershed. The service area is divided into 14 separate sub-areas (the polygon areas in the figure) that discharge both dry weather sanitary and wet weather runoff flow at different locations along the sewer network (the line segments in the figure). The boundaries of these sub-areas were primarily determined by the natural drainage contours of the land surface. They each contain different mixtures of land cover types (roofs, pavement, lawn areas, shrub, and forest). The percentage of each sub-area covered by impervious surfaces ranges from 17 to 75 percent and is displayed in color-coded fashion. The pervious portions of the sewershed consist of Group B soils (a moderately well-draining sandy loam). The CSS network contains pipes ranging in diameter from 21–54 inches. Their slopes vary from 0.7 to 5 percent. The total average dry weather sanitary flow is 1 million gallons per day (MGD).

A key component of any CSS model is the flow diversion (or regulator) device used to divert wet weather flow away from the main interceptor and discharge it directly into a watercourse to avoid surcharge and flooding of the CSS. There are several different types of regulators in common use. One example is the *transverse weir with orifice regulator* (Figure 4-3). Actual diversion structures can be considerably more complex than the one shown here. For this case study, the diversion structure is modeled using SWMM5's Flow Splitter element. The Splitter sends flows of up to 5 cfs (3 MGD or three times the average dry weather flow) to the sewage treatment plant through a two-foot diameter interceptor. Any excess flow above this is directly discharged to the receiving stream.

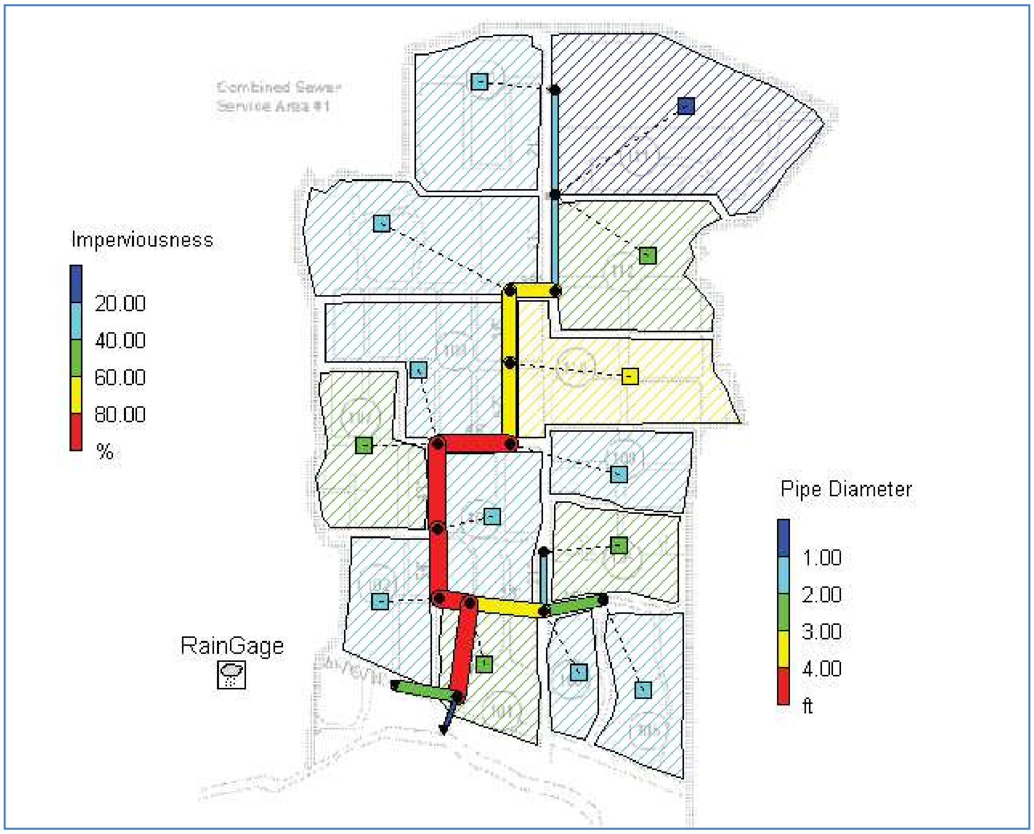


Figure 4-2. SWMM5 representation of the hypothetical case study CSS.

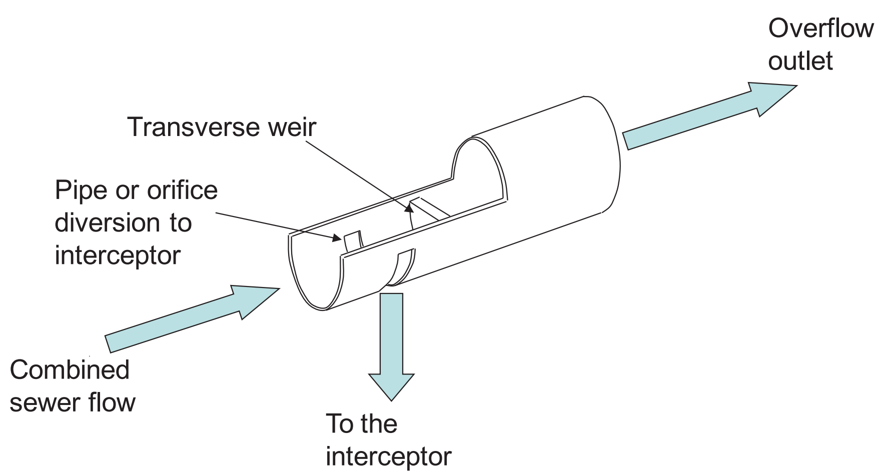


Figure 4-3. A typical transverse weir flow regulator.

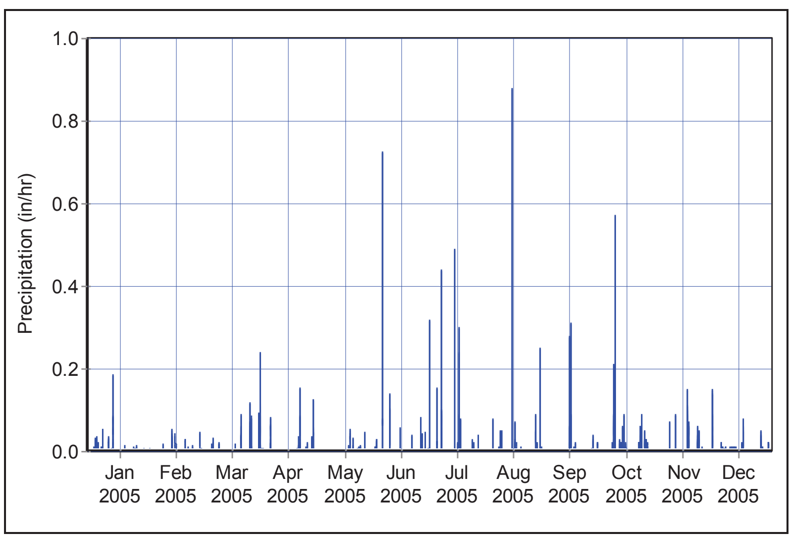
Step 2: Define a Baseline Scenario

The next step is to determine the frequency and magnitude of overflows under current baseline conditions with no CSO controls applied. To do this, the model was run with one year's worth of long-term hourly rainfall data at a nearby rain gage. This particular year was deemed to represent a typical year and serves as a reasonable compromise between running the model over the full historical rainfall record (which consumes a large amount of processing time) and using just a single "design storm" event (which fails to capture a meaningful range of storm magnitudes, durations and antecedent conditions).

The resulting time series of rainfall, interceptor flow, and CSO flow are shown in Figure 4-4. These figures were directly generated from the SWMM5 software. It appears that any rainfall above about 0.1 inches/hour is enough to trigger an overflow. The overall behavior of this baseline scenario is summarized in Table 4-1. The total volume values listed in the table came directly from SWMM5's Status Report listing. The number of days with overflows was determined by using SWMM5's statistics tool, which counts number of days when peak overflow from the regulator was above 0.01 cfs. Under the baseline scenario with no CSO controls there are 64 days with CSOs resulting in a discharge of 28 million gallons of untreated combined sewage in a typical year.

Table 4-1. CSS flow volumes for the case study area in a typical year.

Annual Statistic	
Dry Weather Inflow (MG)	386
Stormwater Inflow (MG)	70
Combined System Inflow (MG)	456
Treated Outflow (MG)	428
Untreated Overflow (MG)	28
Number of Days with Overflows	64



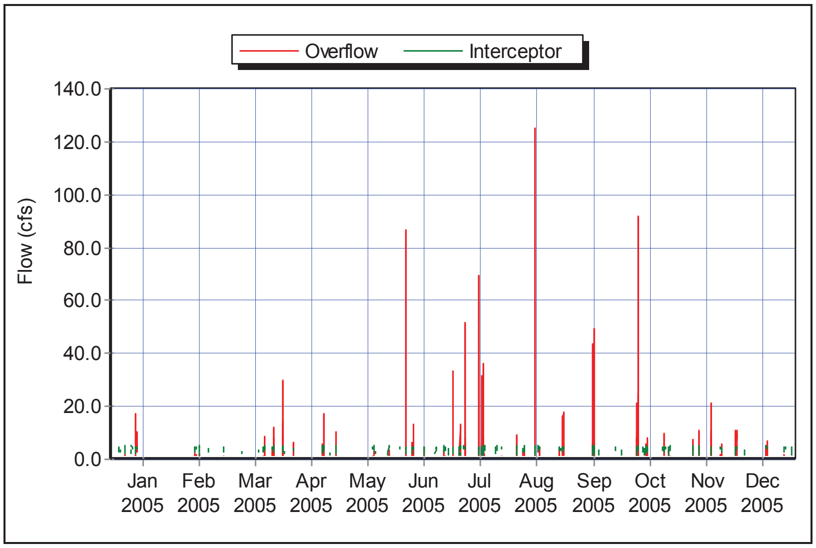


Figure 4-4. Precipitation, interceptor flow, and CSO flow for the baseline scenario.

Step 3: Develop a Gray Infrastructure CSO Control Scenario

Sewer separation, treatment plant expansion, in-line storage, and off-line storage/treatment are traditional approaches to controlling CSOs. These gray infrastructure alternatives all involve adding to, replacing or modifying the existing wastewater collection and treatment system to provide more capacity to handle existing wet weather flows in an environmentally protective manner.

This case study will next consider the effect that different amounts of off-line storage capacity would have in reducing the frequency and magnitude of CSOs. Off-line storage is one of the simplest and most commonly used CSO mitigation measures. Figure 4-5 is a conceptual drawing of how a storage facility works, accepting overflows from the CSO regulator and storing them until such time when the main interceptor once again has enough capacity to accept additional flow.

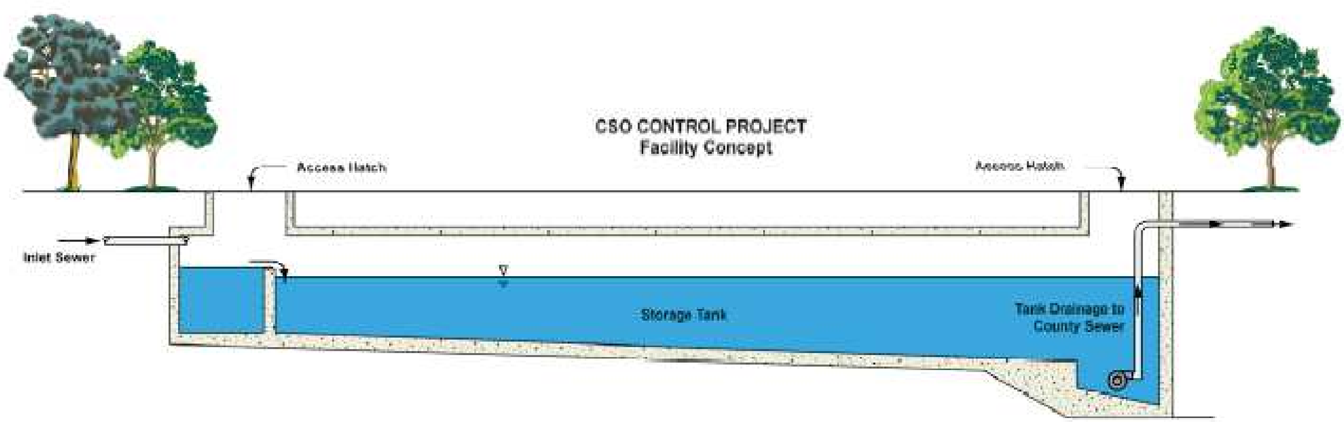


Figure 4-5. Conceptual drawing of a CSO storage facility.

Figure 4-6 shows how an off-line storage facility can be added into the SWMM5 model. The facility is represented here as a SWMM5 Storage Unit element. The diversion leg of the regulator serves as the inlet line to the facility. There are two outlet lines. One is a Weir element placed along the top rim of the unit to discharge any excess overflow from the facility to the CSO outfall. The second outlet line is a Pump element used to empty the contents of the storage unit when capacity becomes available in the interceptor to the treatment plant.

The storage unit is configured to be 10 feet high, 20 feet wide, with a length that can vary from 250–2500 ft., depending on the targeted level of CSO control. This provides 0.4–4 MG of storage depending on the length chosen. The pump used to dewater the unit does so at a constant flow of 3 cubic feet per second (cfs) when the flow in the interceptor drops below 2 cfs (so as not to exceed the 5 cfs capacity of the interceptor). Otherwise, the pump remains off. In the SWMM5 model, a Control Rule element is used to express this pumping policy.

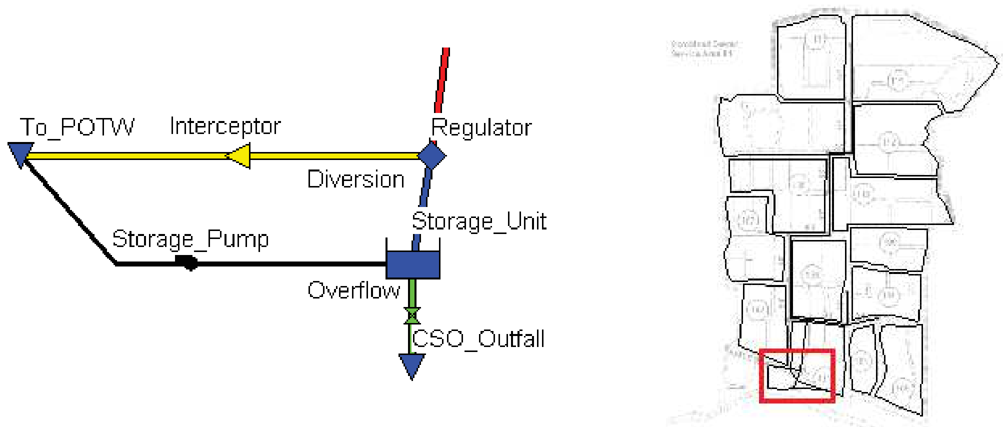


Figure 4-6. Detail of the case study model with CSO storage added.

The case study model can be run with varying levels of off-line CSO storage provided over the same year of rainfall (as was used for the baseline analysis). Figure 4-7 shows how the number and total volume of CSOs varies in this example with the amount of storage provided. Note how the curves flatten out beyond 2 MG of storage (producing four overflow days with a total CSO volume of 5 MG) indicating how additional increments of storage volume become less effective in reducing CSOs beyond this point.

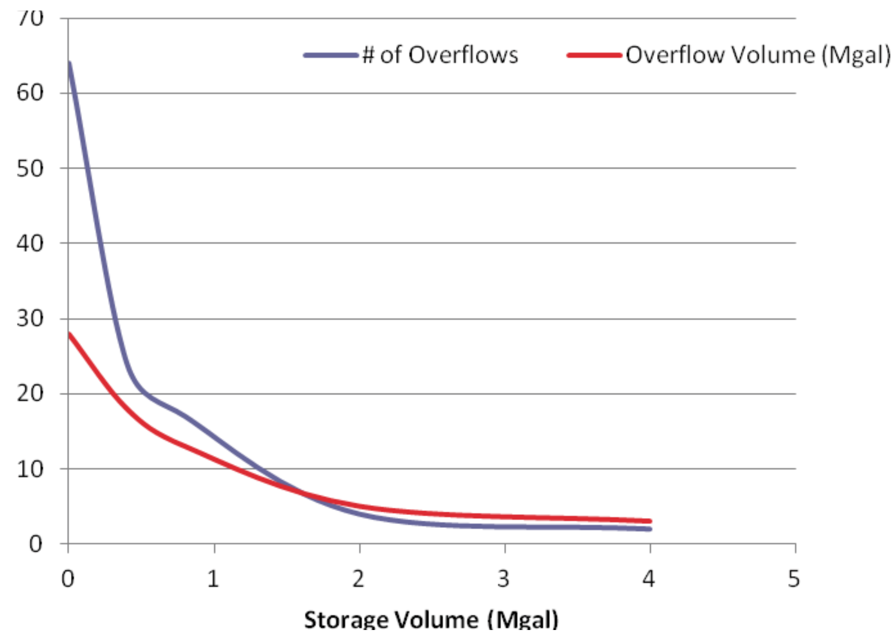


Figure 4-7. CSO frequency and volume with increasing amounts of off-line storage volume.

Step 4: Develop Green Infrastructure Alternatives

Although it is relatively straightforward to model gray infrastructure solutions because of the limited number of feasible alternatives and locations, analyzing the opportunities afforded by green infrastructure requires additional modeling considerations. Green infrastructure utilizes a variety of distributed practices deployed at many locations throughout a service area to reduce stormwater runoff at its source (see Chapter 1). Decisions regarding the type, number, location, sizing, and capture area of each control throughout the entire service area must somehow be conveyed to the H&H model. In addition, the model must be capable of estimating how much reduction in runoff results from utilizing these controls over a long-term sequence of rainfall events.

For planning purposes, it is acceptable to employ some level of aggregation and abstraction when modeling the numerous types and locations of green infrastructure controls that comprise a green solution. One simplified approach is to represent the combined effect of all green infrastructure controls within a particular sub-area by either reducing the amount of impervious area or by having some fraction of the impervious area's runoff be routed onto its pervious area (thus simulating the disconnection practice shown in Table 1-1). Although this method is easily applied, this method fails to account for the intricate dynamics between the rates of surface capture, surface infiltration, evapotranspiration, soil percolation, sub-surface storage, and native soil infiltration that characterize the hydrologic behavior of many green infrastructure controls.

Some H&H modeling packages (including SWMM5) now have the ability to model the hydrologic performance of green practices on an individual unit basis. Here is how one can use this feature to provide a more accurate way to model green infrastructure within a sewershed without having to explicitly represent each individual green infrastructure installation:

1. Select an appropriate sub-set of green infrastructure practices and establish a generic design template for each.
2. For each CSS model sub-area, determine the total amount of impervious area that will be treated by each generic green infrastructure design.
3. Add this information into the CSS model.
4. Run the green infrastructure-augmented CSS model with varying levels of gray control utilized to see the combined effect that a green/gray solution has on CSO frequency and volume.
5. Modify the choices made in step 2 and repeat steps 3 and 4 to see the effect that different green control scenarios have in reducing CSOs.

The key to this approach is recognizing that green infrastructure controls of the same design but different sizing will perform the same as long as their capture ratios (ratio of green infrastructure area to treated impervious area) are the same. This allows many otherwise geographically dispersed green infrastructure units within a sub-area to be treated as one large unit within the H&H model.

In applying this approach to our case study example, three types of generic green infrastructure controls were selected as most suitable for the conditions within the service area. These were permeable pavements (to capture street and parking lot runoff), street planters (to capture runoff from roofs and sidewalks in high-density areas), and rain gardens (to capture roof runoff from individual home lots). A template for designing each type of green infrastructure control on a per unit area basis was then established (see Table 4-2). Note that each control's Capture Ratio parameter allows one to determine its actual size once the amount of impervious area it treats is established.

Table 4-2. Design parameters for the generic green infrastructure controls used within the case study.

Parameter	Permeable Pavement	Street Planter	Rain Garden
Surface Layer			
Capture Ratio (percent)[1]	25	5	5
Ponding Depth (inches)	0	6	6
Soil / Pavement Layer			
Thickness (inches)	4	18	12
Porosity (percent)	11	50	50
Conductivity (in/hr)	100	10	10
Storage Layer			
Thickness (inches)	18	12	0
Porosity (percent)	43	43	0

[1]Ratio of green infrastructure control area to impervious area treated.

The next step is to perform a detailed analysis of the land surfaces and contours within each model sub-area to determine how much of its impervious area could feasibly be treated by a most suitable type of generic green infrastructure control. This assignment of green infrastructure practices to land areas was made for both publicly owned and privately owned land because in many cases it may be easier to implement a green infrastructure program on the former as compared to the latter. Recognizing this distinction results in two green scenarios to consider – public land only and public plus private.

The result of this suitability analysis, shown in Table 4-3, summarizes what percent of the impervious area in each modeled sub-area could be treated by each type of green infrastructure control on both publicly and privately owned land. As an example of how to interpret the numbers in the table, consider the permeable pavement entry for Sub-Area 101. The value of 10 means it was considered feasible to treat 10% of the total impervious area with permeable pavement applied to public land. Because the capture ratio of our generic permeable pavement design is 25%, this means that only 2.5% of the impervious area in Sub-Area 101 is actually replaced with permeable pavement. Summing together the various entries in the table reveals that public green infrastructure could be applied to 20% of the sewershed's impervious area. Another 15% could be treated with controls placed on private land.

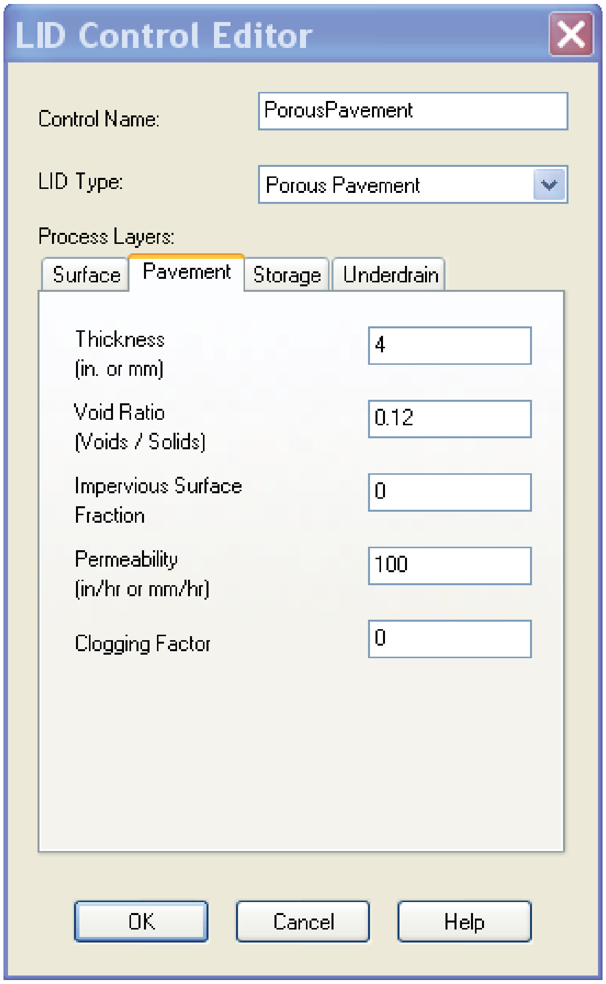
Table 4-3. Percentage of impervious area treatable by different green infrastructure controls.

Sub-Area	Percent Impervious	Public Permeable Pavement	Public Street Planters	Private Rain Gardens
101	55	10	10	15
102	35	10	5	15
103	28	10	5	15
104	55	10	10	20
105	22	10	5	15
106	31	10	5	15
107	46	10	10	15
108	38	10	5	15
109	35	10	5	15
110	75	20	20	10
111	17	0	5	25
112	59	15	10	10
113	39	10	5	15
114	29	10	5	15

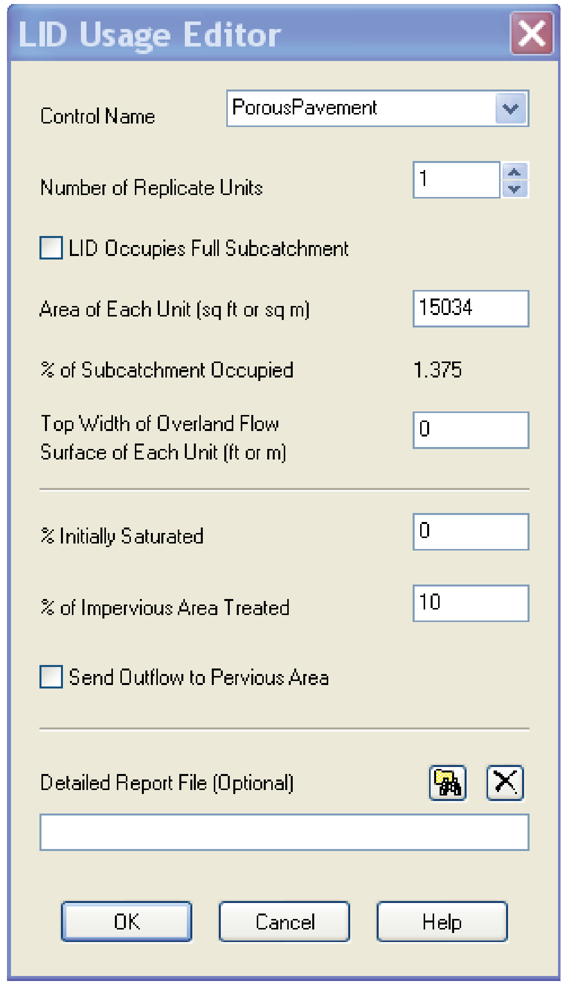
Assembling a "green infrastructure treatability" table like this is not a simple task. It would likely require many hours spent on GIS analysis of aerial and contour maps along with walking tours of the service area. However once compiled in this fashion, it is then relatively straightforward to use this information along with the generic green infrastructure control designs to populate the H&H model with a green infrastructure control plan, and then analyze the impact on controlling CSOs.

Step 5: Analyze Gray/Green CSO Control Scenarios

The case study SWMM5 model with the CSO storage unit can be expanded to include green infrastructure by first defining within the model the three generic green infrastructure control templates listed in Table 4-2. Figure 4-8a shows the SWMM5 dialog used to do this for the permeable pavement option. Note that this generic design applies to all permeable pavement installed within the sewershed, but does not specify the actual amount (or area) used. That is done for each sub-area using the LID Usage editor shown in Figure 4-8b. Here one specifies the actual number of square feet of permeable pavement applied and the amount of impervious area whose runoff it captures and treats using the information contained in Table 4-3. A similar sequence of steps (defining the generic design first and then defining its usage in each model sub-area) was used in this example for street planters placed on public land.



(a)



(b)

Figure 4-8. SWMM5's LID control editor (a) and LID usage editor (b).

At this point, the model contains both a gray CSO control option (the storage unit) and a green option (permeable pavement and street planters applied to public land). As was done before for the gray-only option, the model can be run for a series of different storage unit sizes to see what the combined effect of gray and public green control would have on the number and volume of combined sewerage overflows during a typical year. After these runs, the model can be updated to add an additional increment of green infrastructure – rain gardens applied to private land. Multiple runs at different storage unit sizes are once again made to determine the effect of adding more green infrastructure to the mix. The overall results of these model runs are summarized in Figure 4-9 for CSO frequency and in Figure 4-10 for CSO volume.

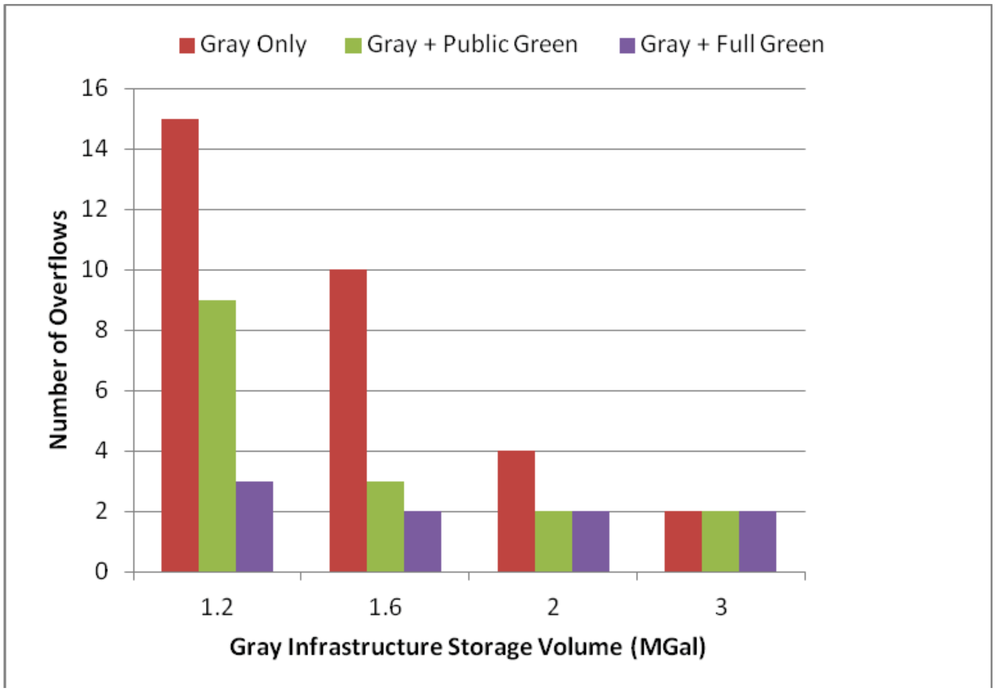


Figure 4-9. Number of overflows with varying gray infrastructure storage volumes with different gray and green CSO controls.

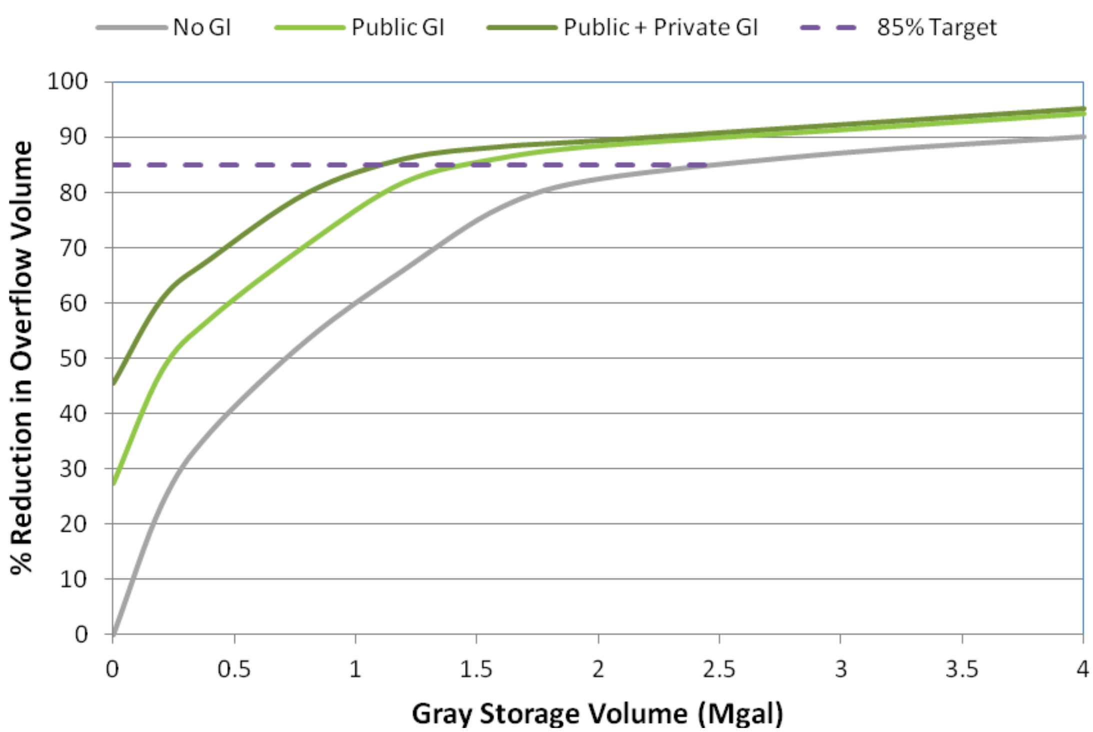


Figure 4-10. Percent reduction in overflow volume using gray and green CSO controls.

Model Outputs

For the purposes of CSO decision-making, the final output of interest from the hydrological component of an H&H model is the volume and timing of water flowing into the CSS through storm drains. Linking planned green infrastructure control measures to their effects is accomplished by quantifying the volume and timing of stormwater runoff entering the CSS as predicted by the hydrology model, and the overflow volume and frequency discharged from the CSS as predicted by the hydraulic model.

Several important results in this particular case study are worth noting. First, for this particular model, green infrastructure appears to have had a greater impact in reducing CSO volumes than CSO frequencies. This follows from the fact that the green infrastructure controls were only designed to treat a limited fraction of the sewershed's impervious area (20–35%) and that the green infrastructure system or practices have a fixed capacity to accept stormwater runoff. This capacity can be exceeded during large storm events or situations where successive storms saturate green infrastructure practices, so overflow events may still result. This example illustrates that in most cases some combination of green infrastructure and gray infrastructure is necessary to reduce or eliminate overflows.

A second result to emphasize is that an all-green solution (i.e., no gray infrastructure storage provided and both public plus private green infrastructure) only treats a fraction (e.g., 35%) of the total impervious area. Yet, it can still provide some significant reductions in CSOs. Overflow frequency can be reduced by 30%, and overflow volumes by 45%.

Finally, green solutions may also help reduce the size and cost of the gray solution needed to meet higher CSO control targets. For example, meeting an overflow volume reduction target of 85% (5 MG) would require a 2.5 MG storage unit without any green infrastructure. This system can be reduced to store 1.3 MG if public green infrastructure controls are used and down to 1 MG (a 60% reduction) if both public and private controls are utilized based on an estimated adoption rate and coverage. Reduced volume of stormwater entering the waste water treatment plant may also translate to additional cost savings, or avoid additional capital costs if expanded treatment capacity would be needed to treat additional stored flows. Here we find that utilizing a dynamic H&H model can help decision makers scope, plan and prioritize a variety of different control options.

Chapter 5: Conclusion

Controlling CSOs is an important element of restoring and protecting water resources in many metropolitan areas. CSO controls often involve a significant financial investment for both sewer districts and municipalities. Today, many communities are investigating the potential for green infrastructure control measures as an element of their overall CSO control strategy. The green infrastructure practices described in this document can help reduce flows going into the sewer system, which may in turn reduce capital and operational costs. Green infrastructure investments also serve as amenities for neighborhoods, providing both social and economic benefits.

Green practices must be planned and scheduled, and implementation tracked and evaluated, similar in concept to how gray infrastructure projects are planned and tracked. In turn green infrastructure should be planned hand-in-hand with gray infrastructure, as these components of an overall CSO control plan are strongly inter-related.

The level of green infrastructure that can realistically be achieved in a given catchment should take into account key sewershed characteristics, such as land use, soil types, topography and the expected degree of buy-in from local stakeholders. Care must be taken in projecting green infrastructure implementation based on these varying factors, such that model outputs provide a strong, realistic basis for future decision-making around green infrastructure investments.

This resource has shown that H&H models are particularly useful tools to help evaluate combinations of gray and green infrastructure. H&H models can also help assess whether planned level of technologies will meet established CSO control objectives. While larger green infrastructure practices that fulfill a storage function can be modeled in the hydraulic component of an H&H model, smaller green infrastructure practices are typically modeled in the hydrologic component. Several techniques can make the model reflect both reduction of flow into the system, as well as extending the time of concentration. The detailed case study provided in Chapter 4 illustrates how changing hydrology parameters within a model (e.g., the conversion of impervious area to pervious area, conversion of directly connected impervious areas to disconnected impervious areas, and modifying depression storage value parameters) can all be used to account for the effects of green infrastructure.

Using these techniques, models such as EPA's SWMM Version 5.0 can help represent the hydrologic response of a variety of green infrastructure practices. Use of this model or others like it can help simplify and standardize the impacts of green infrastructure practices within combined sewer systems.

For more in depth information on integrating green infrastructure into CSO Long Term Control Plans (LTCPs), see: Review of Green Infrastructure (GI) in CSO Long Term Control Plans: A Training Tool produced by EPA Region 5 and EPA's Office of Enforcement and Compliance Assurance (OECA). This resource provides additional insight into how to assess the practicality and likely performance of green infrastructure measures within CSO Long Term Control Plans. The document is available at: http://water.epa.gov/infrastructure/greeninfrastructure/gi_regulatory.cfm#csoplan

FURTHER RESOURCES

Greening CSO Plans is part of a series of technical resources for integrating green infrastructure into permitting and enforcement actions: http://water.epa.gov/infrastructure/greeninfrastructure/gi_regulatory.cfm

For additional resources on green infrastructure, access EPA's Green Infrastructure web page at: http://water.epa.gov/infrastructure/greeninfrastructure

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