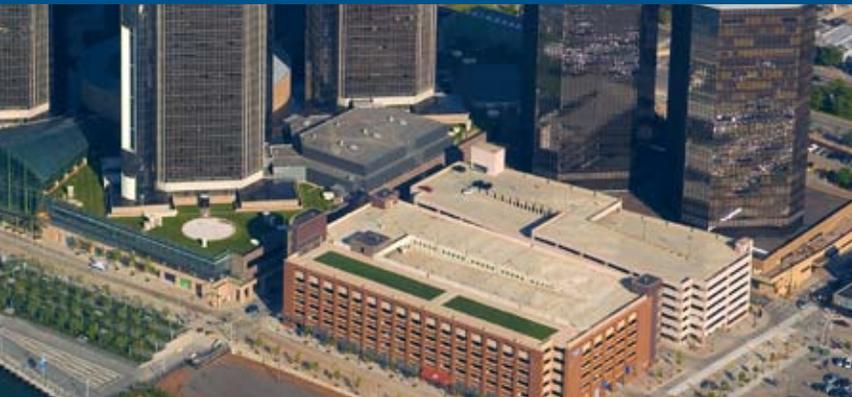


# Alternative Rouge River CSO Control Program Executive Summary

December 15, 2009



A revised approach to pollution control that controls stormwater runoff before it gets into the sewer system and “right sizes” Detroit’s infrastructure investment



# Introduction

When the national financial collapse began in 2008, Detroit’s Rouge River Combined Sewer Overflow (CSO) Control Program was well underway. More than \$400 million had been invested in new infrastructure to capture and treat wet weather discharges from the sewer system by the end of 2008 (Table 1) resulting in significant reductions in CSO discharges.

As the economic crisis worsened and the major auto companies that form the economic backbone of the City faced bankruptcy, it became clear that Detroit residents lacked the resources and revenue to complete the CSO program as originally proposed in 1996. In fact, the 28.9% rate of unemployment in the City of Detroit led the nation (July 2009).

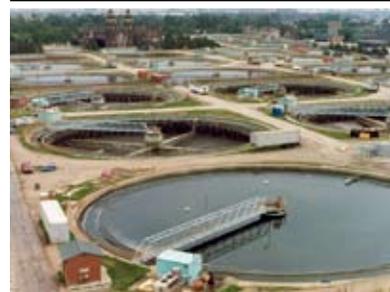
The Detroit Water and Sewerage Department’s (DWSD) most immediate problem was the huge cost associated with construction of two major capital improvement projects and the resulting impact on rates to repay bonds and interest. These included \$880 million for the new Upper Rouge CSO Tunnel (URT) and \$400 million for a new outfall at the wastewater treatment plant (WWTP). In accordance with a rate settlement agreement sanctioned by the federal court, Detroit is responsible for 83% of the URT costs and about half of the outfall project costs.

Faced with rising unemployment, shrinking household income, continued loss of population and huge revenue shortfalls, the City was compelled to terminate these two projects and attempt to develop a less costly, implementable alternative. We thank the State of Michigan for cooperating in our efforts to cancel the contracts and develop a revised CSO Control Program.

This document summarizes the results of DWSD’s evaluation of CSO control alternatives and describes an implementable alternative for the Rouge River CSO Control Program that Detroit is prepared to undertake. We believe this proposal is mutually beneficial for the State of Michigan and the City of Detroit and its rate payers. The proposal represents a creative and viable approach for addressing a complex problem.

**Table 1. DWSD Investment in Rouge River CSO Projects**

<b>Rouge River CSO Projects built or under construction by 2008:</b>	
Hubbell-Southfield Basin (1995)	\$58.9 M
Puritan-Fenkell Basin (1996)	\$18.1 M
7 Mile Basin (1996)	\$14.9 M
In System Storage Gates (1996)	\$3.4 M
WWTP Expansion (2000)	\$50.6 M
Baby Creek S&D Facility (2003)	\$76.1 M
Oakwood Basin & Pump Station (2007)	\$168.7 M
Oakwood Sewer Improvements #1 (2008)	\$15.0 M
<b>Total</b>	<b>\$406 M</b>
<b>Rouge River capital improvement projects that began construction in 2009:</b>	
Upper Rouge CSO Storage Tunnel (terminated)	\$880 M
New WWTP Outfall (DRO-2) (terminated)	\$400 M
Segment 2 of Oakwood Sewers	\$12 M
<b>Total</b>	<b>\$1,292 M</b>
<b>Grand Total</b>	<b>\$1,698 M</b>



WWTP Expansion



Hubbell-Southfield Basin

# Approach

The Southeast Michigan Council of Governments (SEMCOG) has documented that the current economic conditions will be long lasting. In fact, even after the economic recovery occurs, the region is still expected to have fewer jobs in 2025 than in 2000. Between 1970 and 2000, Detroit's population declined by 560,000 (37%). In the last 10 years, it declined by another 124,000. By 2030, Detroit's population is expected to decline by another 119,000.

In the area of the City affected by the URT project, 12% of the parcels are already vacant, without any structures. An additional 6% are abandoned, but contain structures. Based on the forecasted population decline, the amount of vacant land in the tributary area will grow significantly.

Therefore, continuing with a "Business as Usual" approach to sewage collection and treatment systems would be irresponsible and imprudent. Instead, Detroit stepped back to take a more holistic view of its current circumstances to come up with a creative, implementable plan.

The study was tailored to address the issues listed in the April 30, 2009, letter from MDEQ Director, Steve Chester, to DWSD Director, Pamela Turner, which articulated the expectations and outcomes that need to be considered. Detroit's study focused on identifying and pursuing innovative, low-cost, environmentally-beneficial solutions to water pollution problems to supplement reconfigured versions of more typical CSO capital improvement projects.

# Objectives

Against the backdrop of staggering unemployment and potential insolvency, the evaluation took a holistic approach to considering multiple outcomes representing various needs. Instead of proposing continued deferral of Rouge River CSO control projects, Detroit's CSO Program has been restructured to meet the following outcomes:

- Initiate implementation immediately to ensure that environmental and water quality benefits are realized as soon as possible.
- Establish a more affordable program that is within Detroit's current financial capability, thus avoiding long delays tied to the City's eventual economic recovery.
- Support the City's financial recovery by acknowledging the demands and limited resources of Detroit's ratepayers. These ratepayers face escalating costs for other essential utilities and infrastructure services such as water, electricity, gas, etc. As a practical matter, the sustainability of the sewer system is dependent on retaining paying customers, so the customers must be able to actually pay for the costs of the CSO projects.
- Design a program that addresses multiple objectives embraced by Federal and State agencies.



*Rouge River*

# Overview of Recommended CSO Program

DWSD's Alternative Rouge River CSO Control Program is designed to restore water quality and protect public health while staying within its financial means by controlling rate increases that will be needed to pay for new projects. The program encompasses a 25-year phased plan that focuses on "Green Infrastructure" solutions along with "right-sized" conventional CSO control facilities ("Grey" projects).

The Green Infrastructure improvements are designed to keep stormwater runoff out of the sewer system as much as possible. This will reduce combined sewer overflow volumes by an estimated 10% to 20%. This will enable the City to utilize smaller, more cost-effective Grey CSO facilities to store and treat the stormwater that gets into the sewers.

The Green and Grey approach offers many advantages:

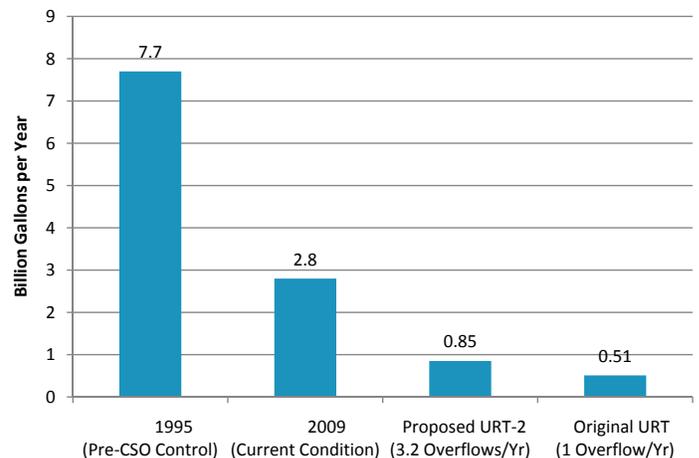
- Lower capital and operating costs. Green projects are a fraction of the cost of traditional Grey projects (basins, tunnels, and pump stations).
- Immediate benefit. Green projects can be done NOW without long delays for planning, design, site acquisition, financing and construction so the beneficial impact is immediate.
- "Right-sized" infrastructure. Using Green Infrastructure solutions means that the City's downsizing can be reflected in a smaller, more manageable sewer system.
- Multiple benefits. Green solutions provide benefits that transcend a typical sewer project like carbon reduction, improved aesthetics, and enhanced property values.

The DWSD CSO Plan focuses on maximizing Green projects in the immediate near term. When coupled with the proposed Grey CSO control facilities, the City will control its wet weather discharges as part of the basin-wide effort to restore the Rouge River.

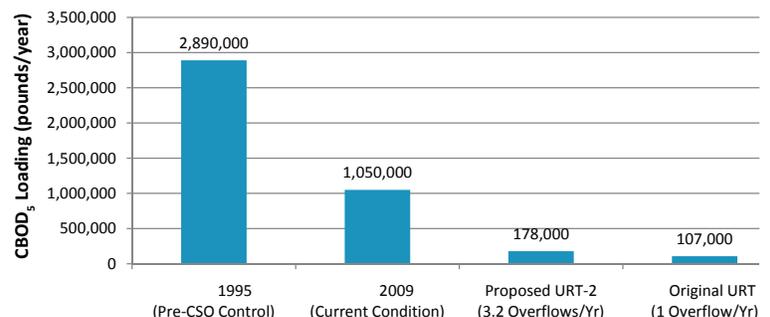
# Expected Outcomes/ Environmental Impacts and Benefits

- Because of DWSD's prior investment in CSO control on the Rouge River (>\$400 million), untreated CSO discharges have already been reduced by 64% from the 1995 volume (from 7.7 billion gallons/year to 2.8 billion gallons/year) as shown in Figure 1. Pollutant loads have similarly been reduced by 64% as shown in Figure 2.
- Massive demographic changes have occurred, and will continue to take place, in the tributary area since the project was first envisioned. These are summarized in Figure 3.

**Figure 1. Annual Untreated Overflow Volume from Detroit CSOs to Rouge River**



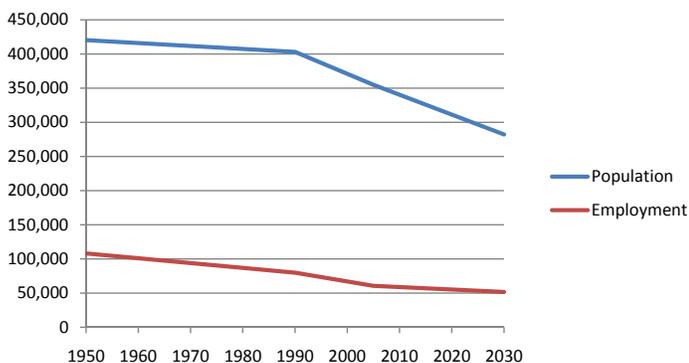
**Figure 2. Annual Pollutant Loading to the Rouge River from Detroit CSOs**





- Green Infrastructure projects will reduce stormwater runoff into the sewer system by at least 10% to 20%. But the reductions could be even greater, and discussions are underway within Detroit to pursue additional opportunities beyond those identified in this report. If successful, these could further reduce stormwater flows into the sewer system.
- Early reductions in CSO discharge volume will be achieved from implementing the Green Infrastructure program, with corresponding improvements in Rouge River water quality.
- USEPA explicitly advocates the incorporation of Green Infrastructure into CSO programs and projects. These types of activities are being implemented in many cities across the nation as part of their CSO Control Programs. The State of Michigan has been a strong advocate for advancing “green practices” in many areas including energy production, land use planning and low impact development.
- Incorporating Green Infrastructure projects into the CSO program helps ensure that these measures will receive funding and be implemented as a component of the sewer system Capital Improvement Plan (CIP).
- Green Infrastructure provides direct benefits for CSO control and a means to “right size” the system to reflect current and future population needs.

**Figure 3. Population and Employment within Tributary Area**



- There is a real possibility that Green Infrastructure projects may create carbon credits that provide additional incentives to expedite implementation.
- Performance predictions for the proposed new conventional CSO projects are based on computer model simulations that have historically over predicted overflow volumes and frequencies. The recommended projects may actually perform much better than predicted by the computer model simulations included in this study.
- As indicated in Table 2 on the following page, the environmental outcomes of the recommended CSO program are very similar to what was previously approved by the State of Michigan (the CSO Program as of 2008), but with a capital cost savings of nearly \$160 million per year.
- The northernmost 1.5 miles of the Rouge River will be restored to a “CSO-free” condition quickly, because the proposed schedule calls for new CSO controls to be initiated at the Pembroke, 7 Mile and Glenhurst outfalls in the initial phase of the recommended program.





Table 2 shows that the untreated CSO volume and pollutant loading from both the old and new CSO tunnels are remarkably similar. As a result, the predicted in-stream dissolved oxygen (DO) and in-stream bacteria levels during wet weather periods are also quite similar as shown in Figures 4 and 5. With respect to DO, the model predicts that compliance with the 5.0 mg/l Water Quality Standard

will be achieved by either facility for all but a few hours each year. The bacteria Water Quality Standard is expected to be exceeded during most, if not all, wet weather events due to sources other than CSO discharges.

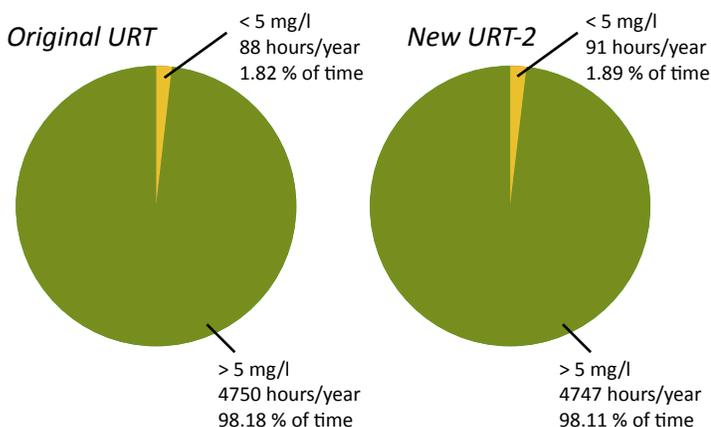
**Table 2. Comparison of CSO Program Results for 2008 Original URT and 2009 Proposed URT-2**

	2008 CSO Program Results for Original URT	2009 CSO Program Results for Proposed URT-2
Overflow Frequency	1 per year	3.2 per year
Untreated CSO Volume <sup>1</sup>	510,000 gallons/year	850,000 gallons/year
Pollutant Load (lbs CBOD <sub>5</sub> ) <sup>1</sup>	107,000	178,000
Dissolved Oxygen Compliance (> 5.0 mg/l) <sup>2</sup>	98.18% of time	98.11% of time
Bacteria Compliance (< 200 Fecal Coli) <sup>2</sup>	0.87%	0.87%
Capital Cost	\$1,342 million (over 7 years)	\$814 million (over 25 years)
Average Annual Cost	\$192 million/year	\$33 million/year

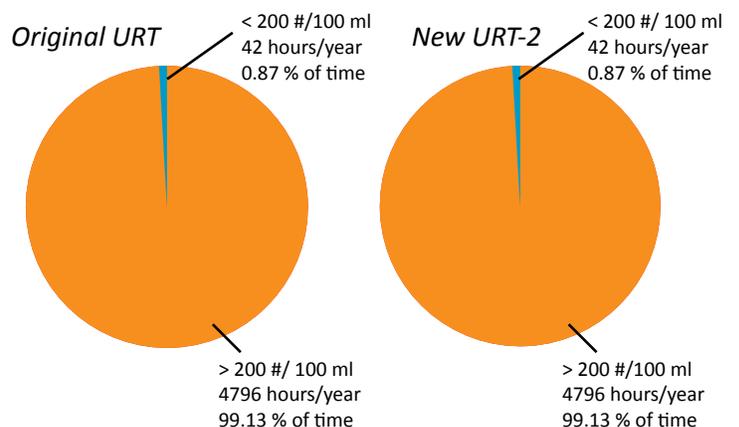
<sup>1</sup>The volume and pollutant load values for the URT-2 do not include green infrastructure components. It is estimated that green infrastructure will reduce volume by 10% to 20%, with a corresponding decrease in pollutant loading.

<sup>2</sup>Compliance data is based on computer simulations of in-stream water quality during wet weather periods.

**Figure 4. Main Branch Rouge River Simulated DO concentrations during Wet Weather Periods vs. Water Quality Standard (5.0 mg/l)**



**Figure 5. Main Branch Rouge River Simulated Bacteria levels during Wet Weather Periods vs. Fecal Coliform target level (200/100 ml)**



# Proposed Projects

DWSD's recommended CSO program for the Rouge River includes both Green and Grey projects.

## Recommended Green Infrastructure projects

1. Disconnect residential and municipal downspouts.
2. Demolish and remove vacant structures and replace with pervious land cover.
3. Use bioswales and tree trenches along roadways and parking lots to intercept runoff and reduce stormwater inputs.
4. Plant trees for uptake and evapotranspiration along roadways and open spaces.
5. Implement activities on municipally-owned properties, focusing on managing stormwater runoff in under-utilized parks.

It is anticipated that the Green Infrastructure projects will be implemented as a cooperative endeavor with multiple City agencies and departments, as well as private and non-profit stakeholders. A \$50 million budget has been established to fund Green Infrastructure projects from sewer revenues as an integral component of the CSO Control Program. For the first 10 years (2010 – 2019), the recommended budget for Green projects as part of DWSD's sewer system Capital Improvement Program (CIP) is \$3 million/year, plus an additional \$2 million/year for the following 10 years (2020 – 2029).



*Rain Garden*



*Parking Lot Bioswale*



*Downspout Disconnection*



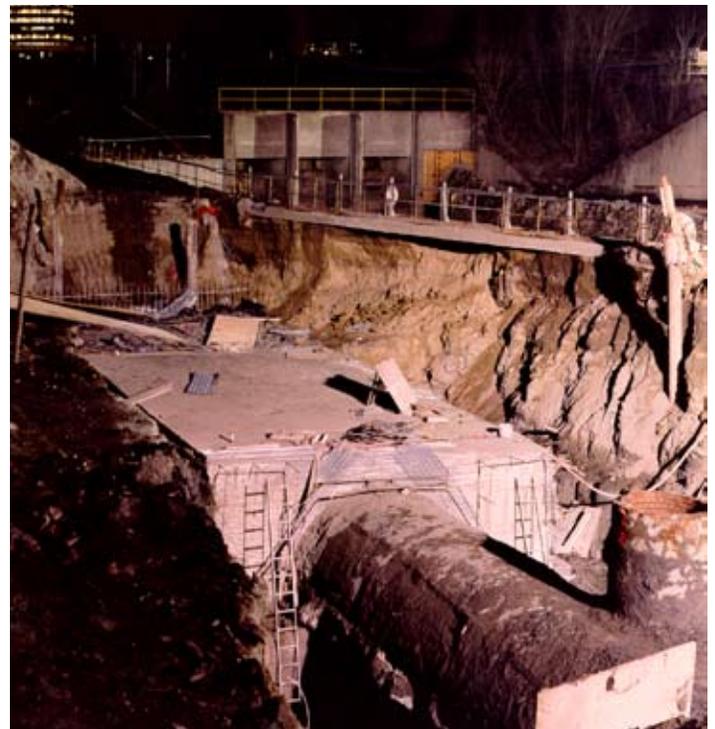
*Tree Planting*

## Recommended conventional (Grey) CSO control projects

In addition to completing the Oakwood CSO Basin and Pump Station, DWSD proposes to undertake the following new CSO control projects within the Rouge River Watershed as shown in Figure 6:

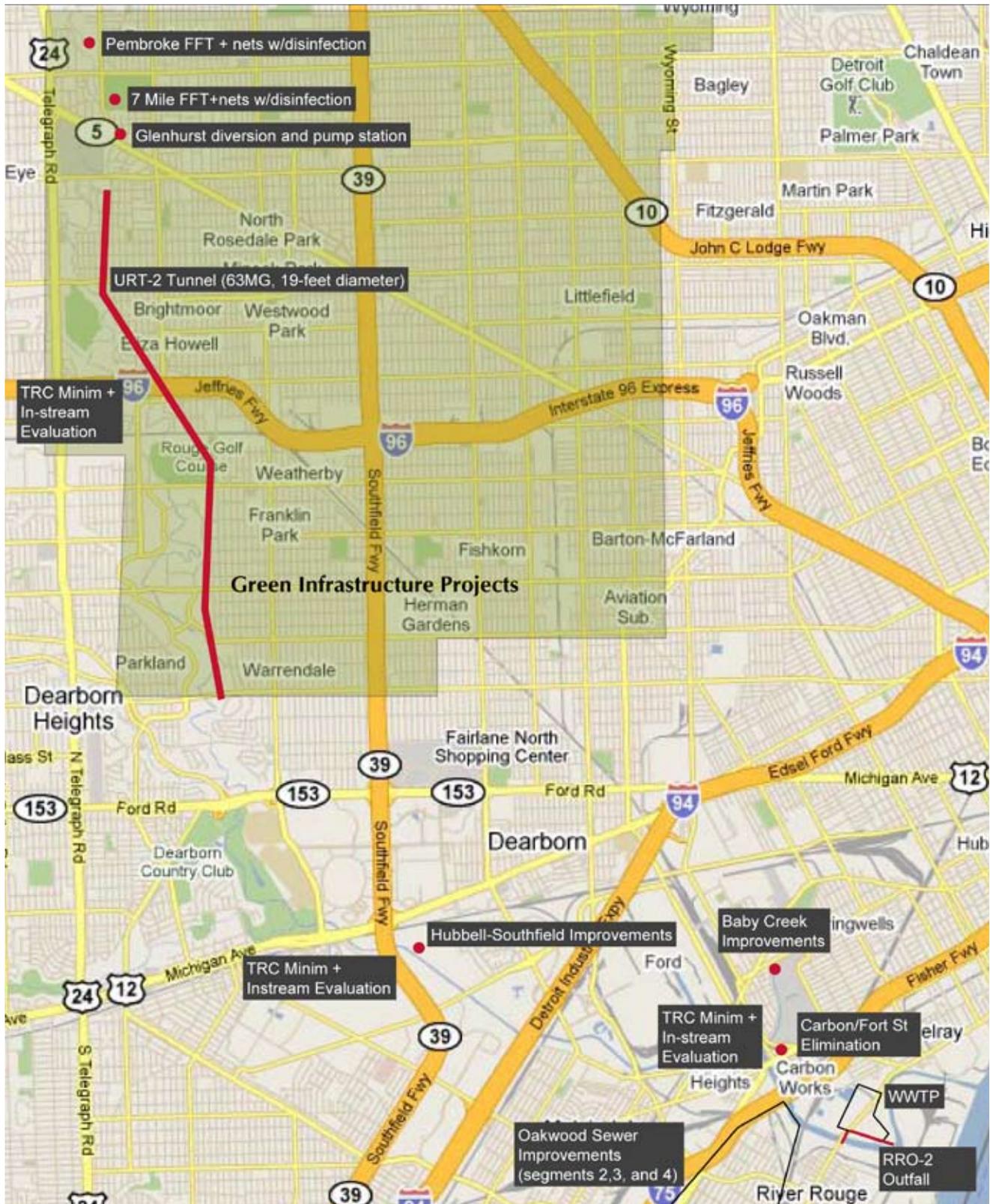
1. Complete the Oakwood District Sewer Improvement Program (three construction contracts totaling \$59 million).
2. Install remedial improvements at the Baby Creek Screening and Disinfection (S&D) Facility including disinfection feed system renovations, new mechanical mixers, and emergency bypass channel (\$3 million).
3. Complete the Total Residual Chlorine Minimization and In-Stream Assessment program for three Rouge River CSO Control Facilities (\$1 million).
4. Initiate improvements at the Hubbell-Southfield CSO Basin to maintain the operational effectiveness of that facility (\$2 million).
5. Modify two Lower Rouge Outfalls to eliminate existing CSO discharges (\$1 million):
  - Carbon Outfall elimination
  - Fort St. East Outfall diversion to Oakwood Basin
6. Eliminate the Glenhurst Outfall by constructing flow control devices and a new pump station to direct this flow to the Oakwood Northwest Interceptor (\$3 million).
7. Construct two new Pilot Projects to demonstrate the effectiveness of First Flush capture tanks in conjunction with disposable nets and innovative upstream disinfection injection systems at both the 7 Mile East and Pembroke outfalls (\$41 million).
8. Re-invest in existing CSO control facilities on a phased basis over the 25-year program to ensure their continued structural integrity and operational viability as they approach their design life expectancies (\$40 million).
9. Construct a new CSO storage tunnel (URT-2); a 5.5-mile long, 19-foot diameter; 63-MG capacity tunnel to control 14 CSOs between Warren Avenue and McNichols; plus associated drop shafts and outfall modifications, and a 35-mgd pump station to dewater the captured flow to the wastewater treatment plant after the storm event (\$484 million).
10. Upgrade the wastewater treatment plant by constructing a new Rouge River Outfall (RRO-2) with the capability to chlorinate and dechlorinate primary effluent to eliminate the existing undisinfected Rouge River Outfall (RRO-1). This project will include improvements at the wastewater treatment plant to provide flow control including gates, regulators, hydraulic structures, and instrumentation and control, plus a new outfall conduit (\$130 million).

The total construction cost for these recommended conventional CSO control facilities is \$764 million (2009 dollars).



*CSO Facility Under Construction*

Figure 6. Recommended CSO Control Program Projects



# Phased Implementation

Current economic forecasts indicate that Detroit’s financial problems may persist for many years, and this could be problematic as DWSD attempts to complete the CSO program. To ensure that the control program is fiscally feasible, DWSD needs to segment its CSO program into five, 5-year phases as shown in Figure 7. This will spread out the cost and mitigate the impact on ratepayers.

Segmenting also allows DWSD to undertake other needed improvements within the sewer system. This includes continued expenditures at the wastewater treatment plant to maintain compliance with NPDES permit limits, and re-investment in existing CSO facilities, many of which will approach or surpass their expected design life in the near future.

EPA’s financial hardship criteria are expected to be exceeded in Detroit for the foreseeable future due to the continued economic decline that has been forecast. This is reflected in a continued decline in household income levels and compounded by increases in the cost of various utility services. These factors make it essential that the recommended CSO control program be implemented gradually over an extended period of time. DWSD will re-examine the CSO program at five-year intervals to assess its progress and to confirm the ability of the system to incur the program costs. If necessary, schedule adjustments and/or program modifications can then be incorporated based on actual conditions.

Unlike any time in our history, there is a great deal of uncertainty regarding several issues that could have profound effects on the optimal path for this project. These include the “bottoming out” of the economic slide, the

rate of recovery in the City, the financial solvency of the City, and the rate at which existing flows can be removed from the system. Therefore, it is critical to plan for possible mid-course corrections based on how these various issues unfold.

**Figure 7. Proposed Project Phases by Five-year Increments**

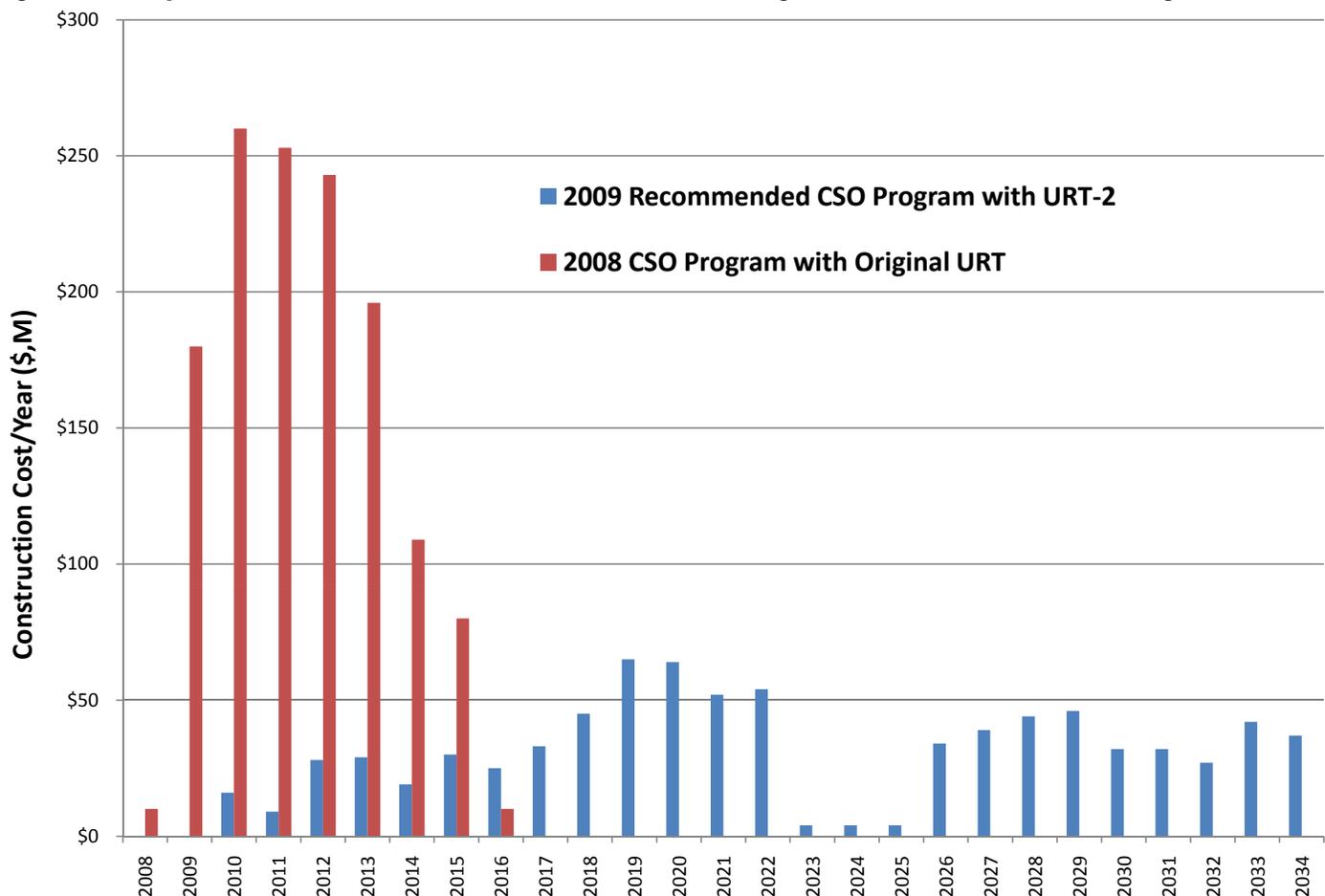
<b>Phase I: 2010-2014 = \$101M</b>	
Oakwood Sewer Segments 2, 3 (\$44 M)	2010-2011
Baby Creek Remedial Improvements (\$3 M)	2010
7 Mile Pilot Project (FFT & nets, NaOCl) (\$17 M)	2012-2014
Pembroke First Flush Tank (\$15 M)	2013-2014
Glenhurst Outfall Elimination (\$3 M)	2014
Carbon/Fort St. Outfall Elimination (\$1 M)	2010
Hubbell-Southfield Re-investment (\$2 M)	2011
TRC Minimization & In-Stream Evaluations (\$1 M)	2010
Green Infrastructure Phase I (\$15 M)	2010-2014
<b>Phase II: 2015-2019 = \$218M</b>	
Oakwood Sewers Segment 4 (\$15 M)	2015-2016
Pembroke Outfall Nets & NaOCl (\$9 M)	2017
WWTP Outfall Gates/I&C (\$30 M)	2015-2016
Re-investment in Existing Facilities (\$10 M)	2015-2020
URT-2 South Tunnel Segment (\$139 M)	2017-2020
Green Infrastructure Phase II (\$15 M)	2015-2019
<b>Phase III: 2020-2024 = \$158M</b>	
URT-2 S. Tunnel Drop Shafts & Near Surf (\$83 M)	2019-2022
URT-2 35 MGD Pump Station (\$55 M)	2021-2022
Re-investment in Existing Facilities (\$10 M)	2019-2024
Green Infrastructure Phase III (\$10 M)	2020-2024
<b>Phase IV: 2025-2029 = \$227M</b>	
URT-2 North Tunnel Segment (\$133 M)	2026-2029
URT-2 N Tunnel Drop Shafts & Near Surf (\$74 M)	2029-2031
Re-investment in Existing Facilities (\$10 M)	2025-2029
Green Infrastructure Phase IV (\$10 M)	2025-2029
<b>Phase V: 2030-2034 = \$110M</b>	
WWTP Outfall Conduit & Cl <sub>2</sub> +SO <sub>2</sub> (\$100 M)	2032-2034
Re-investment in Existing Facilities (\$10 M)	2030-2034

# Financial Commitments/ Affordability

The new DWSD CSO Control Program encompasses \$814 million in new spending for CSO controls on the Rouge River. This includes a \$50 million investment in Green projects starting in 2010 in addition to \$764 million for conventional Grey CSO control facilities. By spreading the cost of the program over 25 years as shown in Figure 8, the average yearly new debt will be about \$33 million which is expected to be a manageable level of spending for DWSD. By contrast, the previously approved

plan would have generated new debt averaging more than \$190 million per year. The CSO plan expenditures will be leveraged as much as possible by taking advantage of low interest loans, grants, support from foundations, and private parties (e.g. utilities supporting Green projects in exchange for carbon credits).

**Figure 8. Comparison of Construction Cost Per Year of 2008 Original Tunnel and 2009 CSO Program**



# Conclusion/ Next Steps

We thank the State of Michigan for cooperating in the termination of the construction contracts for the original URT and the DRO-2 outfall, and for recognizing the necessity and potential benefits of project redesign.

The City has opted to press forward instead of postponing its CSO projects until economic conditions sufficiently improve. The holistic review of relevant circumstances and desired outcomes led us to reduce the amount of “bricks and mortar” that would be added to a system in need of right sizing to reflect new realities. But, opportunities for major benefits beyond addressing CSOs are available as a result of Detroit’s commitment to pursue Green Infrastructure and to institutionalize this by funding implementation as part of DWSD’s ongoing Capital Improvement Program.

We view this proposal as a mutually-beneficial opportunity for the State and City to embrace creative approaches to confronting the challenges before us.

Upon receipt of State approval, DWSD is prepared to immediately begin to implement Green projects. This will include coordination with other City Departments, networking with foundations and private stakeholders, pursuing a change to the Detroit City Code regarding disconnection of downspouts, public education programs, and prioritization of properties for “clean and green” activities.



For more information about the Detroit Water and Sewerage Department’s Alternative Rouge River CSO Control Program, contact:

Mirza Rabbaig  
CSO Program Manager  
Detroit Water and Sewerage Department  
313.964.9880  
rabbaig@dwsd.org

Richard Hinshon  
President  
Hinshon Environmental Consulting  
517.372.1470  
hinshonr@aol.com