Green Infrastructure Progress Report
Upper Rouge Tributary Area

Fiscal Year July 1, 2014 – June 30, 2015

NPDES Permit No. MI0022802

Detroit Water and Sewerage Department

Prepared by:

Tetra Tech

August 1, 2015

TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY 1

Purpose of This Report 1
Program Geography and Background 2
Maximizing Flow Management Benefits 3
DWSD Project Implementation 3
Project Expenditures 4
Annual Report Organization 4

2.0 PLAN IMPLEMENTATION – FY 2014-2015 6

Activity 1- Policies, Procedures and Standards 11
Activity 1-1 Codes and Ordinances 11
Activity 1-3 Drainage Charge Credit System 12
Activity 2 – Prototype Projects 12
Activity 2-1 Small Scale Greening: Ecological Restoration of Demolition Sites 12
Activity 2-2 Large Scale Greening 15
Activity 2-3 Public Facilities Flow Management 15
Activity 2-5 Municipal Parks Flow Management 17
Activity 2-6 Transportation Corridor Flow Management 18
Activity 3 – Continued Implementation 24
Activity 3-1 and 3-2 Downspout Disconnections 24
Activity 3-3 Demolitions and Site Restoration 24
Activity 3-4 Tree Planting 26
Activity 4 – Long Term Performance 28
Activity 5 – Stakeholder and Community Engagement 28
Activity 5-1 Green Infrastructure Website 29
Activity 5-2 Drainage Charge Program Stakeholder Engagement 29
Activity 5-3 Drainage Charge Toolbox 30
Activity 5-4 Drainage Charge Training Workshops 30
Activity 5-5 Green Infrastructure Case Studies and Demonstration Projects 30
Activity 5-6 Green Infrastructure Forum 30
Activity 5-7 Stakeholder Involvement and Education Strategy 30
Activity 5-8 Overarching Green Infrastructure Educational Campaign 31

3.0 INVESTMENT IN GREEN INFRASTRUCTURE 32

4.0 VOLUMETRIC REDUCTIONS 36

Quantification To Date 36

5.0 ACTION PLAN FOR FY 2015-2016 37

REFERENCES 53

LIST OF TABLES

Table 1 Implementation Project for FY2015 – FY2016 4
Table 2 GI Plan Activities – FY2015 Progress 6
Table 3 Significant Codes and Ordinance Meetings 11
Table 4 Ecological Design Project Cost and Performance 12
Table 5 School Properties High Priority Sites 15
Table 6 Preliminary GSD Investigation Results for High Priority Sites 16
Table 7 Large Public Housing Developments 17
Table 8 Proposed Park Improvements 18

Table 9 Transportation Corridor Projects 18
Table 10 Impact of Demolitions, Spring 2014 – June 30, 2015 24
Table 11 Cumulative Impact of Demolitions 24
Table 12 Tree Planting Summary 26
Table 13 Green Infrastructure Program Cumulative Expenditures 32
Table 14 Agreements with Residual Value 35
Table 15 Annual Stormwater Runoff Volume Reduction Summary 36
Table 16 Proposed FY 2015-2016 Activities 37

LIST OF FIGURES

Figure 1 Upper Rouge Tributary Area Location 2
Figure 2 Typical Ecological Design Illustration 13
Figure 3 Ecological Design Project Locations 14
Figure 4 Artesian Street Porous Asphalt Concept 20
Figure 5 Constance Street Sewer Separation and Subsurface Storage Concept 21
Figure 6 Keeler Street Permeable Paver Concept 21
Figure 7 Tireman Avenue Bioswale Concept 22
Figure 8 Transportation Corridor Project Locations 23
Figure 9 URT Area Demolitions 25
Figure 10 Tree Plantings in URT Area 27
Figure 11 DWSD GI Program Expenditures 34

ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
BSEED	Buildings, Safety Engineering and Environmental Department
CPC	City Planning Commission
CSO	Combined Sewer Overflow
DBA	Detroit Building Authority
DEGC	Detroit Economic Growth Corporation
DFC	Detroit Future City
DLBA	Detroit Land Bank Authority
DPW	Department of Public Works
DWSD	Detroit Water and Sewerage Department
EPA	Environmental Protection Agency
FHWA	Federal Highway Administration
Fps	Feet per second
FY	Fiscal Year
GLRI	Great Lakes Restoration Initiative
GSD	General Services Department
JET	City of Detroit Jobs and Economy Team
LID	Low Impact Development
MDEQ	Michigan Department of Environmental Quality
MDOT	Michigan Department of Transportation
MLBA	Michigan Land Bank Authority
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
NWI	Northwest Interceptor
O&M	Operations and Maintenance
P&DD	Planning and Development Department
RCP	Reinforced Concrete Pipe
ROW	Right-of-way
SEMCOG	Southeast Michigan Council of Governments
TAP	Transportation Alternatives Program
TNC	The Nature Conservancy
Tt or TT	Tetra Tech
URT	Upper Rouge Tunnel/ Upper Rouge Tributary
USDOT	United States Department of Transportation

1.0 EXECUTIVE SUMMARY

In 2010, the City of Detroit embarked on an Alternative Rouge River Combined Sewer Overflow (CSO) Control Program that would result in reduced costs for CSO control and would take into account the significant changes in land use in the City of Detroit. A component of this alternative CSO program was an investment in green infrastructure (GI) solutions that would help to reduce the volume of runoff into the combined sewer system.

Green infrastructure programs are, by nature, a mix of actions from public and private entities. The Detroit Water and Sewerage Department (DWSD) has the objective of making the greatest feasible progress toward reduced runoff to the combined sewer system, whether it is through direct implementation projects; or through coordination with other agencies; or whether it is through institutional actions that change the way that sites are developed. All of these actions result in a reduction in the volume and rate of flow delivered to the combined sewer system.

In FY2015, DWSD worked on both projects and institutional issues as part of the green infrastructure program. This has been a highly collaborative effort, supported by significant partners in such entities as the Detroit Land Bank Authority (DLBA), the Building, Safety and Environmental Engineering Department (BSEED), the Planning and Development Department (P&DD), the Department of Public Works (DPW), the University of Michigan Water Center, and many others.

The efforts of DWSD and these other agencies has led to the following significant, measurable progress.

- Expenditures or committed investments of over $3 million in implementation (construction) of green infrastructure. This work includes bioretention practices on demolition sites (the “ecological restoration of demolition sites” project), green street projects and tree planting. This work is underway and is expected to be complete by December 2015. DWSD expects that with the completion of projects under construction or in final design, that 1.525 MG of the 2.8 MG volumetric goal will be accomplished.
- Further investigations and project development that will allow projects to move from the planning queue to project design. Project types include public facility and park projects, and neighborhood scale projects which bridge the concepts of “large scale greening” with “transportation corridor projects”.
- Progress toward the development of a post construction stormwater ordinance as well as “greening of the code”. When complete, these ordinances will help to maintain the newly created hydrologic function of existing or newly created open space across the City. In both FY2015 and early FY2016, DWSD conducted a series of workshops with stakeholders to gain early input during drafting of the ordinance. DWSD also met with several developers who were in early phases of site design, so that the proposed stormwater management concepts could be considered, even prior to ordinance enactment.
- Conversion of approximately 353 acres in the Upper Rouge Tributary Area (URT) from impervious cover to “greened” area from 2010 to June 2015. This work has largely been performed through demolitions by BSEED and later DLBA. DLBA has adopted standards of site restoration that are designed to promote the reduction of runoff. DWSD also invested over $660,000 in demolitions over this period. The estimated runoff reduction during the design event from demolitions: 10.2 MG. An estimated 536 acres have been converted City-wide through demolitions.
- Development of a drainage charge credit system. DWSD is in the process of developing a credit program to accompany the drainage charge system. Although this credit system is not yet available, property owners are proactively converting over 500 highly impervious parcel acres to managed stormwater area. These projects have the potential to reduce the annual runoff to the sewer system by over 80% for the area controlled. In the URT, DWSD has met with property owners that represent 43 acres of impervious area.

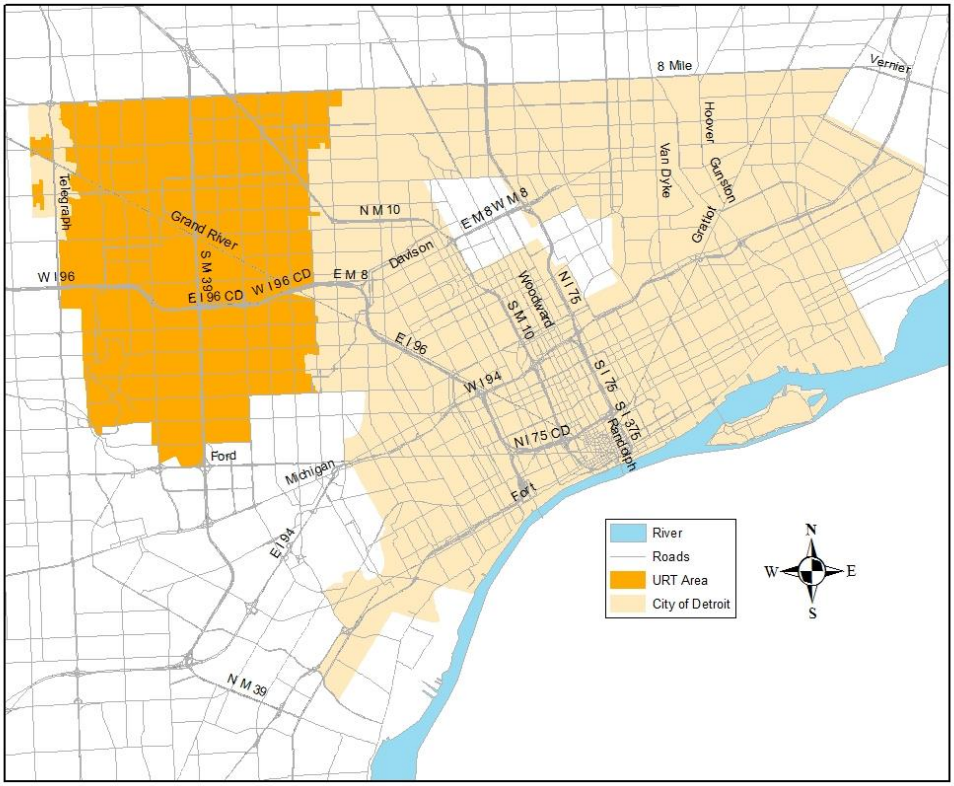
PURPOSE OF THIS REPORT

The Detroit Water and Sewerage Department (DWSD) is responsible for developing and implementing the Alternative Rouge River Combined Sewer Overflow (CSO) Control Program. This CSO Control Program is designed to restore water quality and protect public health, while staying within the City’s 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 (GI) solutions along with “right-sized” conventional CSO control facilities.

This document is the Green Infrastructure Annual Progress Report for FY2015, which corresponds to the time period of July 1, 2014 – June 30, 2015. An annual progress report is required according to the permit (NPDES MI0022802 Part I.A.15.d.5.a) that:

1) *Summarizes the GI implementation work during the preceding DWSD fiscal year that has been undertaken and completed as part of the Green Infrastructure program,*
2) *Contains a work plan for GI implementation projects for the next DWSD fiscal year,*
3) *Documents the annual expenditure for the preceding DWSD fiscal year,*
4) *Documents a cumulative total-spent-to-date on the GI program, and*
5) *Includes an updated estimate of the volume of wet weather flow that has been removed from the combined sewer system as a result of the Green Infrastructure program, using agreed upon calculation techniques.*

Figure 1 Upper Rouge Tributary Area Location



PROGRAM GEOGRAPHY AND BACKGROUND

The Green Infrastructure Program is focused on a 37.5-square-mile portion of the City of Detroit where CSO discharges are tributary to the Upper Rouge River. This portion of the City, alternately referred to as the Upper Rouge Tunnel area and the Upper Rouge Tributary (URT) area comprises approximately 27% of the City of Detroit. This area was identified for a program of both traditional CSO controls and green infrastructure in 2010, following the cancellation of the CSO tunnel project due to escalating costs and financial challenges. The URT includes a complex network of combined sewers, often interconnected. Combined sewage flows in the URT that exceed the capacity of the interceptor system are either discharged from uncontrolled outfalls or treated at the Hubbell-Southfield CSO Facility. The area includes a variety of neighborhood, industrial, and commercial areas which are in varying states of stability. The potential of storm water to be converted to CSO discharges is a factor in prioritizing efforts, while the local socio-economic conditions is a determinant in the type of project implemented.

As reported in the Green Infrastructure Plan for the Upper Rouge Tunnel (Detroit Water and Sewerage Department, 2014a) and in the FY 2014 progress report (Detroit Water and Sewerage Department, 2014b), in

2014 the City of Detroit went through major institutional changes as a result of the bankruptcy filing. Other changes, such as the significant role that the Detroit Land Bank Authority assumed relative to blight removal and management of publicly owned residential properties in the City transpired. In the current fiscal year, the following significant events occurred:

- September 9, 2014. Detroit and leaders of Wayne, Oakland and Macomb counties announced an agreement for the formation of the Great Lakes Water Authority (GLWA).
- November 7, 2014. Judge Rhodes approves Detroit's plan of adjustment, leading to the city's official exit from Chapter 9 bankruptcy.
- June 12, 2015. Lease agreement executed between the City of Detroit and GLWA.

The organizational structures of DWSD/ GLWA and the City of Detroit have a direct impact on the implementation of the green infrastructure program. The working relations between the DWSD Green Infrastructure Program, City of Detroit Departments and other Authorities and Groups have been cooperative and positive, and have eased implementation of opportunities. However the program continues to be implemented in a changing landscape, which results in the need for flexibility and the development of new cooperative structures.

The focus of activities leading up to the prior annual report included a major review and updating of the 2013 GI Plan, moving from a more general assessment of green infrastructure potential, to a specific list of targets for evaluation. In the FY 2014-2015, the focus of efforts has been on implementation of the activities identified in the Plan. These activities have included institutional structures, additional project definition and project implementation.

MAXIMIZING FLOW MANAGEMENT BENEFITS

The ultimate regulatory goal of green infrastructure implementation is a reduction in stormwater entering the combined sewer system, which, in turn, will help to reduce combined sewer overflows. DWSD recognizes that its direct spending on project implementation represents only a portion of the overall actions that result in a change in flow to the combined sewer system. As a result, the green infrastructure program includes significant efforts on institutional structures and policies, and coordination with other activities and partners, which will result in major changes in stormwater generation. Many of the actions that will increase or decrease the quantity of flow entering the sewer will be a result of such activities as demolition and redevelopment; and stormwater management retrofits by private property owners seeking to reduce their drainage charges. The combined sewer system performance will benefit greatly from this implementation by others if systems are in place to support and guide these investments.

Major efforts underway to support land use changes or implementation of stormwater management/ green infrastructure by others:

- DWSD is working with various City departments and stakeholders to develop a stormwater ordinance and to "green the code" – activities that will result in management of stormwater on parcels.
- DWSD is working on updating the drainage charge system, refining data to improve accuracy and developing a credit system to enable customers to receive a reduction in their drainage charge through stormwater management. Within the City, customers are actively taking steps to manage stormwater on-site in 2015, resulting in approximately 500 acres of managed land.
- The Detroit Land Bank Authority (DLBA) is working to demolish vacant and blighted structures. DWSD will be quantifying the land use changes in the City from 2010 through 2015 through new aerial photography. DWSD currently estimates that 353 acres of impervious area have been removed in the URT through demolitions in this period.

DWSD Project Implementation

Over FY 2015, DWSD planned, designed and bid approximately $4.4 million in green infrastructure projects. An additional $1,550,000 in construction projects are in final design, these will be bid in the fall of 2015 or spring of 2016. In addition, DWSD planted 1,775 trees this fiscal year, bringing the total number of trees planted to 7,117. A summary of projects being implemented or planned is presented in Table 1.

Table 1 Implementation Project for FY2015 – FY2016

Project Name	Locations	Engineer's Estimate	Acres Managed	Volume Removed (MG)[1]	Project Status
Ecological Design Projects - Bioretention	(8303 Evergreen, 8097 Vaughan, 8092 Stahelin, 8035 Greenview)	$605,000	2.2	0.08	Construction scheduled August 2015. FY2016.
Tireman Avenue Bioswale	From Chatham to Outer Dr.	$1,600,000	9.5	0.15	PW6968. Funded FY2015
Constance Street Stormwater Management	From Beaverland to Parkland	$1,300,000	11.7	0.55	To be bid FY2016
Artesian Street Porous Asphalt	From Cathedral to Joy	$400,000	5.3	0.06	PW6968. Funded FY2015
Keeler Street Permeable Paver	From W. Outer Dr. Piedmont	$250,000	1	0.04	PW6968. Funded FY2015
Stoepel Park No. 1 - Bioretention and Permeable Pavement	Outer Drive and Evergreen	TBD	9	0.23	Final Concept
Tree Plantings	Throughout area. See Figure 10	$735,000	--	0.05	Planted
Totals		**$4,900,000** (not including Stoepel Park)	**38.7**	**1.16**	

[1]Volume removed is based on a 2-year 24-hour storm event

Additional projects are in the project pipeline with preliminary concepts complete. These projects will require further concept design in order to establish project budgets and public outreach in order to finalize.

Project Expenditures

The spending requirement for the GI Program is for a cumulative expenditure of $30 million by 2019. Through June 30, 2015, $6,719,276 in expenditures has occurred for the GI Program. Construction contracts have been issued or are pending for approximately $2.6 million in construction ($2 million of which is included in expenditures) with an additional $1.55 million estimated for the upcoming fiscal year.

In addition, the Program has a goal of reducing runoff volume to the combined sewer system during the 2-year, 24-hour event. Based on the projects implemented and/or under construction as shown in Table 1, an estimated 1.2 million gallons will be removed per this criterion.

Annual Report Organization

Details for the various items in the permit requirement are presented in this Progress Report. It is structured in the following manner:

- Section 2 summarizes the planning, coordination and implementation efforts undertaken during the FY 2014 – 2015.
- Section 3 provides a financial summary of the investments made toward the green infrastructure program both for the preceding year and the cumulative total to date.

- Section 4 documents the estimated volume of wet weather flow removed as a result of the green infrastructure program.
- Section 5 summarizes the planned activities for the upcoming year.

2.0 PLAN IMPLEMENTATION – FY 2014-2015

The Green Infrastructure Plan is a requirement for DWSD under the NPDES permit (Permit No. MI0022802), issued by MDEQ (State of Michigan Department of Environmental Quality, 2013). The permit requires DWSD to develop and implement a plan that will describe a process for locating, designing, constructing, operating, and evaluating GI in the sewersheds for 17 outfalls to the Rouge River. The permit identifies specific elements that will be included in the Plan including downspout disconnection, demolitions, tree planting, vacant lot greening, bioswales along roadways and parking lots, rain barrels and rain gardens at properties, and programmatic and policy type elements. The 2014 Plan was submitted to MDEQ on August 1, 2014 and was conditionally approved by MDEQ on May 8, 2015.

DWSD's Green Infrastructure Program is envisioned as a continually evolving effort to identify and implement projects and programs that will reduce CSO discharges while benefiting the community. It will be coordinated with other activities in the City that impact stormwater runoff. Because of the dramatic land use changes in the City of Detroit, the stormwater management benefits will develop from three primary mechanisms 1) DWSD or City of Detroit implemented projects for stormwater management/ green infrastructure; 2) green infrastructure (or traditional stormwater management) implementation on existing or redeveloped sites and 3) change in impervious area. The change in impervious cover is primarily occurring through City of Detroit actions to reduce blight and demolish vacant properties. DWSD's program includes directly implemented projects and the advancement of institutional structures that will result in better stormwater management on parcels. These actions will be funded by property owners and have minimal cost to DWSD. Therefore, the Program includes a suite of activities which consider long-term and short-term objectives, and balance institutional structures with project implementation.

DWSD's Green Infrastructure Program included five major activities. Progress on each of those activities over the last year is described in this section. Table 2 provides an overview of the status of each identified activity, with additional detail in the following sections for activities with significant efforts.

Table 2 GI Plan Activities – FY2015 Progress

Task ID	Activities Discussed in 2014 GI Plan	Target Completion Date (GI Plan)	Current Status	Updated Completion Date
Activity 1 – Policies, Procedures and Standards				
1-1	Codes and Ordinances	Complete review and recommendations by June 30, 2015.	Review and Recommendations completed in November 2014.	Initial work complete.
	Comment: Codes and ordinance reviews were completed in Fall 2014. DWSD is currently working with other City agencies to develop a post construction stormwater ordinance and supporting material. DWSD is also working on "greening of the code".			
1-2	Stormwater Technical Reference Manual	Draft of manual complete by March 31, 2015. Final version complete by March 31, 2016.	Initiated	Prepare in FY 2015 – 2016 as a draft.
1-3	Drainage Charge Credit System	Complete initial standards and processes by April 30, 2015. Finalize by November 30, 2015.	In progress	July 1, 2016
	Comment: Efforts on this program in 2014 – 2015 were focused on outreach to specific customers seeking drainage charge reductions and interested in applying onsite stormwater controls. Results of these meeting led to concepts being utilized in the drainage charge credit system. Overall launch delayed to confirm data integrity and provide public notification.			

Task ID	Activities Discussed in 2014 GI Plan	Target Completion Date (GI Plan)	Current Status	Updated Completion Date
1-4	Green Streets Standards	Draft standards by June 30, 2016. Final by June 30, 2017.	Not started.	June 30, 2016
	Comment: Various design details were created as part of the 2015 green streets projects that can be incorporated into future standards.			
1-5	Structure Demolition and Lot Greening Standards	Provide technical support upon request.	As needed	
	Comment: DWSD has provided technical assistance upon request. DLBA adopted site restoration standards.			
1-6	Public Stormwater Maintenance Guidance	Draft guidance complete by June 30, 2015. Final version complete by June 30, 2016.	Not started	July 31, 2016
	Comment: The Public and Municipal Stormwater Maintenance Guidance will be developed concurrently with the Stormwater Technical Reference Manual. Schedule will be based on overall codes and ordinance schedules in order to be consistent with the code.			
1-7	Municipal Stormwater Maintenance Manual	Draft manual complete by July 31, 2016. Final by July 31, 2017.	In progress	July 31, 2016
	Comment: The Public and Municipal Stormwater Maintenance Guidance will be developed concurrently with the Stormwater Technical Reference Manual. Schedule will be based on overall codes and ordinance schedules in order to be consistent with the code.			
1-8	Tracking System	Draft tracking system by July 31, 2015. Final by July 31, 2016.	In progress	Asset management and GI credit tracking by July 31, 2016.
	Comment: DWSD is currently tracking all green infrastructure expenditures in GIS data sets.			
Activity 2 - Prototype Projects				
2-1	Small Scale Greening	Ecological restoration of demolition sites constructed by December 31, 2014. Other opportunities are ongoing.	In progress	Ecological restoration of demolition sites constructed by November 2015. Other opportunities are ongoing.
	Comment: The ecological restoration projects were bid in fall 2014, then rebid in early 2015. The project has been awarded to a contractor and construction is anticipated to be complete by December 31, 2015.			

Task ID	Activities Discussed in 2014 GI Plan	Target Completion Date (GI Plan)	Current Status	Updated Completion Date
2-2	Large Scale Greening	Begin stakeholder and community engagement by September 1, 2014. Complete engagement process and conceptual designs by August 31, 2016.	In progress	Ongoing through FY 2016
	Comment: A number of neighborhood scale opportunities have been identified for further evaluation.			
2-3	Public Facilities Green Infrastructure/ Flow Management	Develop prioritized opportunity list by January 31, 2015. Project selection and implementation schedule by July 31, 2015.	In Progress	October 31, 2015
	Comment: A preliminary list of projects has been developed that must be reviewed with the agencies prior to project selection.			
2-4	Open Stream Connections	Develop prioritized opportunity list by January 31, 2015. Complete conceptual designs by June 30, 2015. Project selection and implementation schedule by July 31, 2015.	In Progress	Public outreach and agency input on concepts by June 30, 2016
	Comment: This task is being renamed “Historic Stream Corridors” to better reflect proposed activities.			
2-5	Municipal Parks Green Infrastructure/ Flow Management	Develop prioritized opportunity list by January 31, 2015. Project selection and implementation schedule by May 31, 2015.	In Progress	Present options for public input and select initial project(s):
	Comment: A prioritized list has been compiled which considered the feasibility of all parks within the URT Area based on criteria identified in the 2014 Green Infrastructure Plan. These projects must be reviewed with stakeholders and the public prior to project selection and implementation.			
2-6	Transportation Corridor Flow Management	Develop prioritized opportunity list by January 31, 2015. Project selection and implementation schedule by May 31, 2015. Annual updates and coordination with city departments, county and state.	Opportunity list, project selection, and implementation schedule is complete	Project completed final design in FY 2015. Construction financed.
	Comment: Three projects are being coordinated with Detroit Department of Public Works road resurfacing projects for construction in late 2015. The projects are out for bid and are expected to be awarded in August 2015. DWSD has funded $2 million to DPW through an MOU. An additional $1.55 million is expected to be funded for construction in spring 2016.			

Task ID	Activities Discussed in 2014 GI Plan	Target Completion Date (GI Plan)	Current Status	Updated Completion Date
Activity 3 - Continued Implementation				
3-1	Downspout Disconnection - Homes	Process update by November 30, 2014. Coordination with major landlords, neighborhood groups and organization by April 30, 2015. Major implementation emphasis in Spring 2015 and ongoing through June 2017.	In Progress	See comment.
	Comment: Future program to be determined.			
3-2	Downspout Disconnection - Multi-Family Residential, Commercial, and Industrial	Site characterization assessment complete by January 31, 2015. Approach methodology by May 31, 2015. Pilot disconnection projects by November 30, 2015.	In Progress	Discontinued, see comment
	Comment: Opportunities limited without other green infrastructure practices to manage flow once disconnected. This effort discontinued as a separate item.			
3-3	Demolitions and Site Restoration	Budget planning by October 31, 2014. Coordination with DBA ongoing.	Ongoing	TBD
	Comment: DWSD has been in regular contact with the DLBA regarding demolition coordination. The DLBA has primarily been focused on the demolition efforts using Hardest Hit Funds. Actual funding of demolitions in FY 2014-2015 was limited to carry over of prior efforts.			
3-4	Tree Plantings	Opportunity assessment by October 31, 2014. Additional planting beginning Fall 2014.	Complete.	
	Comment: Tree planting exceeded targets for FY 2014-2015, with 1,775 trees planted versus the target of 800.			
Activity 4 - Long Term Performance				
4-1	Updated Collection Systems Model	Complete by April 1, 2015	Complete	
	Comment: Under separate DWSD contract.			
4-2	Green Infrastructure Performance Planning	Complete by June 30, 2015	In progress	September 30, 2016
	Comment: Coordination with local researchers and the GLRI project. The ecological restoration projects include monitoring capabilities.			
4-3	Green Infrastructure Benefits Evaluation	Complete by June 30, 2016	Future	June 30, 2016

Task ID	Activities Discussed in 2014 GI Plan	Target Completion Date (GI Plan)	Current Status	Updated Completion Date
4-4	Amendment to the Supplemental Report on Alternative CSO Controls for the Upper Rouge	Complete by January 1, 2017	Future	January 1, 2017
4-5	Legal agreements for long-term sustainability	Ongoing	Ongoing	
Activity 5 - Stakeholder and Community Engagement				
5-1	Green Infrastructure Website	Functional by February 15, 2015.	Complete	Ongoing updates
5-2	Green Rewards Program Stakeholder Engagement	Stakeholder team formation launched August 2014 and following Drainage Charge System Schedule.	Draft storm water drainage charge and green rewards stakeholder outreach strategy developed in September 2014	Anticipated Fall 2015 launch
5-3	Green Rewards Toolbox	Materials available in draft form by January 31, 2016.	In progress	January 31, 2016
5-4	Green Rewards Training Workshops	Concurrent with Green Rewards Public Launch.	Concurrent with Green Rewards Public Launch	Estimated to launch in early 2016
5-5	Green Infrastructure Case Studies and Demonstration Projects	Ongoing with initial case studies developed by June 2015.	In progress	Ongoing
	Comment: Stakeholder and community engagement is conducted as part of the GI design process. Information is disseminated through fact sheet mailings, a series of public meetings, and meeting summary mailings. There is also opportunity for the public to be involved in the planting portion of the project as applicable.			
5-6	Green Infrastructure Forum	Annually in May.	Moved to fall	Fall 2015
5-7	Stakeholder Involvement and Education Strategy	Draft by September 30, 2014. Finalize Plan with input by December 31, 2015.	Being implemented	
5-8	Overarching Green Infrastructure Educational Campaign	Ongoing	Ongoing	Ongoing

Additional information is provided for various major activities in the following sections.

ACTIVITY 1- POLICIES, PROCEDURES AND STANDARDS

Institutional processes that are put in place by DWSD and the City of Detroit will drive implementation of green infrastructure on parcels and private property in the long term. Within the URT area, approximately 70 percent of the land area is made up of parcels and 63 percent of the total impervious area is located on parcels. Managing flow from these parcels is directly related to the institutional processes that are in development.

Significant efforts occurred relative to activities 1-1 and 1-3, which are discussed below.

Activity 1-1 Codes and Ordinances

Code and Ordinance Review and Development. DWSD completed a review of existing codes and ordinances and presented finding in a workshop of City departments in November 2014. The review revealed that there are three areas where the code could be amended to better support the implementation of green infrastructure – the development of post-construction stormwater management regulations, the revisions of existing regulations to allow multiple benefits to be achieved in landscaping areas and the update of parking requirements and standards to allow for the reduction of impervious area within off-street parking areas. DWSD is now working with the Mayor's Office, the Building, Safety Engineering and Environmental Department (BSEED), the Planning and Design Division (P&DD), and other departments to address code and ordinance language that either does not require stormwater management or support green infrastructure.

The development of post-construction stormwater management regulations was deemed to be the top priority and a draft ordinance was developed in January of 2015. The City then coordinated two stakeholder meetings to educate stakeholders about the need for the regulations and to request that they participate in a work session designed to elicit valuable input from these stakeholders, which included City staff, developers, planning agencies, environmental groups and other interested stakeholders. The stakeholder meetings were held in April and June of 2015. In July 2015, a work session was held and comments were received on the draft ordinance. These comments will be used to inform the next draft of the ordinance which will be completed by December 31, 2015 and submitted to City Council for review and approval. The second significant activity is on an effort to "green the code", making implementation of GI practices more feasible and accepted for property owners. This process

Table 3 Significant Codes and Ordinance Meetings

Date	Representatives	Purpose
November 14, 2014	DWSD, Law Dept., BSEED, DPW, P&DD, CPC, TNC, General Services Dept., Neighborhoods, Clerk's Office, Mayor's Office, Tt, City Council representation, JET	City Code & Ordinance Evaluation Presentation Meeting
February 16, 2015	DWSD, Mayor's Office, Clerk's Office, BSEED, GSD, DPW, TNC, Tt	City Post-Construction Storm Water Management Ordinance Meeting
April 13, 2015	Members of the development community, BSEED, P&DD, DWSD, DEGC and Tt.	Post-Construction Stormwater Management Regulation Developer Input Meeting
June 2, 2015	Sierra Club, Land, Inc., Eastern Market, Friends of the Rouge, Erb Family Foundation, American Rivers, DPW, DWSD, Councilman Benson's office, Sustainable Water Works, Mayor's office, Detroit Future City, The Nature Conservancy, Recovery Park, Greening of Detroit, Tetra Tech, Mannick and Smith	Post-Construction Stormwater Management Regulation Stakeholder Input Meeting

Date	Representatives	Purpose
July 20, 2015	Sierra Club, Land, Inc., Eastern Market, Friends of the Rouge, Erb Family Foundation, American Rivers, DPW, DWSD, P&DD, CPC, BSEED, Councilman Benson's office, Sustainable Water Works, Mayor's office, Detroit Future City, The Nature Conservancy, Recovery Park, Greening of Detroit, Tetra Tech, Mannick and Smith, MDEQ, SEMCOG, MDOT, Environmental Consulting and Technology, Zachary and Associates, Giffels Webster, Bedrock Real Estate Services, NTH Consultants, Great Lakes Environmental Law Clinic, Redico, 42nd Parallel Group	Post-Construction Stormwater Management Regulation Stakeholder Working Session
July 21, 2015	Mayor's Office, DWSD, DPW, BSEED, P&DD, CPC, The Nature Conservancy, Tetra Tech	City Post-Construction Storm Water Management Ordinance Meeting

Activity 1-3 Drainage Charge Credit System

DWSD funds wet weather related costs (e.g. CSO control, treatment of wet weather flows at the treatment plant) through a drainage charge. DWSD is in the process of updating land cover data to improve billing accuracy. As part of this process, a methodology is being developed that will result in reduced bills for those customers who manage their flows on-site. As part of the green infrastructure program, DWSD is reporting efforts toward the development of the credit system and other outreach efforts with property owners that are necessary to result in on-site implementation. DWSD is in discussions with over 20 major property owners on strategies to control stormwater that could lead to reduced bills. These properties are inside and outside the URT.

ACTIVITY 2 – PROTOTYPE PROJECTS

Activity 2-1 Small Scale Greening: Ecological Restoration of Demolition Sites

In cooperation with the Detroit Land Bank Authority (DLBA) and the University of Michigan Water Center, DWSD is in the process of constructing bioretention practices on four cleared residential lots within the NWI area to help manage local road runoff. Under a grant from the Erb Family Foundation, the University of Michigan research team will will assess social and water quality impacts. The lots were cleared of blighted homes to assist in the stabilization and beautification of the neighborhood. The four project areas are under contract for construction and are expected to be built by the end of 2015. Table 4 identifies the location, cost and anticipated performance of the practices, while Figure 2 and Figure 3 show a typical rendering and the locations respectively.

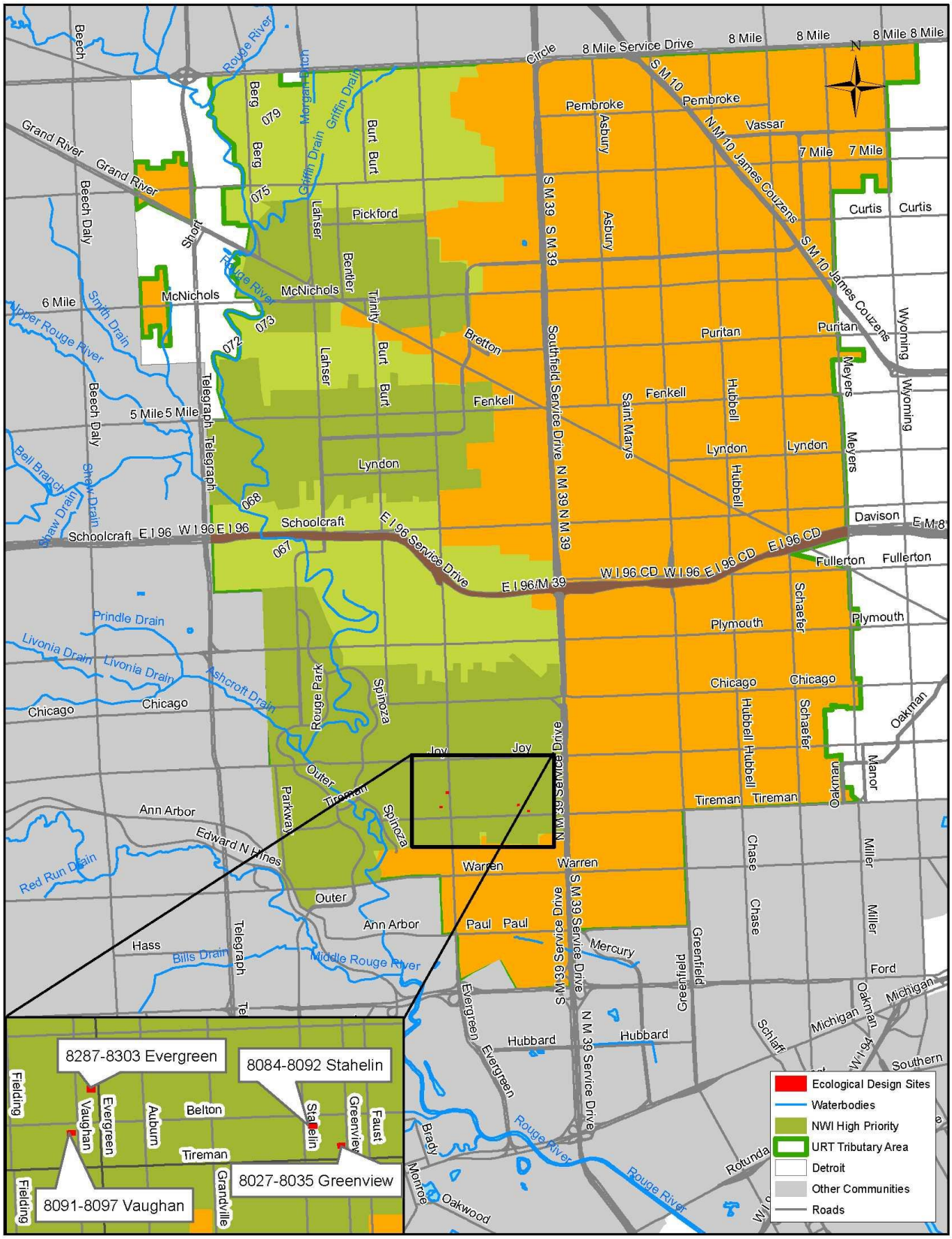
Table 4 Ecological Design Project Cost and Performance

Lot Address	Engineer's Cost	Cost Effectiveness ($/gal)	Performance (MG)	% of 2 Year Design Storm	Status
8287-8303 Evergreen	$170,000	$7.10	0.024	Retain: 100% Detain:	Construction summer 2015
8091-8097 Vaughan	$140,000	$7.80	0.018	Retain: 100% Detain:	Construction summer 2015

Lot Address	Engineer's Cost	Cost Effectiveness ($/gal)	Performance (MG)	% of 2 Year Design Storm	Status
8084-8092 Stahelin	$160,000	$6.40	0.025	Retain: 100% Detain:	Construction summer 2015
8027-8035 Greenview	$135,000	$9.64	0.014	Retain: 100% Detain:	Construction summer 2015
Estimate of Retained Runoff Reduction (MG)			**0.081**		

Figure 2 Typical Ecological Design Illustration

Figure 3 Ecological Design Project Locations



Activity 2-2 Large Scale Greening

Several meetings were held over the past year to discuss possibilities for large scale greening projects. Large scale greening encompasses projects that include smaller individual activities together into one larger implementation project. Meetings were held to discuss coordination with various directly affected parties (DTE, DPW, DWSD's water master plan team, Detroit Housing and Revitalization department, DBA and DLBA) and with other agencies or groups that work on similar issues (Detroit Future City, The Nature Conservancy). . Detailed concepts were not advanced in FY2015.

Activity 2-3 Public Facilities Flow Management

Three major public entities within the City of Detroit were contacted and pursued to improve parcel drainage management including:

- Detroit Public Schools (DPS)
- City of Detroit General Services Department (GSD)
- Organizations managing large public housing facilities.

Detroit Public Schools

A preliminary exam of 28 active Detroit Public Schools (DPS) within the project area was conducted to determine which have the greatest potential site drainage improvement opportunity. Pervious and impervious surfaces were delineated for each of the 28 schools along with their respective tributary areas. Ten schools were selected for additional field investigations based upon input of DPS, total impervious surface area and availability of adjacent green space for flow management. Comprehensive analysis for each of the ten sites included:

- Detailed field investigations, including building drainage
- Construction and record drawings review
- Site drainage performance evaluation
- Physical verification of sanitary and storm sewer piping
- Optimal green infrastructure siting

Upon completion of the analysis, three schools were selected for further concept development, which are detailed in Table 5 below.

Table 5 School Properties High Priority Sites

School Name	Location	Performance (MG)	% of 2 Year Design Storm	Status
Gompers Elementary	NWI High Priority Area	Retain: 0.18	TBD	Concept
Ludington Magnet Middle School	NWI High Priority Area	Retain: 0.01	TBD	Concept
Charles Wright Academy	NWI High Priority Area	Retain: 0.35	100%	Concept

Detroit General Services Department Facilities

Active City of Detroit facilities managed by GSD within the project boundary were evaluated for potential greening opportunities. A total of 89 properties were investigated using available GIS data, aerial photography and sewer section maps. Of these 89 properties, 30 facilities are in the NWI tributary boundary while the remaining are located elsewhere in the URT. Through review of the tabulated data for each facility, and conversation with GSD, several sites were selected for further site investigations.

Field investigations, evaluations and concepts these facilities are ongoing. Preliminary investigations show potential opportunity for flow management, however, results have not been finalized as only three facilities (The Gun Range and Police Precinct) have received detailed field investigations. Coordination with property managers for access to these facilities can be challenging considering work load and schedules of City staff.

Table 6 Preliminary GSD Investigation Results for High Priority Sites

Facility Name	Location	Parcel Size (Acre)	Roof Area (Acre)	Parking Lot Area (Acre)	Area for GI
DPW Yard (12235 Southfield)	URT	11.29	0.79	8.18	Yes. DPW Yard
Police Precinct at Grand River (13500 Lesure)	URT	2.38	0.44	1.84	Yes. Large Parking Area. Three parcels together make the police precinct 22032572 plus 22030918-20 plus 22030921
Police Precinct at Plymouth (11450 Warwick)	NWI	1.16	0.64	0.54	Yes. The parking lot is located adjacent to Fitzpatrick-Warwick playground which is also maintained by GSD.
GSD Yard (21800 Joy Rd.)	NWI	2.77	0.26	2.19	Rouge Park
Gun Range Near GSD Yard (21800 Joy Rd.)	NWI	2.62	0.226	0.47	Rouge Park

Major Large Public Housing Institutional Properties

Institutions targeted for site evaluations at large public housing facilities include:

- Detroit Housing Commission (DHC)
- Detroit Land Bank Authority (DLBA)
- Housing for Urban Development (HUD)
- Michigan State Housing Development Authority (MISHDA)

Through contacting these entities, four large housing developments were identified for further investigations as listed in Table 7. Site investigations for each of these facilities were performed with the exception of the Renaissance Village, which has declined to participate in the project at this time. Detailed field investigations determined that of the three facilities, only Smith Homes provided potential site drainage management improvements. Greenbrook Manor's plumbing and property dimensions did not provide suitable GI opportunities. GardenView Estates already manages their site storm drainage with a retention pond which was confirmed to be online by the site developer. Potential conceptual designs for managing the Smith Homes Community Center storm drainage are being evaluated.

Table 7 Large Public Housing Developments

Facility Name/Entity	Location	Parcel Size (Acre)	Roof Area (Acre)	Parking lot Area (Acre)	Area for GI
Smith Homes/DHC (14313 Crescent Dr)	NWI	19.5	4.63	4.27	Yes. A large amount of green space near community center. Apartment downspouts are disconnected.
Greenbrook Manor/DHC (19805 Greenfield)	URT	0.75	0.28	0.2	No. Property size and site plumbing limits GI opportunity
GardenView Estate/DHC (16461 Van Buren Ave)	URT	135	Varies due to construction	Varies due to construction	Storm water management practice exists currently.
Renaissance Village Apartments/ MISHDA (19311 Vortobeck Dr)	NWI	23.6	3.28	4.37	Yes. Downspouts disappear. Declined to participate in the Program.

Activity 2-5 Municipal Parks Flow Management

Municipal parks provide an opportunity to manage not only runoff generated within the park, both also from adjacent roads. Management of runoff generated on municipal park parcels is often accomplished by redirecting the impervious surfaces to open spaces within the park or reconstructing the paved surfaces as porous pavement. Additional storm water from adjacent roads can sometimes be directed to the public park in an effort to further manage storm water.

The following tasks have been completed:

- A comprehensive analysis of all parks within the URT was conducted.
- Parks were prioritized based on weighting factors generated from the analysis. This prioritization list will be continually updated as site conditions change or additional information becomes available.
- To ensure efficiency in municipal land selection, all parks within the URT were given an initial rating of priority, high, moderate, or low based on how each park was scored. Supporting information was retained to avoid reanalyzing parks at a later date.
- From the prioritization list, five parks were chosen based on their scores and project feasibility.

The analysis criteria used for park prioritization included:

- Location within URT
- Volume of storm water removed
- Percent of 2 year storm volume retained
- Cost effectiveness
- Current and future uses of park
- Speed of implementation
- Neighborhood stabilization
- Technology demonstration
- Educational benefits
- Community partnerships
- Just and equitable distribution
- Provision of ecosystem services

Table 8 Proposed Park Improvements

Park Name	Location	Preliminary Cost Estimate	Cost Effectiveness ($/gal)	Performance (MG)	% of 2 Year Design Storm	Status
Stoepel Park No. 1 (NE)	NWI	TBD		Retain: 0.09	100%	Final Concept
Stoepel Park No. 1 (SE)	NWI	TBD		Retain: 0.14	100%	Final Concept
Comments: Concepts are being developed in coordination with City of Detroit General Services Department and the Grandmont Rosedale Development Corp.						
Estimate of Retained Runoff Reduction (MG)				**0.23**		

Activity 2-6 Transportation Corridor Flow Management

Roads, including those under the jurisdiction of the City of Detroit, Wayne County and MDOT represent the largest amount of impervious surfaces within the URT. The following section describes the status of ongoing projects and opportunities to reduce the impact of stormwater runoff generated by these impervious surfaces.

Table 9 Transportation Corridor Projects

Road Name	Location/GI Type	Estimated Construction Cost	Cost Effectiveness ($/gal)	Performance (MG)	% of 2 Year Design Storm	Status
Artesian Street (Cathedral to Joy)	NWI Porous asphalt	$400,000	$7	Retain: 0.06 Detain: 0.16	27%	Bid PW6968; construction fall 2015
Constance Street (Beaverland to Parkland)	NWI Storm sewer; stormwater practice in Rouge Park	$1,300,000	$2.50	Retain: 0.55 Detain: 0	100%	Estimated bid date: February 2016
Comment: This project includes construction of a storm sewer along Constance Street and subsurface storage within Rouge Park to discharge to an existing outfall to Bigelow Drain, tributary to Rouge River (Outfall R-17). The “retained” volume is the volume for the 2-year event that is removed from the combined system. The subsurface storage practice will attenuate the peak flow from the 10-yr 1-hr event and promote infiltration.						
Keeler Street (W. Outer Dr. to Piedmont)	NWI Permeable Pavers	$250,000	$6.50	Retain: 0.04 Detain: 0.07	87%	Bid PW6968; construction fall 2015

Road Name	Location/GI Type	Estimated Construction Cost	Cost Effectiveness ($/gal)	Performance (MG)	% of 2 Year Design Storm	Status
Tireman Avenue Phase I & II (Chatham to Outer Dr.)	NWI Storm sewer; Bioswales	$1,600,000	$10.70	Retain: 0.15 Detain: 0.15	29%	Phase I: Bid PW6968; construction fall 2015 Phase II: final design Phase III: future
Comment: This is Phase I and II of a three-phase project. Phase I and II include storm sewer and bioswales on Tireman. Phase III includes green infrastructure and an outfall to the Rouge River via Rouge Park. Phase III will also collect additional stormwater from Sawyer Street. Once Phase III is complete, approximately 1 MG of runoff will be removed from the combined sewer system for the 2-year 24-hour event.						
Estimate of Retained Runoff Reduction (MG)			**0.80**			

Figure 4 Artesian Street Porous Asphalt Concept

Figure 5 Constance Street Sewer Separation and Subsurface Storage Concept

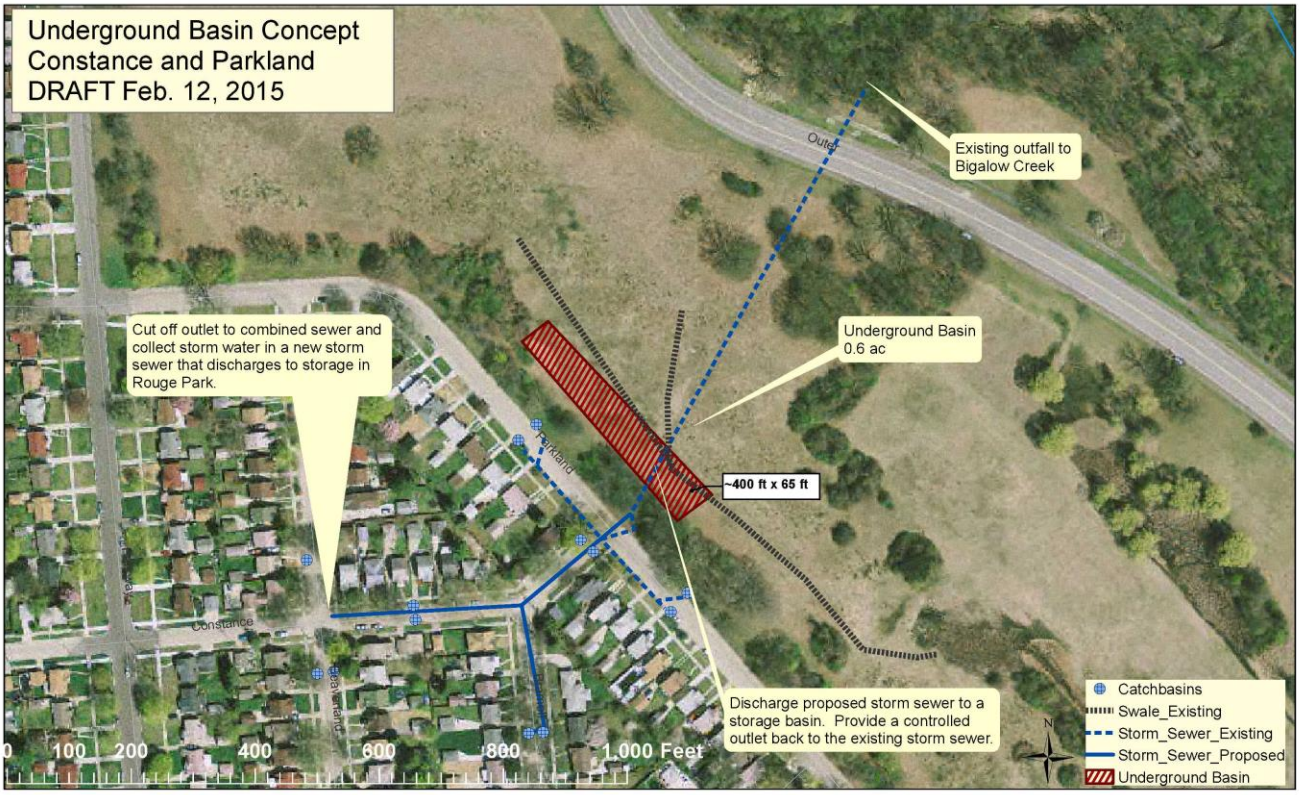
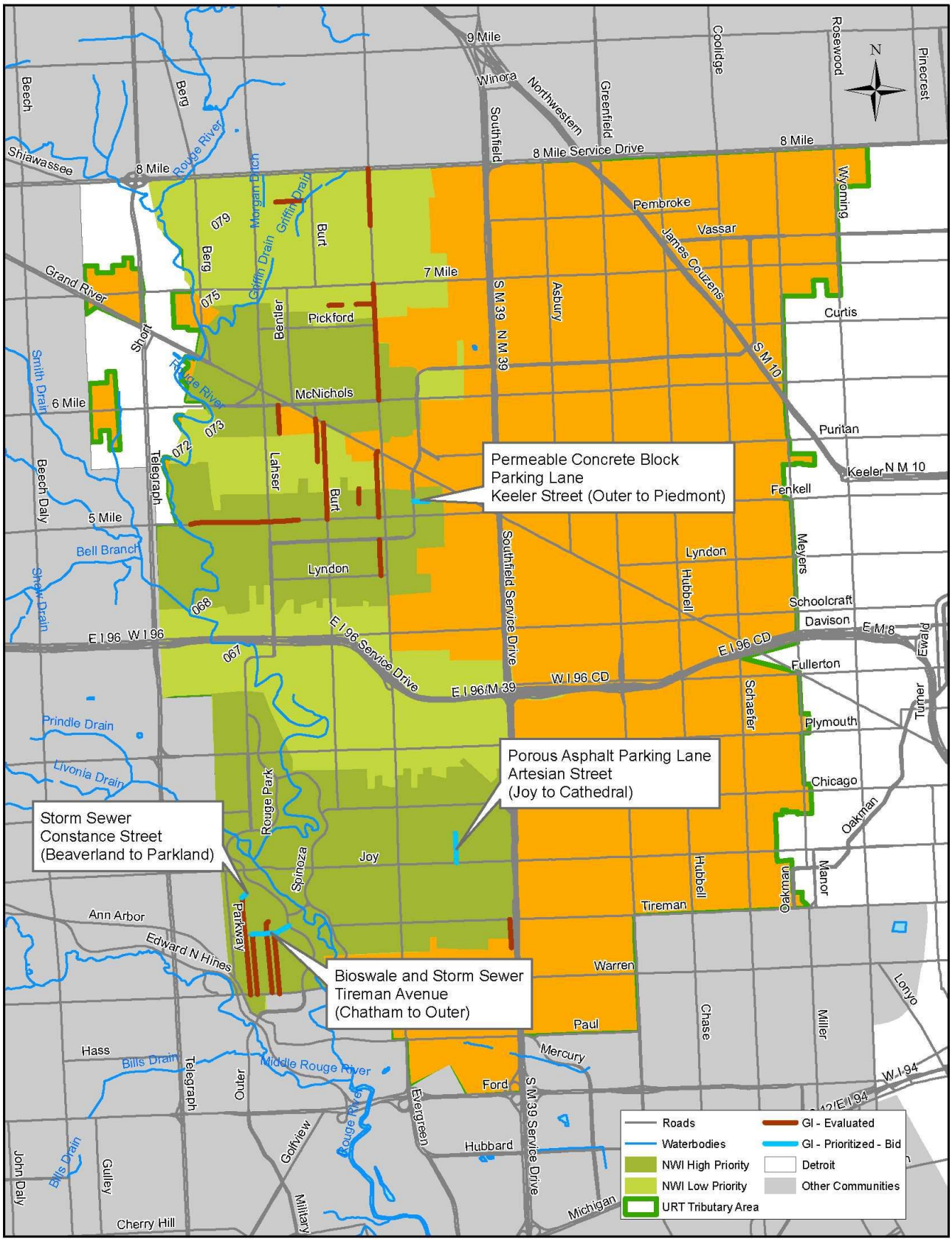


Figure 6 Keeler Street Permeable Paver Concept

Figure 7 Tireman Avenue Bioswale Concept

Figure 8 Transportation Corridor Project Locations



ACTIVITY 3 – CONTINUED IMPLEMENTATION

DWSD has previously participated in a series of projects including downspout disconnection, demolitions and site restoration, and the planting of trees in the area. Activities will continually adapt based on current conditions and needs. The general status of this fiscal year's efforts are detailed in the sections below.

Activity 3-1 and 3-2 Downspout Disconnections

A feasibility analysis was performed to determine whether or not a new downspout disconnection plan should be implemented. Based on neighborhood participation rates, number of connected downspouts and a review of DWSD's available information, neighborhoods have been selected if a potential program were to move forward. Furthermore, properties held by large land banks and major institutions were evaluated, and both the National Community Stabilization Trust and Housing for Urban Development would be willing to assist by requiring disconnection for residential housing loans or refinancing within the city limits. Progress of this program is dependent upon legal department reviews, City ordinances, and coordination for permit and funding requirements between DWSD and the MDEQ.

Activity 3-3 Demolitions and Site Restoration

The pace of demolitions in the URT continued at a significant rate over the past fiscal year. DWSD estimated total impact of demolitions from a variety of data sources. Estimated recent and cumulative impact of demolitions is summarized in Table 10 and Table 11, respectively. Locations of URT demolitions are shown in Figure 9. Note that the NWI areas are a subset of the URT.

Table 10 Impact of Demolitions, Spring 2014 – June 30, 2015

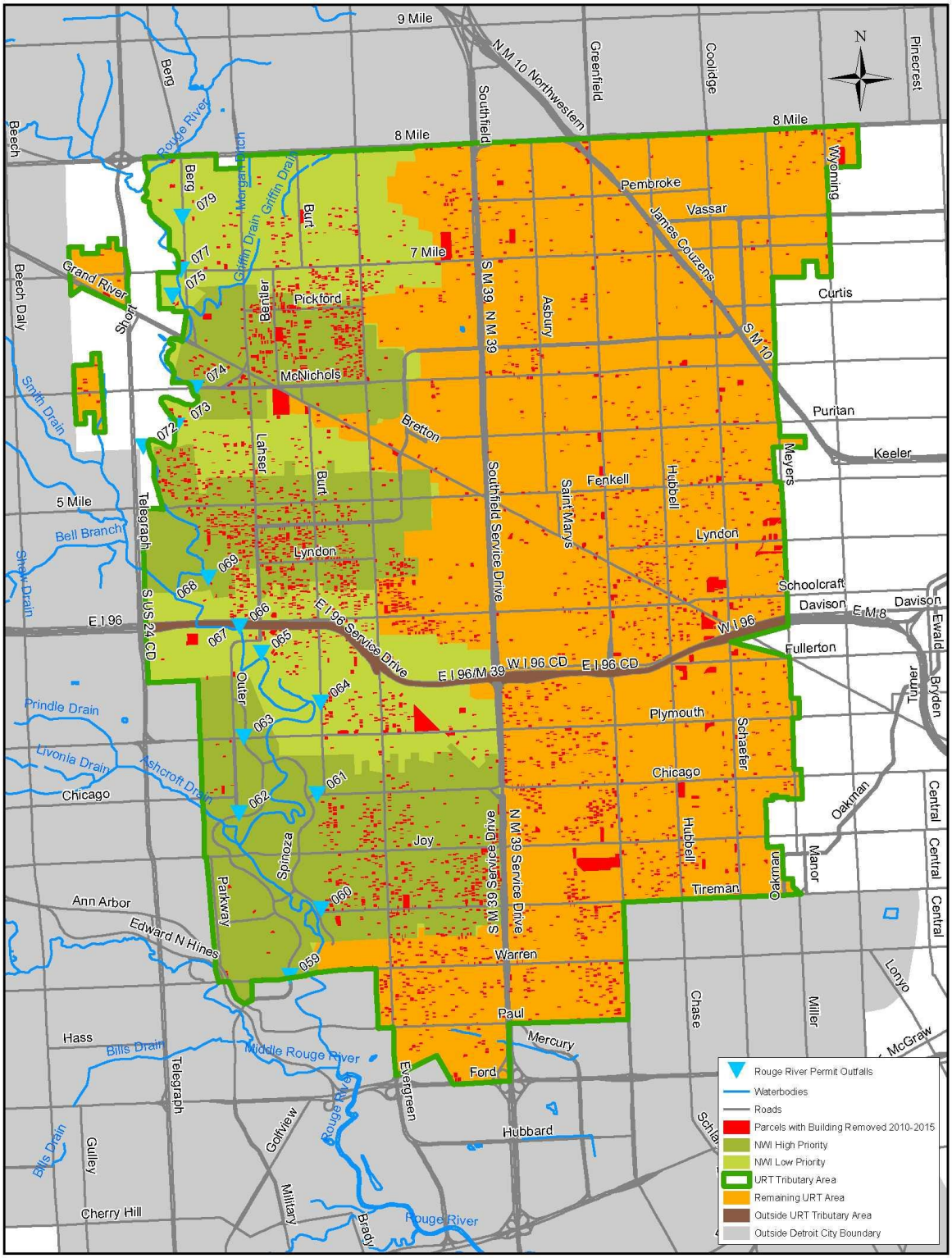
Statistic	NWI High Priority	NWI Low Priority	URT Total
Number of parcels with structures, 2015	19,790	15,360	87,210
Number of Demolitions, 2015	1,265	556	2,838
Estimated parcel area (acres)	98	42	222
Building footprint area removed in 2015 (acres)	13	5	31
Estimated total impervious area removed	43	17	94
Estimated Runoff Reduction (MG)	**1.2**	**0.5**	**2.7**

Table 11 Cumulative Impact of Demolitions

Statistic	NWI High Priority	NWI Low Priority	URT Total
Number of parcels with structures, 2010	21,913	16,335	92,666
Number of parcels with structures, 2015	19,790	15,360	87,210
Estimated Building Footprint removed as of 2015 (acres)	35	29	145
Estimated total impervious area removed as of 2015 (acres)	91	66	353
Estimated Runoff Reduction (MG)	**2.6**	**1.9**	**10.2**

Also accomplished during the FY 2014-2015, DLBA adopted site restoration standards following demolition that will promote infiltration and evapotranspiration. These standards call for a minimum depth of topsoil or amended soil prior to seeding the sites. Also, as part of the GLRI project on Detroit's east side, an evaluation of runoff characteristics of various vacant lots is underway. This assessment will help inform the best investments in vacant lots.

Figure 9 URT Area Demolitions



Activity 3-4 Tree Planting

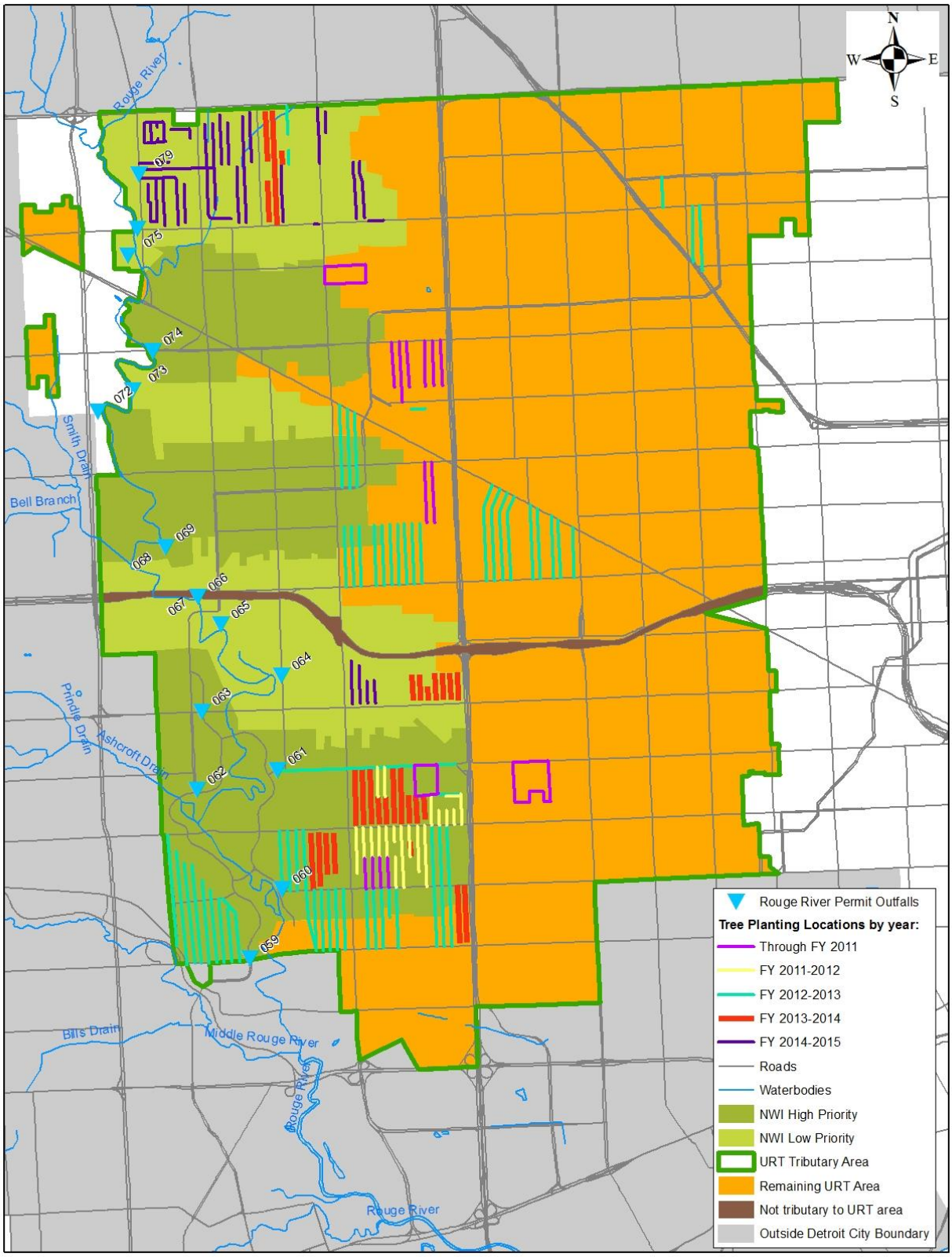
DWSD has funded tree planting through The Greening of Detroit. This work was originally performed under contract CS-1546. Later efforts were performed under CS-1522. Street tree planting is implemented within the road right-of-way between the sidewalk and curb along city and county roads. Tree plantings were also completed in Rouge Park, which were required as replacement for trees cleared at the South Tunnel project site.

An additional 282 park trees and 1,493 street trees were planted in the current fiscal year. Cumulative to date, Greening of Detroit has planted 7,117 trees in the URT area under the DWSD Green Infrastructure Program, as summarized in and shown on Table 12 and Figure 10.

Table 12 Tree Planting Summary

Description	Number of Trees Planted in the URT Area	Estimated Runoff Reduction (MG)
Through FY 2011 Street Trees	332	0.009
Through FY 2011 Park Trees	769	0.022
FY 2011-2012 Street Trees	985	0.028
FY 2012-2013 Street Trees	1,867	0.052
FY 2012-2013 Park Trees	170	0.005
FY 2013-2014 Street Trees	1,219	0.034
FY 2014-2015 Street Trees	1,493	0.042
FY 2014-2015 Park Trees	282	0.007
Total	**7,117**	**0.199**

Figure 10 Tree Plantings in URT Area



ACTIVITY 4 – LONG TERM PERFORMANCE

Activities associated with long term performance over the period of FY 2014-2015 were limited and are reflected in the summary table.

ACTIVITY 5 – STAKEHOLDER AND COMMUNITY ENGAGEMENT

Coordination with departments, agencies, and groups continued throughout the fiscal year. Coordination efforts occurred with the following:

Internal DWSD Groups

- DWSD Customer Services
- DWSD Financial Planning Division
- DWSD GIS Group
- DWSD Water Supply Operations
- DWSD Public Affairs

City Government

- Buildings, Safety Engineering and Environmental (BSEED)
- Planning and Development (P&DD)
- Public Works (DPW)
- Housing
- Jobs and Economy Team (JET)
- General Services – parks
- General Services – buildings
- Neighborhoods
- City Planning Commission
- Mayor's office

Agencies

- Detroit Land Bank Authority
- Detroit Building Authority
- Michigan Land Bank
- Wayne County Department of the Environment
- Wayne County Road Commission
- Michigan Department of Transportation (MDOT)
- Detroit Economic Growth Corporation
- Michigan Department of Environmental Quality (MDEQ)
- United States Environmental Protection Agency (US EPA), Region V
- Detroit Public Schools
- Detroit Housing Commission
- Michigan State Housing Development Authority
- DTE Energy

Organizations

- Detroit Future City
- Sierra Club
- Erb Family Foundation
- Detroit Greenways Coalition
- Brightmoor Alliance
- Grandmont Rosedale Development Corporation
- Rosedale Grandmont Little League Baseball
- Joy Southfield Development Corporation
- Friends of Rouge Park
- Far West Detroit Civic Association
- Cody Rouge Neighborhood Partnership
- Other neighborhood groups (as needed)

Institutions

- University of Michigan
- Wayne State University
- Lawrence Tech University

Groups

- Green Infrastructure Task Force – water subcommittee
- Blue Green Task Force

Stakeholder outreach and participation has been, and will continue to be an important aspect of DWSD's overall Green Infrastructure Plan. DWSD's green infrastructure stakeholder outreach is comprised of three components: 1) Storm water drainage charge reduction through green infrastructure implementation; 2) Green infrastructure project-specific outreach; and 3) Overarching, collaborative green infrastructure public education campaign. All green infrastructure outreach activities conducted during the FY 2014-2015 touch on one or more of these branches.

The focus of outreach activities during 2014-2015 was developing a tailored Green Infrastructure Stakeholder Outreach Strategy that leverages existing knowledge and experience from DWSD staff, as well as key local partners also engaged in green infrastructure implementation throughout Detroit. As a result, a large focus of this year's stakeholder and community engagement activities was on listening – through meetings of the Detroit Blue Green Infrastructure Workgroup, the City of Detroit's Green Task Force, managers from the Detroit Department of Neighborhoods, and local groups like Brightmoor Alliance, Cody Rouge Community Action Alliance, and the Grandmont Rosedale Development Corporation.

Examples of prior outreach and participation are listed below. These and additional activities are anticipated in the future:

- Greening of Detroit utilizes a community engagement process to select streets for street tree planting. This includes community meetings and engaging residents in planting and maintenance. In addition, each resident is informed ahead of time of the planting and can "opt out" of the program.
- The local neighborhood association and/or community development corporation is initially engaged in site selection for projects implemented through the program.
- A public engagement process is included in each major green infrastructure construction project, including the development of large-scale green infrastructure on vacant property, implementing green streets, and incorporating green infrastructure on municipal properties. This will include engagement of neighborhood associations and/or community development corporations and general citizens during from the initial design through implementation.
- Stakeholders are also educated about DWSD's green infrastructure activities through DWSD's public outreach mechanisms, including their recently redesigned Green Infrastructure and Storm Water web pages and green infrastructure project case study fact sheets, community meeting summaries, and meeting announcements.

Activity 5-1 Green Infrastructure Website

The DWSD website will be a primary source of information for local, state, and national stakeholders interested in DWSD's green infrastructure activities. DWSD Public Affairs staff worked with Tetra Tech to identify desirable features of other green infrastructure websites from across the country to develop design and content goals for new DWSD Green Infrastructure and Storm Water pages. In September 2014, DWSD Public Affairs and DWSD's consultant, Tetra Tech, drafted proposed new language for the Storm Water and Green Infrastructure pages that would help to introduce basic storm water and combined sewer system/overflow concepts to a general audience, providing the foundation to explain the need and purpose of DWSD' Green Infrastructure Program. Given the ongoing effort to refine the storm water drainage fee, which is linked to the green infrastructure rewards program, DWSD decided to take a phased-approach to the Green Infrastructure/Storm Water web pages. The web page text, lay out, images, and existing content focus on an introduction to Green Infrastructure concepts, the DWSD Green Infrastructure Program goals, past green infrastructure activities, and fact sheets on planned green infrastructure projects, as well as information about past and upcoming opportunities to get involved in green infrastructure meetings. DWSD began the process of uploading the redesigned web pages in June 2015. DWSD will update the content with new green infrastructure practice fact sheets, updated site-specific project information, and green rewards program information as it becomes available. The updated website is at: http://www.dwsd.org/pages_n/green_infrastructure.html.

Activity 5-2 Drainage Charge Program Stakeholder Engagement

DWSD developed a draft storm water drainage charge stakeholder outreach strategy in September 2014 to help guide the green rewards program stakeholder engagement activities through the development and implementation phases. Project Innovations is currently facilitating the Drainage Fee Program Management Steering Team and is using the storm water drainage charge and green rewards stakeholder outreach strategy as part of the overall development efforts.

Activity 5-3 Drainage Charge Toolbox

This activity is related to the refinement of the storm water drainage charge and development of the green rewards program. Once the Drainage Charge Program Management Steering Team has the refinements to the drainage charge in place, DWSD will have the foundation needed to craft the details of the green credits program and associated toolbox materials.

Activity 5-4 Drainage Charge Training Workshops

This activity is related to the refinement of the storm water drainage charge and development of the green credits program. Once the Drainage Charge Program Management Steering Team has the refinements to the drainage charge in place, DWSD will have the foundation for needed to craft the details of the green credits program and associated green credits training workshops.

Activity 5-5 Green Infrastructure Case Studies and Demonstration Projects

DWSD initiated the development of project fact sheets for the green infrastructure road resurfacing projects underway in conjunction with the Detroit Department of Public Works, as well as the Ecological Design projects and the Stoepel Park No. 1 improvements. The current versions of the case study fact sheets focus on the planning phase of the projects for use during community stakeholder meetings and other outreach activities to reach key stakeholders. The current versions of the existing suite of green infrastructure case study fact sheets are available on DWSD's redesigned web pages.

Activity 5-6 Green Infrastructure Forum

Over the course of the year, there have been a number of green infrastructure related stakeholder meetings, either hosted by DWSD for specific green infrastructure projects or workshops or in partnership with DWSD. During these various outreach events, DWSD has had the opportunity to consider the role a broader green infrastructure forum would play in Detroit and the appropriate timing for such an event. DWSD anticipated that stakeholders would have numerous questions regarding the drainage charge and progress on a green infrastructure credits program if a green infrastructure forum was held in May 2015, as was the original target date in the 2014 Green Infrastructure Plan. As work on codes and ordinances moves forward, along with the process for refining the drainage charge as the foundation for the green credits program, DWSD expects to hold the green infrastructure forum in fall 2015.

Activity 5-7 Stakeholder Involvement and Education Strategy

DWSD developed a draft Green Infrastructure Stakeholder Outreach Strategy in September 2014 that identifies three branches of outreach consisting of the six elements of stakeholder outreach used in EPA's *Getting In Step Guide*.

Crafting the strategy for the first branch of stakeholder outreach—storm water drainage charge reduction through green infrastructure implementation—was the initial focus of the Green Infrastructure Stakeholder Outreach Strategy development. DWSD provided this piece of the strategy to Project Innovations for use in facilitating the Drainage Fee Program Management Steering Team.

The second branch of stakeholder outreach—green infrastructure project-specific outreach—has been a significant focus of 2014-2015 outreach activities. The strategy for this branch of outreach has evolved based on meetings and discussions with DWSD Public Affairs staff, the City of Detroit's Department of Neighborhood managers, Detroit Future City staff, Erb Family Foundation's Blue Green Infrastructure Workgroup, neighborhood organizations such as the Brightmoor Alliance, the Grandmont Rosedale Community Development Corporation, and the Cody Rouge Community Action Alliance. The outreach activities used to support ongoing green infrastructure projects, including the DWSD green infrastructure road projects initiated with the Detroit Department of Public Works, have informed this branch of the overall Green Infrastructure Stakeholder Outreach Strategy. The lessons learned from these early project-specific outreach activities are the basis for updating this branch of the Green Infrastructure Stakeholder Outreach Strategy. Under this branch of outreach, DWSD has planned and conducted community outreach meetings for the DWSD-DPW green infrastructure projects tied to road resurfacing activities in January and February 2015. The two sets of community meetings were held in conjunction with the Cody Rouge Community Action Alliance at Don Bosco Hall and the Grandmont Rosedale

Community Development Corporation at their office. DWSD summarized the input received at these meetings and distributed summaries to all participants, as well as made the summaries available to the public via DWSD's website. The information collected during the community meetings helped to inform the green infrastructure project planning process and raised community residents' awareness about the benefits of and process for implementing green infrastructure.

The third branch of stakeholder outreach—the overarching, collaborative green infrastructure public education campaign—is mentioned in the draft Green Infrastructure Stakeholder Outreach Strategy and is still in the planning phase. This branch of outreach is discussed in more detail below.

Activity 5-8 Overarching Green Infrastructure Educational Campaign

This branch of stakeholder outreach discussed in the Green Infrastructure Stakeholder Outreach Strategy has been the subject of numerous planning conversations with the Erb Family Foundation's Blue Green Infrastructure Workgroup, Detroit Future City, Sierra Club, SEMCOG, and other local partners. For an overarching green infrastructure educational campaign, DWSD would like to continue using the Green Space, Blue Water logo developed by SEMCOG for DWSD to help brand the campaign. One of the primary issues discussed by DWSD and other local green infrastructure partners is where a centralized, overarching green infrastructure educational campaign for Detroit should "live" on the Internet. DWSD envisions that a separate, collaborative website that is all-inclusive of Detroit green infrastructure information should be created that links to DWSD's Green Infrastructure Program.

3.0 INVESTMENT IN GREEN INFRASTRUCTURE

Since the inception of DWSD's Green Infrastructure Program, a variety of implementation projects and coordination efforts have occurred. These projects include stakeholder workshops, distribution of education materials, and efforts toward tree planting, demolitions, small scale lot greening, and downspout disconnections.

As part of the preparation of this report, a detailed review of prior spending was performed. Previous reports have not differentiated between projected and actual spending. This report and future annual progress reports will clearly distinguish between the two. The costs identified in Table 13 and displayed on Figure 11 are based on the date of the invoice, although some of the effort may have been performed in the prior fiscal year. Program funding expended during the current fiscal year was $2,513,540.

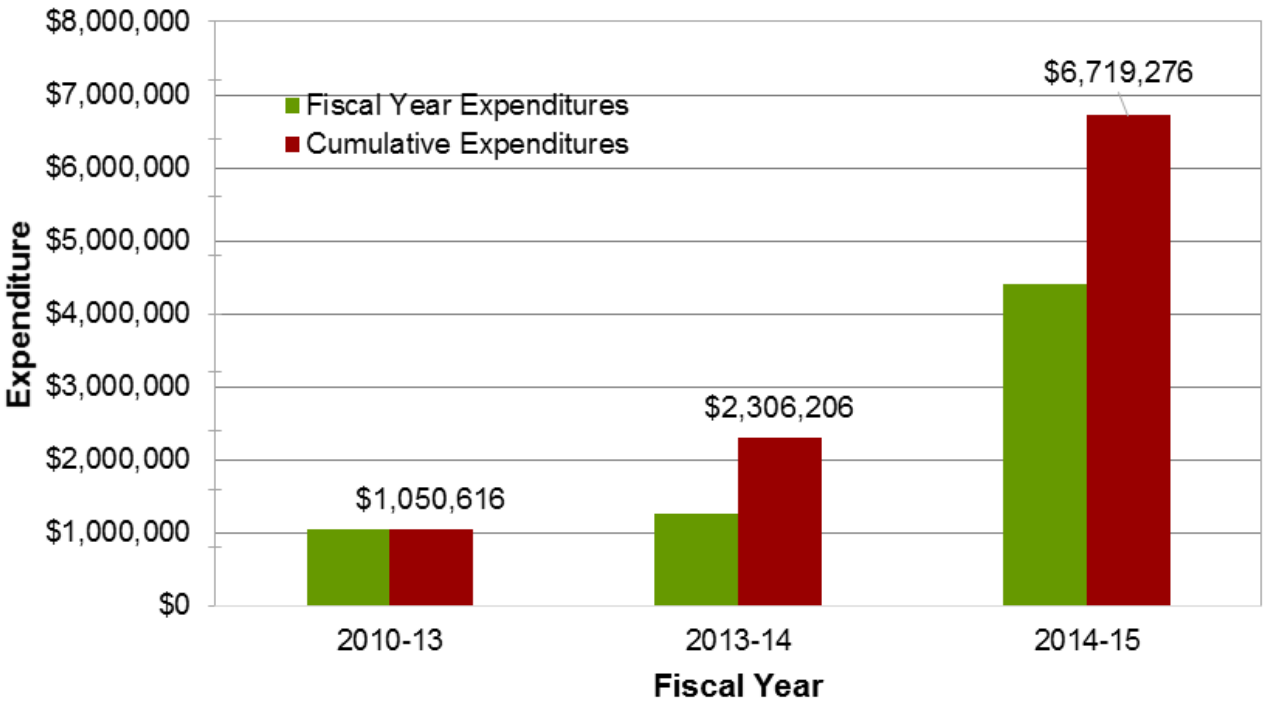
Table 13 Green Infrastructure Program Cumulative Expenditures

Activity	FY 2010-2013	FY 2013-2014 Professional Services	FY 2013-2014 Implementation	FY 2014-2015 Engineering and Administration	FY 2014-2015 Implementation	Projected FY 2015-2016 Implementation	Cumulative Expenditures (Includes projected)
General Project Management	$97,298	$55,593		$135,516			$288,407
Activity 1 – Policies, Procedures and Standards							
1-1 Codes and Ordinances		$13,590		$101,644			$115,234
1-2 Storm Water Technical Reference Manual							
1-3 Drainage Charge Credit System		$15,230		$63,160			$78,390
1-4 Green Streets Standards							
1-5 Structure Demolition and Lot Greening Standards							
1-6 Public Storm Water Maintenance Guidance							
1-7 Municipal Storm Water Maintenance Manual							
1-8 Tracking System	Reported as part of General Project Management						
Activity 2 - Prototype Projects							
2-1 Small Scale Greening Ecological restoration of demolition sites			$25,000	$129,106		$605,000	$759,106
2-2 Large Scale Greening				$112,271			$112,271
2-3 Public Facilities Flow Management				$227,389			$227,389
2-4 Open Stream Connections							
2-5 Municipal Parks Flow Management	Reported as part of Activity 2-3 Public Facilities Flow Management						
2-6 Transportation Corridor Flow Management				$267,259	$2,000,000	$1,550,000	$3,817,259

Activity	FY 2010-2013	FY 2013-2014 Professional Services	FY 2013-2014 Implementation	FY 2014-2015 Engineering and Administration	FY 2014-2015 Implementation	Projected FY 2015-2016 Implementation	Cumulative Expenditures (Includes projected)
Activity 3 - Continued Implementation							
3-1 and 3-2 Downspout Disconnection	$95,551	$2,378	$56,295	$36,410			$190,634
3-3 Demolitions and Site Restoration	$55,186	$2,378	$571,284	$25,570	$8,050		$662,468
3-4 Tree Plantings	$581,103		$106,330	$37,009	$698,230		$1,422,672
Activity 4 - Long Term Performance							
2014 GI Plan		$224,118		$274,257			$498,374
Annual Reports				$35,686			$35,686
4-1 Updated Collection Systems Model							
4-2 Green Infrastructure Performance Planning				$29,414			$29,414
4-3 Green Infrastructure Benefits Evaluation	Reported as part of Activity 4-2 Green Infrastructure Performance Planning.						
4-4 Amendment to the Suppl. Report on Alt. CSO Controls for the Upper Rouge							
4-5 Legal agreements for long-term sustainability	Reported as part of Activity 4-2 Green Infrastructure Performance Planning.						
Activity 5 - Stakeholder and Community Engagement							
5-1 Green Infrastructure Website		$34,502		$109,002			$143,504
5-2 Green Credits Program Stakeholder Engagement		$15,230		$48,098			$63,328
5-3 Green Credits Toolbox	Reported as part of Activity 5-2 Green Credits Program Stakeholder Engagement.						
5-4 Green Credits Training Workshops	Reported as part of Activity 5-2 Green Credits Program Stakeholder Engagement.						
5-5 Green Infrastructure Case Studies and Demonstration Projects	Reported as part of Activity 5-2 Green Credits Program Stakeholder Engagement.						
5-6 Green Infrastructure Forum	Reported as part of Activity 5-1 Green Infrastructure Website.						
5-7 Stakeholder Involvement and Education Strategy	Reported as part of Activity 5-1 Green Infrastructure Website.						
5-8 Overarching Green Infrastructure Educational Campaign	Reported as part of Activity 5-1 Green Infrastructure Website.						

Activity	FY 2010-2013	FY 2013-2014 Professional Services	FY 2013-2014 Implementation	FY 2014-2015 Engineering and Administration	FY 2014-2015 Implementation	Projected FY 2015-2016 Implementation	Cumulative Expenditures (Includes projected)
DWSD Staff	$200,000	$75,000		$75,000			$350,000
SEMCOG Staff	$21,478	$58,661					
Subtotal	$1,050,616	$496,681	$758,909	$1,706,790	$2,706,280	$2,155,000	$8,874,276
Expenditures per FY	**$1,050,616**	**$1,255,590**		**$4,413,070**			
Cumulative Expenditures To-date	**$6,719,276**						
SEMCOG Staff Outside of URT				$55,287			
Note: Other expenditures on projects outside the URT total $8,536.							

Figure 11 DWSD GI Program Expenditures



In addition to actual expenditures (invoices), DWSD has committed funds for future expenditures on the Green Infrastructure Program. Original contract value and residual contract value for major agreements performing ongoing work associated with DWSD's Green Infrastructure Program are displayed in Table 14. The MOU for demolitions with BSEED is no longer presented in this table.

Table 14 Agreements with Residual Value

Vendor	Contract Number	Contract Dates	Contract Value	Residual Contract Value
SEMCOG	CS-1547	2012-2015	$300,000	$160,795
Tetra Tech	CS-1522	2013-2018	$12,500,000[1]	$9,781,570
DPW	PW-6968	2015-2016	$2,000,000	$0
Total			**$14,800,000**	**$9,942,365**

[1] The DPW MOU was funded out of CS-1522 funds, reducing the corresponding contract value to $12,500,000.

Based on the cumulative spent to date and the agreements that have been executed, DWSD has committed a total of $16,661,641 to the Program through 2018.

4.0 VOLUMETRIC REDUCTIONS

QUANTIFICATION TO DATE

The runoff volume estimates for discrete storm events are based on NRCS curve number hydrology calculations. Green infrastructure practices that are designed to manage stormwater runoff are calculated based on the runoff volume from the tributary area. In the case of practices which result in a land cover conversion the managed runoff calculation is based on the change in curve numbers. Detailed information of the NRCS Curve Number approach is available in the NRCS Part 630 National Engineering Handbook (NRCS, USDA, 2004). The initial abstractions assumption inherent in the NRCS approach was updated according to the ASCE *State of the Practice Curve Number Hydrology* (Hawkins, 2009). Volume calculations are summarized in Table 15 for a single 2-year, 24-hour storm event (equivalent to approximately 2.34 inches of rainfall).

Estimated runoff reduction volumes for tree planting are based on 7,117 trees being planted in the URT since the inception of the program. The planting locations and methods are such that the greatest benefit from a stormwater runoff perspective is from tree canopy interception. Tree canopy interception rates are based on interception capabilities as planted. As the trees grow and the canopy increase, the interception will increase and the corresponding runoff reduction estimates from tree plantings will increase.

Table 15 Annual Stormwater Runoff Volume Reduction Summary

Activity	FY 2010-2013	FY 2013-14 (MG)	FY 2014-15 (MG)	Projected FY 2015-16 (MG)	Cumulative Total (MG)[1]
Activity 2-1 Small Scale Greening	N/A	0.022	N/A	0.081	0.022
Activity 2-5 Municipal Parks Flow Management	N/A	N/A	N/A	0.23	0.00
Activity 2-6 Transportation Corridor Flow Management	N/A	N/A	0.11	0.69	0.11
Activity 3-1 and 3-2 Downspout Disconnection	N/A	N/A	N/A	TBD	0.063
Activity 3-3 Demolitions and Site Restoration	N/A	0.130	0.0	TBD	0.130
Activity 3-4 Tree Planting	0.116	0.034	0.049	TBD	0.199
Total					**0.524**

[1] Does not include projected values. The cumulative total with projected values equals 1.525 MG.

5.0 ACTION PLAN FOR FY 2015-2016

INTRODUCTION

This section provides a description of the action plan for FY 2015 – 2016. Much of this work was originally identified in the 2014 Green Infrastructure Plan. However some tasks have been completed, other tasks have been added, and some tasks have been modified or deleted. The structure continues the original concept of five categories of activities:

1. Policies, Procedures and Standards
2. Prototype Projects
3. Continued Implementation
4. Long Term Performance
5. Stakeholder and Community Engagement

IMPLEMENTATION SCHEDULE

The schedule for implementation of green infrastructure projects has been developed to identify specific activities and the proposed schedule for implementation. In the first year of implementation of the GI Plan, some activities were prioritized over others, resulting in either tasks being completed ahead of the original schedule or delayed relative to the dates presented. Capitalizing on opportunities, the program completed design and bidding of transportation corridor projects well ahead of what was originally envisioned. Code and ordinance efforts were also accelerated based on the significant interest in new development in the City. The following section includes an updated implementation plan based on results of the FY 2014-2015, and includes some items that were not identified in the 2014 Plan. Note that **bolded dates** are actual dates.

SUMMARY OF ACTIVITIES

Table 16 provides an overview of the action items planned. Additional details describing the individual activities are provided in the subsequent sections.

Table 16 Proposed FY 2015-2016 Activities

No.	Activities	Proposed Schedule
Activity 1 – Policies, Procedures and Standards		
1-1	Codes and Ordinances	FY 2015-2016 to focus on post construction stormwater ordinance and “greening of the code”.
1-2	Storm Water Technical Reference Manual (for Stormwater Ordinance)	Publically available version by June 2016.
1-3	Drainage Charge Credit System	Draft available for public comment January 1, 2016.
1-4	Green Streets Standards	General timeframes. Draft standards by June 30, 2016. Final by June 30, 2017.
1-5	Structure Demolition and Lot Greening Standards	Standards were adopted by DLBA in the FY 2014 - 2015
1-6	Public Storm Water Maintenance Guidance	Publically available version by June 2016.
1-7	Municipal Storm Water Maintenance Manual	Draft manual July 31, 2017.
1-8	Tracking System	Updated impervious cover analysis data complete by December 31, 2015. Other systems ongoing.

No.	Activities	Proposed Schedule
Activity 2 - Prototype Projects		
2-1	Small Scale Greening	Ecological design project construction to be completed by November 2015. Evaluation of other greening opportunities in FY 2015- 2016.
2-2	Large Scale Greening	Ongoing planning and project development FY 2015-2016.
2-3	Public Facilities Green Infrastructure/ Flow Management	Select initial projects by October 31, 2015.
2-4	Historic Stream Corridors	Ongoing planning and project development FY 2015-2016.
2-5	Municipal Parks Green Infrastructure/ Flow Management	Select initial projects by October 31, 2015. Implement Stoepel Park and other selected project(s) in 2016.
2-6	Transportation Corridor Flow Management	Task subdivided into components. Develop prioritized opportunity list by January 31, 2015. Project selection and implementation schedule by May 31, 2015. Annual updates and coordination with city departments, county and state.
Activity 3 - Continued Implementation		
3-1	Downspout Disconnection - Homes	Program under review.
3-2	Downspout Disconnection - Multi-Family Residential, Commercial, and Industrial	Non-SFR properties are included either in 2-3 Public Facilities Flow Management addressed through drainage charge / code review activities.
3-3	Demolitions and Site Restoration	Coordination with DLBA and DBA is ongoing.
3-4	Tree Plantings	Majority of opportunity locations completed. No additional plantings planned for 2016.
Activity 4 - Long Term Performance		
4-1	Updated Collection Systems Model	Completed under CS-1499.
4-2	Green Infrastructure Performance Planning	Complete by June 30, 2015.
4-3	Green Infrastructure Benefits Evaluation	Complete by June 30, 2016.
4-4	Amendment to the Supplemental Report on Alternative CSO Controls for the Upper Rouge	Complete by January 1, 2017.
4-5	Legal agreements for long-term sustainability	Ongoing.
Activity 5 - Stakeholder and Community Engagement		
5-1	Green Infrastructure Website	Ongoing updates.
5-2	Green Credits Program Stakeholder Engagement	Anticipated launch is fall 2015.
5-3	Green Credits Toolbox	Materials available in draft form by January 31, 2016.
5-4	Green Credits Training Workshops	Concurrent with Green Credits Public Launch.
5-5	Green Infrastructure Case Studies and Demonstration Projects	Ongoing with initial case studies developed by June 2015.
5-6	Green Infrastructure Forum	Fall 2015.
5-7	Stakeholder Involvement and Education Strategy	Draft by September 30, 2014. Finalize Plan with input by December 31, 2015.

No.	Activities	Proposed Schedule
5-8	Overarching Green Infrastructure Educational Campaign	Ongoing.

ACTIVITIES DESCRIPTIONS

ACTIVITY 1 – POLICIES, PROCEDURES AND STANDARDS

Institutional processes will drive implementation of green infrastructure on both parcels and rights-of-way in the long term. DWSD will implement processes within its ability and will work with other City departments to promote other institutional processes. DWSD is currently in the early stages of development of these programs. Efforts will initially be focused on working through policy and process issues on the variety of programs. These programs are expected to evolve and the action plan as presented is based on the current definition of objectives and constraints.

1-1 Codes and Ordinances

DWSD is working with the Building, Safety Engineering and Environmental Department and the Planning and Development Department. These efforts are intended to address questions related to roof drain disconnections and site development standards. The following activities are envisioned to be part of FY 2015-2016:

Continue coordination with BSEED, P&PD, CPC, DPW and other relevant departments that manage the zoning, building codes and site reviews/ permitting in the city.
Continue to assess barriers posed by existing regulations, internal policies and land use plans which may hinder the implementation of green infrastructure.
Continue development of code language to facilitate green infrastructure.
Provide education and training for City staff that are unfamiliar with green infrastructure and how it performs.
Coordinate the development of the Storm Water Technical Reference Manual with the modifications to the City's codes and ordinances. PENDING
Present findings as appropriate to stakeholder groups and decision-makers. ONGOING
Develop a post construction stormwater ordinance ONGOING
Propose updates to code language to facilitate implementation of green infrastructure. "Greening of the Code". ONGOING

The milestone schedule for these efforts is:

Task ID	Activity	Target/Actual Start	Target/Actual Complete
1-1-1	Code and ordinance review and recommended modifications	**June 1, 2014**	**November 15, 2014**
1-1-2	Provide education and training for City staff	**April 1, 2014**	Ongoing
1-1-3	Post construction stormwater ordinance	**January, 2015**	January 2016 (to council)
1-1-4	"Greening of the code"	**June 2015**	TBD

1-2 Storm Water Technical Reference Manual

A technical reference manual for managing storm water runoff will be developed. This material will be drafted in coordination with a City of Detroit steering committee with representatives from applicable departments. Its timeline will correspond to the code development/ revision activities. This document will be coordinated along with other identified documents with the objective of streamlining the overall suite of reference materials his will serve as a resource manual that will support both the post construction stormwater ordinance (note: purpose narrowed from the GI Plan). The manual will also address the permit requirements (Part I.A.15.d.9) pertaining to storm

water controls for projects requiring a Part 41 construction permit issued by MDEQ. Design of green infrastructure practices will be addressed in the manual. The manual is envisioned to cover the following topics:

- Applicability of the requirements for new development, redevelopment, and municipal projects including roadway improvements.
- Design criteria for site drainage, roadway and parking lots, and flow conveyance of sewers, culverts, and open channels. The design criteria will address water quantity and quality considerations. Design standards for both the combined sewered areas and the separately sewered areas will be addressed.
- Overview of drainage design methodologies and acceptable practices.
- Storm water control measures design considerations for systems such as green roofs, water harvesting, bioretention, tree plantings, porous pavements, and detention and retention basins.
- Special conditions and constraints for environmentally sensitive areas, floodplain encroachments, and contaminated sites.
- Procedures and submittals requirements for site plan approval.
- Operation and maintenance practices, agreements and easements.
- Design and construction performance certifications.
- Erosion and sediment control for construction sites.

Development of the manual will be collaborative effort between City departments. As such, a working group will be convened for the manual development. Development of the manual will also be coordinated with Wayne County and other agencies and groups as appropriate. DWSD will take a lead role in drafting the manual but adoption of the manual will require the participation of other departments.

The milestone schedule for these efforts is:

Task ID	Activity	Target Start	Target Complete
1-2-1	Manual Development	October 2015 (revised)	June 2016 (publically available)
1-2-2	Manual Clarifications; addenda (as needed)	January 2017	June 2017
1-2-3	Provide education and training	June 2016	Ongoing

1-3 Drainage Charge Credit System

DWSD is in the process of updating its drainage charge system. The drainage charge system distributes costs associated with wet weather flows based on parcel imperviousness. This task is focused on the development of a drainage charge credit system to encourage implementation of green infrastructure and other storm water management practices on parcels. These practices may be implemented as redevelopment occurs or as retrofits to existing sites. The following activities being conducted as a part of developing a credit system:

- Evaluation of similar programs in other communities for criteria and process. *Ongoing.*
- Defining potential drainage charge reductions that are consistent with DWSD's permit compliance goals to reduce storm water volume, CSO discharges, and total volume to treatment. *Ongoing.*
- Meetings with ratepayers to identify areas of flexibility that should be considered in the drainage charge calculation methodology. *Ongoing.*
- Identification of an internal DWSD task force that would include key decision makers throughout the organization, including executive management, customer service, financial planning and green infrastructure. This team would work to define policies and clarify processes. *Working group identified and meeting.*
- Coordination with code and ordinance issues to facilitate property owner ability to implement green infrastructure practices. *Ongoing.*
- Implementation of community conversation with stakeholder group and broader audience. (under activity 5-2).
- Development of a summary policy and procedures manual (under activity 1-3) and a "toolbox" for ratepayers (under activity 5-3).
- Quantification of DWSD investment through direct support and credits
- Instructional workshops.

The milestone schedule for these efforts is:

Task ID	Activity	Target Start	Target Complete
1-3-1	Draft Manual for Drainage Charge System	**March 2015**	January 2016
1-3-2	Final Manual	January 2016	July 2016
1-3-3	Provide education and training	January 2016	July 2016

The drainage charge in Detroit is currently one of the highest drainage charges in the country. It is expected that as drainage credits are rolled out to the entire city (expected July 1, 2016) many customers will have incentives to reduce their impervious area and adopt green infrastructure approaches. A substantial effort is currently underway to update the parcel-based impervious data, display the information to customers, and provide tools so that customers may estimate their drainage credits under various approaches.

1-4 Green Streets Standards

Green Street standards will document the process, procedures and design standards for managing runoff on City streets and county roadways. These standards may be developed as a reference manual or have the force of policy. Green streets design needs to involve a variety of departments and agencies representing City (and potentially other streets), utilities, DDOT (bus service), planning, emergency services (e.g., fire), and other stakeholders. These standards would be developed subsequent to completion of early pilot projects, when issues are better understood and processes have been tested.

The milestone schedule for these efforts is:

Task ID	Activity	Target Start	Target Complete
1-4-1	Draft Standards	October 1, 2015	June 30, 2016
1-4-2	Final Standards	July 1, 2016	June 30, 2017
1-4-3	Provide education and training	May 1, 2016	Ongoing

1-5 Structure Demolition and Lot Greening Standards

In the FY 2014-2015, a working group that included the Detroit Building Authority (DBA), DLBA, BSEED, MDEQ, EPA, and demolition contractors developed site restoration standards for demolitions. DWSD is not directly involved in this working group, but provided some technical support and input upon request. There is no specific planned additional work on this item.

Separate efforts are underway related to greening of vacant lots. Refer to Activity 2-1 Small Scale Greening.

The milestone schedule for these efforts is:

Task ID	Activity	Target Start	Target Complete
1-5-1	Lot Greening Standards	**Completed FY 2014-2015**.	

1-6 Public Storm Water Maintenance Guidance

A maintenance guidance document will be developed for the general public in caring for storm water management features such as rain gardens, rain barrels, disconnected downspouts, porous pavements, and detention basins. A target audience for this guidance is private property owners receiving drainage credits for storm water management practices. This guidance will address common types and frequency of maintenance activities. Inspection and recordkeeping for practices receiving storm water drainage credits will also be addressed. Development of the manual will be coordinated with a work group of stakeholders and the final manual will be published for general use. This manual may be combined with the Storm Water Technical Reference Manual

The milestone schedule for these efforts is:

Task ID	Activity	Target Start	Target Complete
1-6-1	Manual Development	October 1, 2015	Publically available version by June 2016.
1-6-2	Manual Clarifications; addenda (as needed)	January 2017	June 2017
1-6-3	Provide education and training	June 2016	Ongoing

1-7 Municipal Storm Water Maintenance Manual

The target audience for this manual is the municipal staff responsible for caring for the publically owned and maintained storm water management practices. Municipal staff includes but is not limited to DWSD. The objective of the manual is to identify methods and approaches to maintain green infrastructure practices. This manual will address institutional and technical issues, inspections, and recordkeeping, amongst other efforts.

The milestone schedule for these efforts is:

Task ID	Activity	Target Start	Target Complete
1-7-1	Draft Manual	August 1, 2015	July 31, 2016
1-7-2	Final Manual	August 1, 2016	July 31, 2017
1-7-3	Provide education and training	June 1, 2016	Ongoing

1-8 Tracking System

DWSD is developing a tracking and performance assessment database for green infrastructure implementation activities. The objective of this database is to define, at a minimum, the location, ownership, financial investment, performance, and installation date of the green infrastructure practices. There are three primary types of data that will be maintained by DWSD:

DWSD constructed or direct funded green infrastructure
Privately owned green infrastructure practices that qualify for drainage charge credits
General land use cover change over time

Future needs will include:

Developing an asset management system for GI maintenance activities. This is expected to work with other asset and maintenance systems operated by DWSD.
Developing a tracking system for private investments that result in a drainage charge credit.

Supplemental efforts will include the following:

Identifying other green infrastructure inventories within southeast Michigan.
Mapping of GI practices for public education purposes.

The milestone schedule for these efforts is:

Task ID	Activity	Target Start	Target Complete
1-8-1	Draft Tracking System	**June 1, 2014**	July 31, 2015
1-8-2	Final Tracking System	August 1, 2015	July 31, 2016
1-8-3	Provide education and training	June 1, 2015	Ongoing
1-8-4	Impervious land cover update	**July 1, 2015**	December 1, 2015

ACTIVITY 2 - PROTOTYPE PROJECTS

Implementation of green infrastructure requires the development of new policies, processes, and procedures. It also requires additional understanding of the performance, costs, and implementation realities associated with various project types. DWSD has worked to form relationships with a number of relevant agencies, organizations and community groups. In the process of working with these entities, a number of issues have been discussed regarding project responsibilities and concerns. The realities of policies, processes, and procedures can best be realized in the process of implementing projects. DWSD intends to launch a series of prototype projects that will help to answer the following questions:

- What policy issues need to be addressed and what procedures need to be developed in order to implement a specific project type?
- What is the timeframe associated with implementing various types of projects? What is the appropriate planning cycle?
- How well does the project type control runoff and reduce CSO discharge?
- How much does the project cost to implement?
- What technical issues need to be addressed to design and implement the project?
- What institutional issues need to be addressed to design and implement the project?
- Who will own and maintain the project upon completion?
- What project types will the community accept and in what conditions?

A range of project types has been identified for inclusion in the prototype implementation. These project types include:

- Land assembly and large scale greening
- Municipal property roof and parking lot management
- Municipal parks
- Road decommissioning
- Rights-of-way storm water management
- Managing ROW runoff on vacant lots
- Managing pump stations discharge on vacant lots

2-1 Small Scale Greening

Small scale greening projects include parcel-based practices on individual parcels. Several small parcels grouped together are also considered small scale. Examples of greening practices include bioretention, porous pavements, underground detention or retention, infiltration basins, green roofs, and water harvesting projects. Storm water runoff from the site is managed and additional runoff from adjacent parcels and the roadway may also be managed.

Examples of small scale greening include vegetating vacant lots or installing bioretention systems in conjunction with building demolitions. In this case, the void left after removing a demolished structure (including the basement) is used for a bioretention system and road runoff is diverted into the practice. Four of these systems are being constructed through a joint project with DLBA, DBA, the University of Michigan Water Center and Wayne State University. This project is referred to as *Ecological Restoration of Demolition Sites.*

A second project that will be explored is the greening of poorly vegetated sites. The GLRI project on the east side of Detroit is exploring vacant lot greening, and the hydrological performance of vacant lots. Detroit Future City helped lead a team to develop a rapid assessment tool for vacant lots. As part of the GLRI project, Don Carpenter of Lawrence Technological University is performing hydrologic evaluations of various sites. Lessons learned from this project will help identify beneficial practices in the URT. An exploratory project for greening of vacant lots based on this newly gained information is planned for FY 2015-2016. This project will help to define cost effective future actions.

The milestone schedule for these efforts is:

Task ID	Activity	Target Start	Target Complete
2-1-1	Ecological Restoration of Demolition Sites – site selection and design	**July 1, 2014**	**August 31, 2014**
2-1-2	Ecological Restoration of Demolition Sites – bidding & construction	**March 2015**	November 2015
2-1-3	Identification of project opportunities, selection, design and construction	Ongoing	
2-1-4	Vacant Lot Greening Exploratory Project in collaboration with Detroit Future City	January 2016	June 2016

2-2 Large Scale Greening

Large scale greening encompasses projects that synergize individual activities together into one larger implementation project. An example of this type of project includes road decommissioning with vacant parcel greening.

Identify large scale greening project opportunities. This would include evaluation of individual project opportunities identified in this Plan for incorporation into a larger greening effort.

Coordinate concepts with City departments and stakeholders and select projects for implementation based on feasibility. Based on the scale of the projects, the coordination and outreach process is expected to take an extended period of time.

Over the extended outreach and education period, concept alternatives will be developed. These will provide detail for cost, implementation and policy issues.

Develop a schedule for implementation, design and construction.

The milestone schedule for these efforts is:

Task ID	Activity	Target Start	Target Complete
2-2-1	Identify large scale greening project opportunities	**July 1, 2014**	Continuing effort
2-2-2	Stakeholder and community engagement	**September 1, 2014**	August 31, 2016
2-2-3	Develop conceptual designs	**September 1, 2014**	August 31, 2016
2-2-4	Develop a schedule for implementation, design and construction	September 1, 2015	TBD

2-3 Public Facilities Green Infrastructure/Flow Management

Management of storm water from public buildings and parking lots focuses on redirecting stormwater to green infrastructure practices for infiltration, detention and potential direct discharge to receiving streams. Emphasis is on roof and parking lot runoff. Activities for FY 2015-2016 include:

Based on work done in FY 2014-2015, develop a prioritized list of public properties for potential projects. Primary focus in FY 2014-2015 was on Detroit Public School sites. Detroit Public Schools efforts will require a memorandum of understanding between DWSD and DPS. The MOU will clarify issues of funding, ownership, maintenance, and education. DWSD has also been working with Detroit Housing Commission and City of Detroit General Services for other project opportunities.

Based on the prioritized list, it is expected that one or more prioritized projects will be advanced to implementation.

The estimate milestone schedule for these efforts is:

Task ID	Activity	Target Start	Target Complete
2-3-1	Identify and prioritize opportunities; evaluation of institutional issues.	**August 1, 2014**	September 30, 2015
2-3-2	Develop prioritized project listing	**June 1, 2015**	September 30, 2015
2-3-3	Select projects and develop an implementation schedule	September 30, 2015	October 31, 2015
2-3-4	Design for first site(s)	November 1, 2015	April 2016
2-3-5	Bidding and construction for first site(s)	May 2016	November 2016

2-4 Historic Stream Corridors

Based on work performed relative to what was originally described as “open stream connections”, the concept has shifted toward the use of historic stream corridors as a natural placement location for green infrastructure practices. If historic stream or ditch flow is located in enclosed sewers in proximity to these locations that provides an opportunity to redirect those flows into green infrastructure practices. Historic stream corridors are, in essence, a location where the natural topography allows for the creation of stormwater practices that can be used for runoff from streets and parcels in the vicinity. The current concept includes:

Identifying historic stream corridors and comparing these corridors to existing topography.
Identifying publically owned parcels in the vicinity of the historic stream corridor; practice concepts.
Identification of potential areas tributary to practice areas and means of routing flows.
Coordination of projects with existing utilities.
Concept development and public outreach.
Project definition and design.

The milestone schedule for these efforts is:

Task ID	Activity	Target Start	Target Complete
2-4-1	Identify and prioritize opportunities; evaluation of institutional issues.	**August 1, 2014**	September 30, 2015
2-4-2	Develop conceptual project configurations	July 1, 2015	November 30, 2015
2-4-3	Public Outreach and agency input	December 1, 2015	June 30, 2016
2-4-4	Design of phase I project	July 1, 2016	June 30, 2017

2-5 Municipal Park Green Infrastructure/Flow Management

Management of stormwater in municipal parks is expected to include management of impervious surfaces within the park or redirecting stormwater from adjacent roads into green infrastructure practices in the park. Storm water management projects on municipal park land will be coordinated with General Services – Parks staff. Many of the parks have local citizen groups that also will be included in the project development. Stoepel Park has been the subject of design efforts and is expected to move into implementation in FY 2015-2016.

Based on work performed in FY 2014-2015, develop a prioritized list of parks projects that incorporates community input.
Based on the prioritized list, it is expected that one or more prioritized projects will be advanced to implementation.

Stoepel Park. Complete design and implement project.

The estimate milestone schedule for these efforts is:

Task ID	Activity	Target Start	Target Complete
2-5-1	Identify and prioritize opportunities; seek community input in prioritization. Initial project selections.	**August 1, 2014**	October 31, 2015
2-5-2	Stoepel Park final design.	January 1, 2015	December 31, 2015
2-5-3	Design for other selected site(s) 2016	November 1, 2015	April 2016
2-5-4	Select project and develop an implementation schedule	April 1, 2015	May 31, 2015
2-5-5	Stoepel Park bidding and construction	February 2016	November 2016
2-5-6	Bidding and construction for other selected sites	May 2016	November 2016

2-6 Transportation Corridor Flow Management

Transportation corridor flow management has focused on integrating green infrastructure with DPW projects. Projects designed and bid in FY 2014-2015 will be implemented in 2016, and other projects will be developed. Projects anticipated in FY 2015-2016 include the following.

Coordinate with the Detroit Department of Public Works (DPW) on roadway resurfacing projects for 2016. Standard details have been developed for permeable pavement projects that could be easily repeated. DWSD may also propose some additional locations based on suitability for green infrastructure. DPW's road resurfacing list is updated annually between late summer and early fall, for construction the following summer.

DWSD will coordinate with the Wayne County Roads Division to update potential projects where green infrastructure could be applied. Wayne County has minimal projects in the URT included in their current capital improvement program.

DWSD will coordinate with MDOT for potential projects. MDOT has no planned significant capital projects on road corridors in the URT.

DWSD will evaluate additional locations for projects in road corridors. In particular, DWSD has begun exploration of bioswales in boulevard areas. These opportunities are being evaluated at more of a neighborhood scale, although all work is anticipated to be performed in public rights-of-way or parcels.

The milestone schedule for these efforts is:

Task ID	Activity	Target Start	Target Complete
2-6-1	Early coordination with Detroit DPW. Review planned road improvement projects and identify green infrastructure project opportunities.		Annually
2-6-2	Early coordination with Wayne County Roads Division. Review planned road improvement projects and identify green infrastructure project opportunities.		Annually
2-6-3	Early coordination with MDOT. Review planned road improvement projects and identify green infrastructure project opportunities.		Annually

Task ID	Activity	Target Start	Target Complete
2-6-4	Identify and prioritize opportunities; evaluation of institutional issues.	**August 2014**	**January 2015**
2-6-5	Develop conceptual designs, five sites	**October 2014**	**October 2014**
2-6-6	Select projects and develop an implementation schedule	**November 2014**	**November 2014**
2-6-7	Final design and construction. Development of a post construction operation and maintenance plan. (DPW-6968)	**December 2014**	December 2015
2-6-8	Refine action plan for other opportunities	**June 1, 2015**	December 31, 2015
2-6-9	Tireman and Constance Phase II Projects Final Design and Construction	**May 2015**	June 2016
2-6-10	Identification of future projects	**April 2015**	November 2015

ACTIVITY 3 - CONTINUED IMPLEMENTATION

DWSD has previously participated in a series of projects including downspout disconnection, demolitions and site restoration, and planting trees in the area. Each of these activities will be continued in the future, and adapted for current conditions. Current focus for each of these projects includes the following:

3-1 Downspout Disconnection - Homes

Disconnection of downspouts for homes, including single family residential, duplex and townhomes requires working with the property owner, resident and BSEED. The primary mechanism to accomplish these disconnections, outside of green infrastructure funding, will be through code compliance and education. DWSD previously considered provided financial support to property owners who are otherwise unable to disconnect downspouts. The level of effort associated with this work is under review.

The milestone schedule for these efforts is:

Task ID	Activity	Target Start	Target Complete
3-1-1	Policy, and process elements	**June 1, 2014**	**November 30, 2014**
3-1-2	Outreach materials	**August 1, 2014**	TBD
3-1-3	Coordination with major landlords	**November 1, 2014**	TBD
3-1-3	Coordination with neighborhood groups or organizations	**November 1, 2014**	TBD
3-1-4	Downspout disconnections (SFR)	Ongoing	TBD

3-2 Downspout Disconnection - Multi-Family Residential, Commercial, and Industrial

Opportunities for disconnection of downspouts for multi-family residential, commercial, industrial and institutional properties are limited unless other green infrastructure practices are included. This is due to the lack of lawn area on most parcels into which downspouts could be discharged. Downspout disconnection for these properties will therefore be included in greening of public parcels (for public sites) or through property owner actions associated with the drainage charge credit system (private parcels). The code review work being performed under Activity 1-

1-4 will help streamline private property discharge of roof runoff into green infrastructure practices, for both new development and retrofits.

This item will be discontinued as an independent item.

Task ID	Activity	Target Start	Target Complete
3-2-1	Physical characterization of properties	**June 1, 2014**	**January 31, 2015**
3-2-2	Roof water management standard approaches	**October 1, 2014**	discontinued
3-2-3	Public buildings pilot downspout disconnection projects	Moved to task 2-3	
3-2-4	Downspout disconnection strategy implementation (non-SFR)	Moved to task 2-3	

3-3 Demolitions and Site Restoration

Residential demolitions in the City of Detroit are managed through the Detroit Land Bank Authority (DLBA) and the Detroit Building Authority (DBA).Commercial demolitions involve DBA and BSEED.

DWSD's strategy will be to support demolitions which cannot be funded through other mechanisms and will result in removal of significant impervious area. As such, these demolitions may include isolated single-family homes or non-single-family residential properties. DWSD funded demolitions will require control of runoff from the site as a condition of the funding.

DWSD is in regular communication with the DLBA and the DBA so that specific opportunities may be considered as the demolition activities continue. These may include such DWSD involvement as: assisting with restoration of large demolition sites, such as school properties, which could also be used for stormwater management from surrounding areas.

Other ongoing activities relate to demolitions. These activities include:

Activity 1-5 Structure Demolition and Lot Greening Standards
Activity 2-1 Small Scale Greening
Activity 2-2 Large Scale Greening

The milestone schedule for these efforts is:

Task ID	Activity	Target Start	Target Complete
3-3-1	Budget planning for building demolitions	Evaluate based on specific opportunities	
3-3-2	Coordinate with DLBA and DBA for building demolitions and site restoration/ use for stormwater management	Ongoing	

3-4 Tree Planting

Tree planting efforts were advanced in FY 2014-2015, with more than double the planned number of trees planted in the fiscal year. DWSD has no specific plans to plant additional trees in FY 2015-2016 outside of specific green infrastructure projects.

The milestone schedule for these efforts is:

Task ID	Activity	Target Start	Target Complete
3-4-1	Evaluate opportunities	**August 1, 2014**	**October 31, 2014**
3-4-2	Plant approximately 800 additional trees in the NWI	**August 1, 2014**	**December 31, 2014**

Task ID	Activity	Target Start	Target Complete
3-4-2	Identify projects	**November 1, 2014**	**January 31, 2015**
3-4-3	Select, schedule and implement projects	**Fall 2014**	**June 30, 2015**

ACTIVITY 4 - LONG TERM PERFORMANCE

The objective of the Green Infrastructure Program is ultimately to reduce CSO discharges. As green infrastructure projects are implemented, a better understanding will be developed of the performance of green infrastructure. This improved understanding will support an update to the "Supplemental Report on Alternative CSO Controls for the Upper Rouge River" (dated April 30, 2010). This is a requirement of the NPDES permit, if DWSD choses to amend the current plan, and is currently due January 1, 2017.

Specific activities planned for 2016 include:

- Evaluation of performance of various green infrastructure practices. This will include collaboration with the work being performed under the GLRI project to better quantify performance of vacant lands of various type, as well as selective monitoring of installed green infrastructure practices.
- Evaluation of larger scale implementation of green infrastructure and its cumulative estimated impact. DWSD is currently evaluating several neighborhood scale implementation projects on the order of 80 – 120 acres. This will consider both implementation feasibility from a technical and property ownership perspective and from a cost/ benefit perspective.
- Legal agreements between DWSD and the property owners for green infrastructure sites will be prepared to ensure long-term sustainability. The agreements will be prepared in conjunction with the project design and construction. The prototype projects will likely be the first projects for which formal legal agreements are developed.

Task ID	Activity	Target Start	Target Complete
4-1	Sewer system flow monitoring program and updated model in support of CSO frequency and volume determination	**January 1, 2014**	**April 1, 2015**
4-2	Development of monitoring plans and implementation to evaluate questions of hydrology and green infrastructure performance (specifically ecological restoration of demolition sites and coordination with GLRI).	**September 2014**	September 30, 2016
4-3	Study to evaluate benefits that can be achieved through green infrastructure implementation based on projects implemented and data collected (specifically evaluation of neighborhood scale implementation)	August 1, 2015	June 30, 2016
4-4	Amendment to the Supplemental Report on Alternative CSO Controls for the Upper Rouge	January 1, 2016	January 1, 2017
4-5	Legal agreements for long-term sustainability.	**January 1, 2015**	Ongoing

ACTIVITY 5 - STAKEHOLDER AND COMMUNITY ENGAGEMENT

DWSD will continue to work with key partners to collaborate on stakeholder involvement and education activities with the goal of gaining insight, input, implementation support, and balanced public policy. Efforts will also work to promote implementation of green infrastructure on parcels. Stakeholder and community engagement will be a fundamental component of code and ordinance development, each implementation project and the drainage charge system.

5-1 Green Infrastructure Website

DWSD's website will be the primary distribution channel for many of the stakeholder outreach materials and messages, as well as technical documentation, on green infrastructure. The website will continue to be updated throughout FY2016 with new project information and general education materials.

Task ID	Activity	Target Start	Target Complete
5-1-1	Draft Website	**February 2015**	**April 2015**
5-1-2	Final Website	**May 2015**	**June 2015**
5-1-3	Website Updates	Ongoing	

5-2 Green Credits Program Stakeholder Engagement

This activity is the outreach component associated with Drainage Charge System and the credit system under development. The stakeholder program is expected to convene a customer group that would help to identify specific areas of ratepayer concern, help define critical processes and needs of the customer community and gather input onto the credit program. As requested by current drainage charge customers, DWSD has been meeting to review site characteristics and to explain the drainage bills.

The milestone schedule for these efforts is:

Task ID	Activity	Target Start	Target Complete
5-2-1	Engagement Program (identification)	July 1, 2015	September 30, 2015
5-2-2	Engagement Program (input sessions)	October 1, 2015	December 31, 2015
5-2-3	Engagement Program (notification)	January 1, 2016	June 30, 2016

5-3 Green Credits Toolbox

The green rewards toolbox is envisioned as standardized approaches to green infrastructure on private parcels. These "tools" will support in both site design (to support the codes/ ordinances) and in drainage charge reductions.

The milestone schedule for these efforts is:

Task ID	Activity	Target Start	Target Complete
5-3-1	Draft Technical Support Materials	May 1, 2015	January 31, 2016
5-3-2	Final Technical Support Materials	February 1, 2016	June 30, 2016

5-4 Green Credits Training Workshops

DWSD will develop and implement two types of training workshops to promote implementation of green infrastructure and participation in the Green Credits program: 1) training for city department staff and other local partners that will help educate ratepayers on DWSD's programs and requirements; and 2) training for ratepayers seeking to learn more about the storm water drainage charge and how to obtain a discount through the Green Credits program. The types of workshops may be modified or expanded to specifically target other audiences such as consulting engineers, small businesses or faith community/non-profit properties. Workshops will be tailored to the audience and present instruction in the various materials that have been developed.

The schedule for these activities will parallel the drainage charge system development. Initial expectations include:

Task ID	Activity	Target Start	Target Complete
5-4-1	Internal City Staff Workshop	May 1, 2015	December 2015
5-4-2	Public workshops	February 1, 2016	December 2016

5-5 Green Infrastructure Case Studies and Demonstration Projects

DWSD will highlight examples of public and private GI projects through case studies, distributed as fact sheets on the DWSD Green Infrastructure website or through presentation materials. Fact sheets have already been started for DWSD funded projects and will be expanded for select additional projects.

The milestone schedule for these efforts is:

Task ID	Activity	Target Start	Target Complete
5-5-1	Draft Case Studies	**January 2015**	Ongoing
5-5-2	Final Case Studies	Ongoing	Ongoing

5-6 Green Infrastructure Forum

DWSD recognizes the importance of sustaining communication and coordination among City department staff and key green infrastructure partners throughout the city that play a role in green infrastructure implementation. DWSD will plan and host, with assistance from other key green infrastructure partners, a regularly scheduled forum or conference for a variety of stakeholders to discuss issues related to green infrastructure. The FY 2016 forum will occur in fall 2016.

The milestone schedule for these efforts is:

Task ID	Activity	Target Start	Target Complete
5-6-1	2014 – 2015 recap green infrastructure forum		May 2015
5-6-2	2016FY forum		Fall 2015

5-7 Stakeholder Involvement and Education Strategy

DWSD is prepared a draft Stakeholder Involvement and Education Strategy to support the Green Infrastructure Program, and is currently implementing aspects of the plan. This plan will be reviewed in FY2016 to optimize efforts and address gaps.

The milestone schedule for these efforts is:

Task ID	Activity	Target Start	Target Complete
5-7-1	Draft Strategy	**June 1, 2014**	**September 30, 2014**
5-7-2	Final Strategy	Document remains a working draft	

5-8 Overarching Green Infrastructure Educational Campaign

In FY2016, DWSD will continue to have conversations with key partners about developing and implementing an overarching green infrastructure educational campaign. These activities represent an ongoing effort.

The milestone schedule for these efforts is:

Task ID	Activity	Target Start	Target Complete
5-8-1	Overarching green infrastructure educational campaign	Ongoing	

REFERENCES

Detroit Water and Sewerage Department. (2014a). *Green Infrastructure Plan for the Upper Rouge Tunnel Area.* Prepared by Tetra Tech, Inc.

Detroit Water and Sewerage Department. (2014b). *Green Infrastructure Progress Report Upper Rouge Tunnel Area, Fiscal Year July 1, 2013 - June 30, 2014, NPDES Permit No. MI0022802.* Prepared by Tetra Tech, Inc.

Hawkins, R. H. (2009). *Curve Number Hydrology: State of the Practice.* Reston, VA: American Society of Civil Engineers.

NRCS, USDA. (2004). *National Engineering Handbook: Part 630 - Hydrology.* Washington, DC, USA: USDA Soil Conservation Service.

State of Michigan Department of Environmental Quality. (2013). *Permit No. MI0022802, Authorization to Discharge Under the National Pollutant Discharge Elimination System - Detroit Water and Sewerage Department.* Retrieved July 15, 2015, from http://www.michigan.gov/documents/deq/deq-wrd-npdes-DetroitWWTP_Permit_415424_7.pdf