



Green Infrastructure Progress Report Upper Rouge Tributary Area

Fiscal Year July 1, 2017 – June 30, 2018

NPDES Permit No. MI0022802

Detroit Water and Sewerage Department

735 Randolph
Detroit, MI 48226

August 1, 2018

**Green Infrastructure Program
Upper Rouge Tributary Area**

Annual Progress Report

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ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
BSEED	Buildings, Safety Engineering and Environmental Department
CSO	Combined Sewer Overflow
DBA	Detroit Building Authority
DLBA	Detroit Land Bank Authority
DPSCD	Detroit Public Schools Community District
DPW	Department of Public Works
DWSD	Detroit Water and Sewerage Department
EPA	Environmental Protection Agency
FY	Fiscal Year
GLWA	Great Lakes Water Authority
GSI	Green Stormwater Infrastructure
HRD	Detroit Housing and Revitalization Department
MDEQ	Michigan Department of Environmental Quality
MDOT	Michigan Department of Transportation
MG	Million Gallons
MOU	Memorandum of Understanding
NPDES	National Pollutant Discharge Elimination System
OPC	Opinion of Probable Cost
PCSWMO	Post-Construction Stormwater Management Ordinance
RPR	Resident Project Representative (for construction)
TAC	Technical Advisory Committee
TNC	The Nature Conservancy
URT	Upper Rouge Tributary Area/ Upper Rouge Tunnel

EXECUTIVE SUMMARY

This report provides an update on the status of green stormwater infrastructure (GSI) efforts by the Detroit Water and Sewerage Department (DWSD) for FY2018. It fulfills the annual regulatory reporting requirements associated with the National Pollutant Discharge Elimination System (NPDES) permit. The City's program focuses specifically on the Upper Rouge Tributary Area (URT).

DWSD continues to support its choice to use GSI both to aid in the control of CSO discharges and to improve the quality of life in the City and strives to provide conscious and thoughtful investments in GSI in locations within the City where there is the potential to reduce basement backups and street flooding, beautify neighborhoods, as well as to reduce combined sewer overflows.

PROGRESS OF MAJOR INITIATIVES IN FY2018

With the basic understanding that GSI programs are, by nature, a mix of actions from public and private entities, DWSD's efforts are intended to continue to create a policy and process framework that will drive the greatest possible implementation of GSI. These efforts have included the development of institutional structures that change the way stormwater is managed on parcels, collaboration with other City of Detroit departments to encourage GSI as a component of each project, implementing projects that support neighborhoods, and evaluation of those projects in coordination with research partners.

The four primary actions that have been undertaken by DWSD, the City of Detroit, and partner public agencies that will result in changed stormwater management are discussed below:

Post-Construction Stormwater Management Ordinance (PCSWMO)

DWSD is working with other City departments on updates to the City's codes and ordinances with the intent of incentivizing stormwater management on new development and redevelopment. The work has included so called "Greening of the Code" updates, which were included within a set of compiled code updates called the 5th General Text Amendment, that were passed by City Council in November 2017. These updates are intended to facilitate the implementation of GSI practices.

This work also included the development, review and legislative action on an update of Article III *Sewer and Drains of Chapter 56 Utilities*. This is the primary mechanism for more effective stormwater management on development and redevelopment sites. In FY2018, the draft ordinance was finalized by DWSD and is under review by various affected City departments, as it is being prepared for City Council action.

DWSD's approach as embodied in the PCSWMO meets and exceeds the permit requirement. Not only does the PCSWMO apply to projects that would require a Part 41 construction permit, it also applies to reductions or replacement of impervious cover above a certain threshold.

The estimated schedule for the PCSWMO implementation was submitted to MDEQ on April 1, 2017. The letter identified multiple steps in the process of bringing the ordinance to City Council, culminating in August 2018. This effort is proceeding according to schedule.

DWSD Implemented GSI Projects

Four DWSD construction projects were completed and contracts closed (with the exception of maintenance periods). These included Stoepel Park No. 1, Liuzzo Park, transportation corridor projects (PW-6968, joint with DPW) and Tireman bioswales. DWSD also initiated two projects with the Parks and Recreation Department (Crowell and O'Shea) which began construction in April and May 2018, respectively (Figure 1). A shift was made to neighborhood scale projects, with planning and design of several such projects in process. Monitoring of existing projects helped define the performance of constructed practices, and a better understanding of the geotechnical limitations in the City of Detroit shifted the emphasis of projects to those that would remove volume from the system by redirecting stormwater to the Rouge River or have a primary emphasis on detention.

**Figure 1 Construction Performed in FY2018
Crowell PaveDrain (left) and O'Shea (right)**



Drainage Charge Credit System

DWSD continued to promote the drainage charge program as an institutional measure that provides an incentive for customers to implement GSI practices. This included the launch of the Capital Partnership Program that provides up to \$5 million annually for capital support in a matching grant program. DWSD also collaborated with other departments such as PDD and BSEED to promote GSI during site plan reviews for redevelopment and development projects.

Demolition Program

The demolition program continued in FY2018, including efforts by the Detroit Land Bank Authority (DLBA) and the Detroit Building Authority (DBA). This work has largely been performed by other City of Detroit departments or agencies, specifically BSEED from 2010 – 2013 and DLBA from 2014 – 2018. DLBA has adopted standards of site restoration, based on the input of DWSD to the demolition specification, that are designed to promote the reduction of runoff.

NPDES METRICS

DWSD's NPDES permit requires certain reporting and expenditure metrics and also establishes a volumetric reduction goal. DWSD's NPDES permit term expired in 2017 and a new permit is under negotiation between DWSD and MDEQ. Since the new permit has not been issued, DWSD is operating under the requirements and conditions of the expired permit as permitted by the MDEQ. Therefore, the basis for documentation is unchanged from prior report versions. The progress reporting requirement of this permit is fulfilled by this annual report.

FY2018 EXPENDITURES

In FY2018, DWSD's Green Stormwater Infrastructure program expended funds or awarded projects as shown in Table 1. A more detailed description of expenditures is included in Section 5.0, Investment in Green Infrastructure.

Table 1 FY2018 Expenditure Summary

Effort	Expenditures 2018	Cumulative FY2010-FY2018	Comments
Code and Ordinance Efforts	\$ 4,542	\$ 167,318	Work for ordinance development and implementation, prorated to URT share (27.1%)
Project Management and Planning	\$ 532,946	\$ 2,655,177	DWSD staff and consultant services
Drainage Charge Program	\$ -	\$ -	Not included in NPDES permit spend.
Outreach	\$ 82,138	\$ 487,496	GSI Program Outreach, additional outreach efforts included in project implementation
Tracking Impervious Cover Analysis	\$ 58,283	\$ 113,586	Impervious cover (prorated); GIS data management
Project Implementation	\$ 2,126,658	\$ 13,395,011	Design and Construction of GSI
Maintenance	\$ 40,951	\$ 40,951	
2018 Spend	\$ 2,845,519	\$ 16,859,540	
Project Implementation (bid but not spent)	\$ 989,340	\$ 989,340	Includes PC-799 (Crowell/Ecosites) and PC-800 (O'Shea)
Total Obligated	\$ 3,834,860	\$ 17,848,880	
Pending		\$ 5,400,000 \$ 225,000	Oakman Blvd. Joy Road
Total with Future Construction		\$ 23,473,880	

1.0 INTRODUCTION

The Detroit Water and Sewerage Department (DWSD) and the Great Lakes Water Authority (GLWA) are jointly 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 to pay for new projects. The program encompasses a 25-year phased plan that focuses on green stormwater infrastructure (GSI) solutions along with "right-sized" conventional CSO control facilities. DWSD is responsible for the implementation of the GSI program.

This document is the Green Stormwater Infrastructure Annual Progress Report for FY2018, which corresponds to the time period of July 1, 2017 – June 30, 2018. An annual progress report is required according to the permit (NPDES MI0022802 Part I.A.15.d.5.a) that:

- 1) **Summarizes the GSI 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 GSI 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 GSI program.**
- 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.**

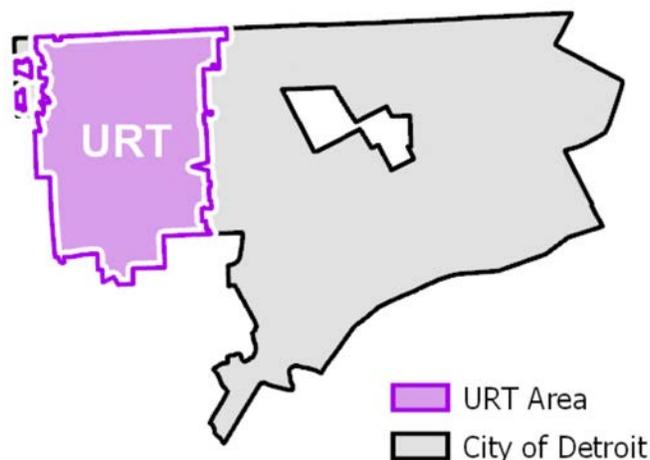
PROGRAM GEOGRAPHY AND BACKGROUND

The Green Stormwater 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 27.1% of the City of Detroit and is illustrated in purple in Figure 2. This area was identified for a program of both traditional CSO controls and green stormwater infrastructure in 2010, following the cancellation of the Rouge River CSO tunnel project due to escalating costs and financial challenges. The URT includes a complex network of combined sewers. 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, Seven Mile, or Puritan-Fenkell CSO Facilities. The area includes a variety of residential, industrial, and commercial neighborhoods which are in varying states of stability. The potential of stormwater to be converted to CSO discharges is a factor in prioritizing implementation efforts and locations, while the local socio-economic conditions are a determinant in the type of project implemented.

DWSD's GSI Program has seen a series of major changes in organizational structures and other events that influence the context within which the Program must function. The major institutional changes that occurred from FY 2013 - FY 2017 were discussed in previous reports.

With 138 square miles of GSI opportunity, DWSD sees the potential to be a benchmark for stormwater management using green stormwater infrastructure. The department's executive management team is emphasizing the potential for Detroit to be a national leader in green stormwater infrastructure. The working relationships between the DWSD GSI Program, City of Detroit departments, and other authorities and groups continues to be cooperative and positive. DWSD's GSI team also facilitates the workgroup that has identified a citywide definition and vision of green stormwater infrastructure and is developing metrics to benchmark progress toward becoming a greener city.

Figure 2 Upper Rouge Tributary Area



The focus of activities for DWSD in FY2018 has included GSI project implementation, identification and development of future projects, launch of the revised drainage charge program and credit system, and continued building of institutional structures to support internal and external project coordination. Long-term planning within the URT has also been a major focus of FY2018.

PROGRAM OVERVIEW

The ultimate regulatory goal of GSI implementation is a reduction in stormwater entering the combined sewer system, which, in turn, will help to reduce untreated 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. Many of the actions that will impact the quantity of flow entering the sewer system will be a result of activities such as redevelopment or demolition and stormwater management retrofits by private property owners seeking to reduce their drainage charges. As a result, DWSD is implementing a three-pronged approach for better stormwater management. The three approaches, as seen in Figure 3, include code and ordinance modifications, implementation of a drainage charge credit system, and project implementation in coordination with other activities and partners.

Figure 3 DWSD's Approach to Stormwater Management



2.0 PLAN IMPLEMENTATION – FY2018

The Green Stormwater Infrastructure Plan was 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 GSI in the sewer sheds for 17 CSO 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, 2016.

DWSD's Green Stormwater 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 is and will continue to be coordinated with other activities in the City that impact stormwater runoff. Activities fall into two primary groups:

- **Institutional:** Efforts associated with codes and ordinances, drainage charge and other department/agency interactions.
- **GSI Implementation:** Direct spending of DWSD on GSI projects. These activities include planning, design and construction, and public outreach.

A summary of activities in FY2018 is described in this section.

INSTITUTIONAL EFFORTS

Each year, the annual report highlights the various institutional changes and activities that impact the GSI Program. As in prior years, the City of Detroit continues to work toward policies and processes that include GSI as the standard approach for project implementation. Internal to DWSD, in collaboration with the GSI community in Detroit and in partnership with the Great Lakes Water Authority (GLWA), structures are gradually being established to facilitate project implementation.

Citywide Collaboration and Commitment.

The momentum realized on the GSI program is credited to the highly collaborative effort of entities such as the Detroit General Services Department (DGSD), Detroit Land Bank Authority (DLBA), the Building, Safety and Environmental and Engineering Department (BSEED), the Planning and Development Department (PDD), the Department of Public Works (DPW), the University of Michigan Water Center, and many community groups including Grandmont Rosedale Development Corporation, Friends of Rouge Park, Cody Rouge Community Action Alliance, Warrendale Community Organization, and the Viola Liuzzo Park Association.

Significant DWSD events include:

- Advanced the Post-Construction Stormwater Management Ordinance that encourages green infrastructure implementation to City Council.
- Passed City Code updates that make implementation of GSI practices more feasible for property owners.
- Developed the Stormwater Management Design Manual that accompanies the proposed stormwater ordinance for use by residents and private developers within the City. The manual will be uploaded to the City of Detroit's website for ease of access and reference.
- Continued the drainage charge credit program for commercial and industrial properties with the City of Detroit with full implementation of the residential program to be complete in FY2019.
- Oversight and review of stormwater improvements through site redevelopment by the newly developed stormwater management group (SMG).
- Augmented SMG staff by hiring of multiple staff with the focus on long term implementation and management of DWSD's stormwater program and green policies.
- Procured DWSD's maintenance crews and began use of permeable pavement cleaning equipment for continued use on green stormwater infrastructure throughout the City.
- Developed a Municipal Stormwater Maintenance Manual for use by the City maintenance personnel responsible for caring and maintaining the practices.

Status of GSI Plan Activities

No.	Activities	Proposed Activities and Schedule	Current Status
Activity 1 – Policies, Procedures and Standards			
1-1	Codes and Ordinances	Code updates “greening of the code” September 2017 Post-construction stormwater management ordinance August 2018	Passed City Council November 2017 Under City of Detroit review
1-2	Stormwater Design Manual (for Stormwater Ordinance)	Draft September 2017	Draft completed – under internal department review
1-6	Public Stormwater Maintenance Guidance	Expand existing information into a guidance document by December 2017	Complete October 2017
1-8	Tracking System	Tracking systems ongoing	Ongoing

Stormwater Ordinance and Design Manual

Stormwater Ordinance

In FY2015, DWSD completed a review of existing codes and ordinances and presented findings in a workshop with the City departments. As a result of the review, DWSD began the process of developing the draft post-construction stormwater management ordinance in cooperation with the Technical Advisory Committee (TAC) that was formed with DWSD and other departments. During FY2016, The Nature Conservancy (TNC) conducted an options analysis to see which alternative compliance mechanisms (e.g., off-site mitigation, payment-in-lieu) might be appropriate and beneficial for the City of Detroit and evaluated the impacts to developers who will be regulated by the new rules. During the winter of 2016 and the spring of 2017, TNC and DWSD met numerous times to determine how off-site mitigation could be implemented in the City. Alternative compliance options were added into the draft ordinance in 2017 based on the analysis conducted by TNC and DWSD. The draft ordinance was then finalized for internal review by DWSD and other City departments. The post-construction stormwater ordinance is currently being reviewed with City Council members, developers and City departments for stakeholder input prior to presentation for adoption by City Council.

Simultaneous to the post-construction stormwater ordinance development effort, the City completed the effort to “green the code”, making implementation of GSI practices more feasible for property owners. These updates to the code included items such as:

- Updates to interior parking lot landscaping to remove language to allow for inlets at island curbing and remover requirements for “raised islands”.
- Remove barriers and allow more flexibility regarding permeable parking lot surfaces.
- Support multi-use of screening areas and allow for vegetative barriers.
- Allow trees to count toward shade tree requirements.
- Allow ground-level, non-roof recreational space to be permeable or landscaped.

The proposed code updates were incorporated into the 5th General Text Amendment revisions to the City’s code. These passed City Council in November 2017.

In FY2019, DWSD will continue to advance the PCSWMO. It should be noted that all actions described below are subject to the legislative process which will dictate the implementation schedule. The following activities are envisioned to be part of FY2019:

- Post-construction stormwater management ordinance:
 - Continue the development of post-construction stormwater management ordinance.
 - Present draft final ordinance to the City Planning Commission and City Council for review and adoption.
- Continue coordination with BSEED, PDD, DPW and other relevant departments that manage the zoning, building codes and site reviews/ permitting in the City.
- Conduct stakeholder outreach regarding final draft of PCSWMO and code revisions.

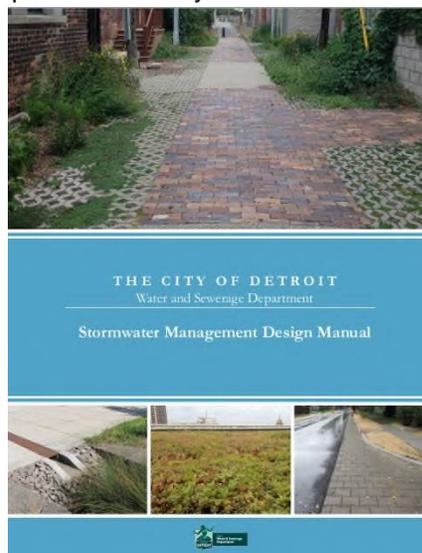
- Continue to coordinate the development of the Stormwater Management Design Manual with the modifications to the City's codes and ordinances.

Design Manual

The Stormwater Management Design Manual was developed as a collaborative effort between City departments and is a technical manual intended to accompany the requirements in the Proposed Post-Construction Stormwater Management Ordinance. As part of the review, technical experts in other City Departments and committees reviewed the document and provided comment.

This manual will serve as a resource manual for both applicants and City personnel to ensure compliance with the Post-Construction Stormwater Ordinance. The manual will also address the permit requirements (Part I.A.15.d.9) pertaining to stormwater controls for projects requiring a Part 41 construction permit issued by MDEQ. In addition to general green stormwater infrastructure design guidance, the manual provides information on the following:

- 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 that will address water quantity and quality considerations. Design standards for both the combined sewer areas and the separately sewer areas will be addressed.
- Overview of drainage design methodologies and acceptable practices.
- Stormwater control measure design considerations for systems such as green roofs, water harvesting, bioretention, tree plantings, porous pavements, and detention and retention basins.



The manual is divided into the following chapters and once finalized, will be uploaded to the City of Detroit website for public access and use.

The descriptions below provide an overview of each chapter in the Design Manual.

Chapter 1 – Introduction

Chapter 2 – Regulatory Requirements

This chapter describes the regulatory requirements and other programmatic drivers for stormwater management in Detroit, with emphasis on the PSCSMO requirements related to water quality, channel protection, and flood control.

Chapter 3 – Site Design and Stormwater Management

This chapter presents guidelines and considerations for designing site development projects including site assessment, site and landscape design principles, and preliminary concept development. The chapter also illustrates how to integrate stormwater management components into site designs for a variety of building sites, open spaces, and building types.

Chapter 4 – Hydrologic Procedures

This chapter provides precipitation data, as well as acceptable methods for calculating runoff volumes and peak discharge rates.

Chapter 5 – Drainage Conveyance

This chapter provides standards and requirements for the design of storm sewer systems to ensure consistency with the current requirements for the City's public roadways and ensure the safe and effective flow of stormwater through conveyance systems that are part of the site design.

Chapter 6 – Soil, Aggregates and Water

This chapter contains general information on the physical properties of soil and aggregates, with a focus on how water moves through these materials and the need for geotechnical information to support the design and construction of stormwater control measures, particularly GSI practices intended to promote infiltration.

Chapter 7 – Detention Practices

This chapter discusses the different types of surface and subsurface detention practices, including basic detention basins, extended dry detention, and extended wet detention, and summarizes technical information necessary to design, construct, and maintain these stormwater control measures.

Chapter 8 – Bioretention

This chapter introduces bioretention practices, including bioswales and tree box filters, and summarizes the technical information for design, construction, and maintenance. Bioretention is a very flexible practice that can be used in a variety of settings and is the most common GSI practice.

Chapter 9 – Infiltration Practices

This chapter covers the technical information for designing, constructing, and maintaining infiltration basins and trenches. Infiltration basins and trenches are designed to encourage percolation and ground water recharge of stormwater runoff. Infiltration basins are typically larger shallow surface impoundments used to manage stormwater runoff from areas between 5-50 acres while infiltration trenches are narrow, linear practices that are used to manage stormwater runoff from areas less than 5 acres, like along a roadway or parking lot.

Chapter 10 – Permeable Pavement

This chapter summarizes the information for designing, constructing, and maintaining several types of permeable pavement, including porous asphalt, pervious concrete, pervious pavers, and grid pavement systems. Permeable pavement allows streets, parking lots, sidewalks and other impervious covers to retain the infiltration capacity of underlying soils while maintaining the structural and functional integrity of traditional pavements.

Chapter 11 – Rainwater Harvesting

This chapter summarizes the information for designing, constructing, and maintaining water harvesting practices such as cisterns. Water harvesting is a practice that captures stormwater runoff often from rooftops for later use as irrigation or alternative grey water uses between storms, providing a potential water bill savings. Cisterns are larger systems (up to 10,000 gallons or even larger) that are more often used on commercial or industrial sites and can be placed aboveground or below ground.

Chapter 12 – Green Roofs and Walls

This chapter summarizes the information for designing, constructing, and maintaining green roofs and walls that capture rainfall in a layer of vegetation and growing media, with excess rainwater directed to roof drains and downspouts.

Chapter 13 – Stormwater Wetlands

This chapter summarizes the information for designing, constructing, and maintaining stormwater wetlands, shallow-water ecosystems designed to treat stormwater runoff in low-lying areas or along river corridors where water tables are high.

Chapter 14 – Manufactured Treatment Systems

This chapter describes the DWSD review and approval process for proprietary manufactured treatment systems. Manufactured treatment relies on a variety of mechanisms to remove pollutants such as sediment, trash, and floatable debris, from stormwater runoff. Two common types of manufactured treatment devices include hydrodynamic separators which use chambers to trap sediment and filtering systems which use a settling chamber then filter to remove specific pollutants.

Maintenance of GSI Practices

Regular care and maintenance of the GSI practices is crucial to maintaining the practices' effectiveness at managing stormwater. In order to ensure that proper and timely maintenance is being performed, DWSD developed a Municipal Stormwater Maintenance Manual and a GIS based tracking program. These two tools will be used together to identify the necessary maintenance tasks and the frequency of conducting these maintenance tasks for the DWSD constructed GSI practices.

The Municipal Stormwater Maintenance Manual was developed in FY2018 to identify specific methods and approaches to maintaining the structures constructed for each GSI practice. Each component of the GSI practice has a standard operating procedure (SOP) outlining the required maintenance tasks and the inspection frequency. Also developed were site specific information packets detailing the site location and SOPs needed during inspections at each site. All structural tasks, including trench drains, catch basins, inlet structures, outlet structures and underground pipes, will be maintained by DWSD’s in-house staff. Maintenance of the vegetation components is currently under contract, DWS-904, awarded to WCI contractors. The contract is a three-year duration.

DWSD is implementing Cityworks, a GIS-based asset management program, to perform and track GSI practice inspections. The content developed in the maintenance manual will be imported into a Cityworks workflow that automatically flags when inspections need to be performed for each asset within a GSI practice (such as for a specific underdrain at the Evergreen Vacant Lot). Cityworks will also allow field crews to fill out maintenance forms digitally, track when inspections have been completed and by whom, track the costs associated with the maintenance of each asset, and provide a history of all inspections performed at that asset. The GIS-based asset management tool is anticipated to be fully implemented within FY2019.

Impervious Cover Reduction

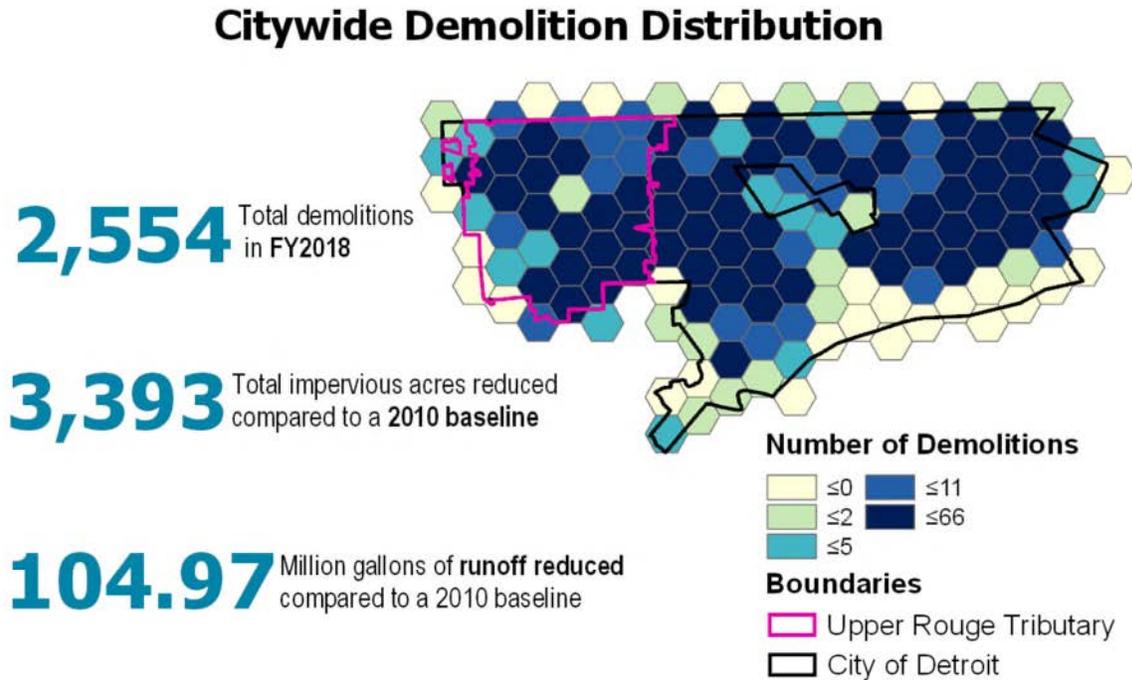
DWSD has tracked impervious cover in the City of Detroit for stormwater management and drainage charge related purposes. Demolitions have historically resulted in significant removal of impervious cover. DWSD has tracked the overall impervious cover change as a result of demolitions since 2010. Calculations reported in this report are based on the 2010 impervious cover layer, the 2015 impervious cover layer and the demolition tracking that is in the City’s “demolition tracker”. Future efforts will focus on the runoff reduction for GSI implemented projects and management of stormwater from new and redevelopment projects.

The estimated recent and cumulative impact of demolitions is summarized in Table 2. Locations of URT demolitions that occurred in FY2018 are shown in Figure 4. There were 807 documented demolitions in the URT in FY2018.

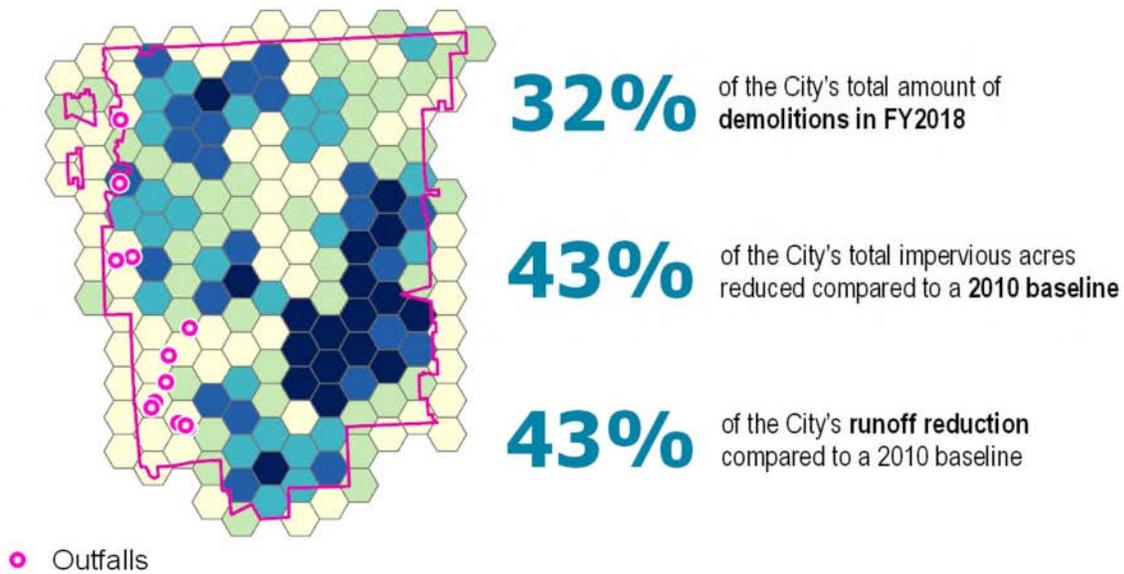
Table 2 Impervious Cover Removal Summary

Statistic	URT (acres)	Citywide (acres)
Impervious Acres in 2010	13,016	48,581
Impervious Acres as of April 2015	11,667	45,639
Subtotal Change in impervious cover (April 2010 – April 2015)	1,349	2,942
Demolition (acres) reported FY2016 Annual Report	50	199
Demolition (acres) reported FY2017 Annual Report	34	148
Demolition (acres) in FY2018	29	104
Total Change in Impervious Cover (April 2010 – June 2018)	1,462	3,393
Estimated Runoff Reduction (MG)	44.98	104.97

Figure 4 URT Area Demolitions, July 1, 2017 - June 30, 2018



Upper Rouge Tributary Demolition Distribution



Tracking System

DWSD is developing a tracking and performance assessment database for green stormwater 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 stormwater infrastructure practices. Three primary types of data are maintained by DWSD:

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

Activities executed for FY2018 include:

- Acquired April 2018 aerial imagery through the Michigan Statewide Authoritative Imagery & LiDAR, which will be classified into updated impervious areas within the City.
- Began implementation of Cityworks, a GIS-based asset management program, to track status and maintenance requirements of DWSD and customer-implemented green stormwater infrastructure.

PROJECT IMPLEMENTATION EFFORTS

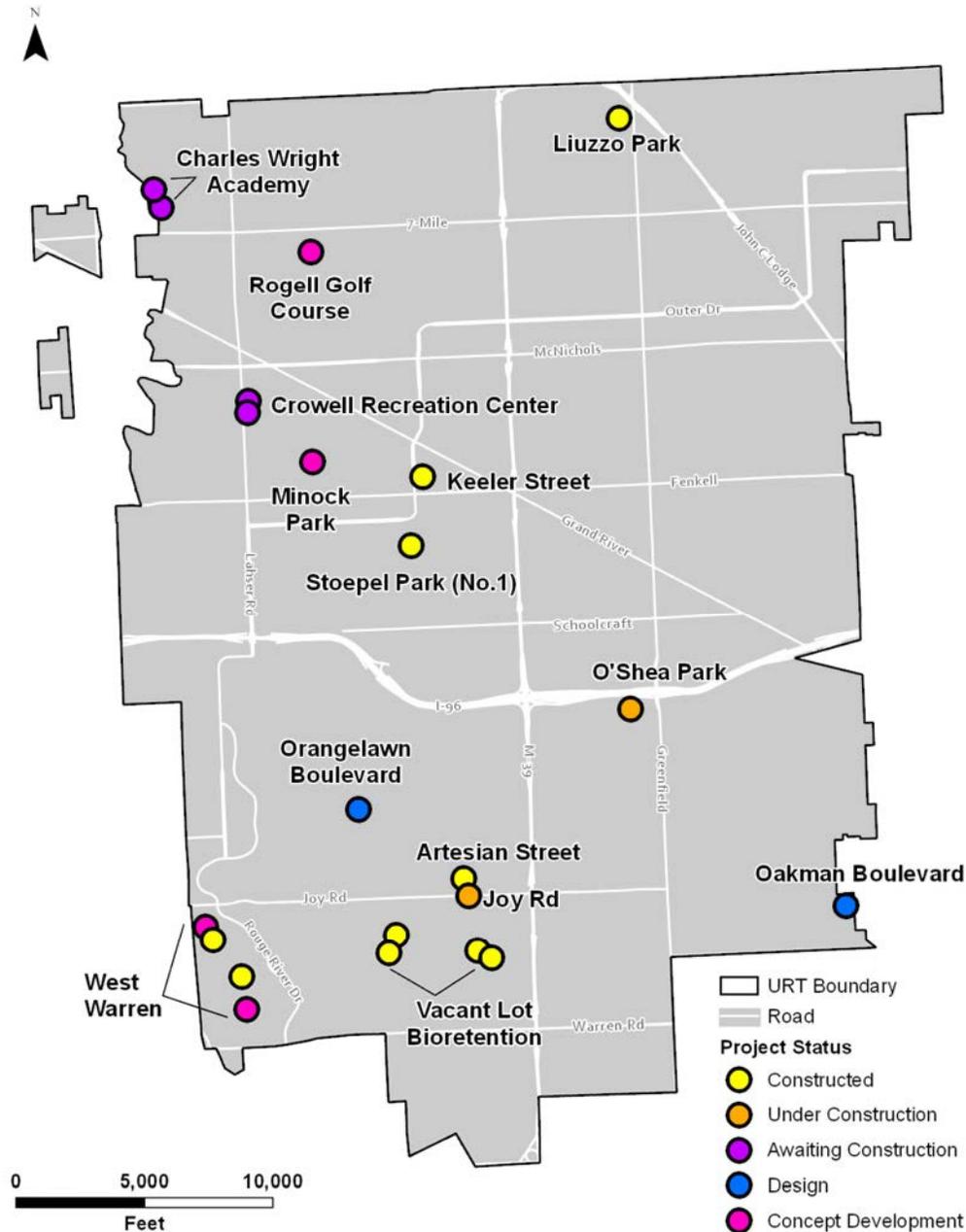
DWSD began implementation of GSI projects in 2015, additional projects are in various phases of construction, design or development. Table 3 provides a summary of the projects and Figure 5 shows the locations of these projects.

Table 3 Implementation Activities

Activities	Anticipated Status (as of 2017 Report)	Actual (FY2018)	Status
Project Implementation	Action Plan		
PW6968 (Transportation Projects)	Construction complete. Contract closeout in FY2018	Complete.	Contract closed out
Stoepel Park No. 1	Construction complete. Contract maintenance period continued in FY2018	Complete.	Maintenance ongoing
Liuzzo Park	Construction complete. Contract maintenance period continued in FY2018	Complete.	Maintenance ongoing
Tireman Phase II (Bioswales in Rouge Park)	Construction complete. Contract maintenance period continued in FY2018	Complete.	Maintenance ongoing
Crowell Recreation Center	Bids received. Begin and substantially complete construction in FY2018	Under construction.	Substantial completion FY2019
Ecosite Retrofits	Bids received. Begin and substantially complete construction in FY2018	Under construction.	Substantial completion FY2019
O'Shea Park	Design complete. Begin and substantially complete construction in FY2018	Under construction.	Substantial completion FY2019
Oakman Blvd	Design at 60% complete. Begin construction in FY2018; complete construction FY2019 or FY2020	Design complete.	Bidding and construction FY2019-FY2020
Vacant Lot GSI	Design FY2018; Construction FY2019		Low Priority

Activities	Anticipated Status (as of 2017 Report)	Actual (FY2018)	Status
Orangelawn Street	Design FY2018 Construction FY2019 – FY2020	Low Priority	
West Warren Projects (Constance Phase II and Tireman Phase III)	Design FY2018 – FY2019 Construction FY2019-FY2020	On hold for further evaluation as part of Wastewater Master Plan	
Rogell	FY2018 Complete concept and schedule implementation	Conducting environmental evaluation	
Minock Park/ Brightmoor	FY2018 Develop concept and schedule implementation	Under evaluation for project scope	
Charles Wright Academy	Acceptance of project by DPS in July 2017 Initial design of school area complete, evaluating larger tributary area	Pending MOU with Detroit Community Public Schools District	
Additional GSI Projects	DWSD will consider additional opportunistic projects in collaboration with the parks, facilities and DPS	On-going	
Activity 3 – Distributed GSI Implementation			
3-1	Downspout Disconnection – Homes	Coordination with faith-based and nonprofit groups for downspout disconnection programs in conjunction with drainage charge credit system and outreach	DWSD Service Credit Program under development
3-2	Downspout Disconnection - Multi-Family Residential, Commercial, and Industrial	Non-residential outreach to stimulate private investment	On-going efforts coordinated through the drainage charge credit program
3-3	Demolitions and Site Restoration	Coordination with DLBA and DBA is ongoing	DLBA continuing demolitions
3-4	Tree Plantings	No additional plantings planned for FY2018	N/A

Figure 5 Project Implementation Status



Completed Projects

Several GSI projects have been completed in vacant lots, public parks, and along the City roadways as part of the DWSD GSI Program. These projects served as prototypes to illustrate the stormwater management and educational benefits accomplished by implementing innovative best management practices in public spaces and are described in the following sections.

Ecological Restoration of Demolition Sites

The Ecological Restoration of Demolition Sites project was completed in fall 2015 on the City's southwest side. Each of the four bioretention sites were constructed on a two-parcel vacant lot and serve an approximate drainage area of 0.5 acres. An example of one of these sites can be seen in Figure 6. Flow monitoring was conducted at the sites in summer of 2017. See Section 4.0, GSI Performance Monitoring, for more information on the flow performance monitoring at the Vaughn and Evergreen sites. Modifications to two of the four sites are currently under construction. See Ecosite Retrofits for information about these sites and their modifications.

Figure 6 Evergreen Vacant Lot Bioretention – Site



Stoepel Park No. 1

Stoepel Park No. 1 is approximately 30 acres in size, and is located within the northeast section of Detroit's Brightmoor Neighborhood within the designated URT priority area (Figure 5). The park provides baseball/softball amenities to the Rosedale Grandmont Little League nonprofit organization which serves roughly 400-800 youth participants annually.

The green stormwater infrastructure project includes two bioretention practices that manage the stormwater runoff generated from tributary areas along Westwood Street. The project also included removal of the existing paved parking lot and replacement with a permeable parking lot constructed of open-graded aggregate to reduce runoff from the parking area (Figure 7). The project was completed November 1, 2016. The contractor remains under contract for a three-year maintenance and plant establishment period.

Figure 7 Stoepel Park Bioretention



Liuzzo Park

In cooperation with the Office of the Mayor, the General Services Department, and the Viola Liuzzo Park Association, DWSD began construction in July 2016 of the three bioretention practices in Liuzzo Park to incorporate green stormwater infrastructure with the planned park improvements (Figure 8). The three bioretention practices capture stormwater runoff from the existing roads on the north and east sides of the park, as well as runoff from within the park. The construction project is substantially complete as of December 1, 2016. The contractor remains under contract for a three-year maintenance plant establishment period.

Figure 8 Liuzzo Park Bioretention Improvements



DPW 6968

To capitalize on cost-sharing efforts and promote coordination with other City departments, several GSI projects were completed in 2016 in conjunction with the City's Department of Public Works (DPW). These projects included bioswales and permeable pavement as well as traditional storm sewer construction at four different locations within the URT. These projects were completed in FY2018.

FY2018 Construction

The following GSI projects are undergoing construction in FY2018. This section provides a summary of each project.

Tireman Bioswales – Phase II Modifications

Tireman Phase II includes two separate bioswales in Rouge Park on the north and south sides of Tireman Avenue between Parkland Street and Outer Drive (Figure 9). This practice captures sheet flow runoff from the adjacent roadway as well as road runoff conveyed to the bioswales from catch basins capturing drainage from the intersection of Parkland Street and Tireman Avenue (Figure 10). The overflow for the bioswales in the park is currently connected back into the combined sewer system at Parkland Street. This is a temporary measure while the design for Phase III moves forward. Tireman Phase III intends to include the sewer separation of approximately 67 acres in the Rouge Park area and routing that diverts water into a regional detention facility. Once Tireman Phase III is designed, the overflow from the larger bioswale in Tireman Phase II will be routed to the newly designed Tireman Phase III detention facility and ultimately outfall to the Rouge River. Phase II construction was initiated in FY2016. The project landscaping and enhancements contract was initiated in FY2016. All work for this enhancements contract, including: landscaping, underdrains, decorative boulders with a gravel path for sediment control, and curb cuts, is complete. Final plantings for the enhancements contract were completed in May 2018.

Figure 9 Tireman Bioswales – Completed Modifications



Figure 10 Tireman Bioswales – Drainage Areas



Crowell Recreation Center

Crowell Recreation Center and its surrounding park, Hope Playground, sits in the center of the Riverdale neighborhood and is surrounded primarily by single-family residential properties.

The GSI project includes removal of two existing paved parking lots (north, Figure 11 and south) and replacement of the center section of parking stalls with permeable block pavement and bioretention islands. Conventional HMA pavement will be laid for the remaining portions of the parking lot with new curb installed around the perimeter of the parking lot. Both parking lots will be regraded to allow the stormwater that is tributary to the parking lots to drain to the proposed permeable block pavement in the center of each parking lot. Additionally, each parking lot will have two endcap bioretention islands that will overflow to the permeable block pavement. Stormwater will enter the bioretention islands through curb cuts that are designed to capture roughly one quarter of the tributary area from the parking lot per island.

Notice to proceed was awarded in October of 2017 and is contracted to reach substantial completion by August 2018.

Figure 11 Crowell Recreation Center Parking Lot (North)



O'Shea Park

O'Shea Park is a 20-acre park located just south of I-96 and east of M-39 (Figure 5). A complete park renovation is scheduled to take place in summer 2018 through the collective efforts of PDD, DWSD and DTE. The park renovation includes demolition of the abandoned recreation center on site and construction of the largest urban solar array at 9 acres, open park space, a basketball court, walking paths and an overlook for the solar array. DWSD collaborated with PDD to incorporate a stormwater management feature into the overall park improvements.

The proposed GSI practice (see Figure 12) consists of a surface bioretention practice at the corner of Rutherford Street and Capitol Street. Road runoff from portions of Rutherford Street, Capitol Street, and park areas including the parking lot will be conveyed to the bioretention practice via concrete inlets along the southern edge of the bioretention practice and a trench drain inlet on the west side of the bioretention practice.

Figure 12 O'Shea Park Bioretention Improvement Rendering



Figure 13 O'Shea Park Drainage Areas



The practice will be constructed with underdrains that will dewater the system and discharge back to the combined sewer at a reduced/throttled rate (Figure 13). As part of the GSI monitoring effort, cameras have been installed at this location to generate time lapse footage of construction activities (Figure 14). This will allow designers to observe construction activities (e.g., sequencing, logistics) while providing residents with informational media that can be used in future outreach activities.

This project began in early May 2018 and has reached substantial completion in July 2018.

Figure 14 O'Shea Park Construction



Ecosite Retrofits

Two of the initial ecological restoration sites, Vaughan and Stahelin, are undergoing additional construction in FY2018. Work includes installation of a trench drain that allows for the capture of stormwater runoff from the opposite side of the road as well as the installation of anti-seep collars (Figure 15). The anti-seep collars will help prevent indirect dewatering back into the combined sewer system. This project was bid along with Crowell Recreation Center and construction began in April 2018 and substantial completion is by July 2018.

Figure 15 Eco Site Retrofits



FY2018 Project Design and Development

Several GSI projects are currently under design and/or concept development, many of which are large-scale practices that have the potential to dramatically improve local conditions with respect to flooding and basement backups. This section provides a summary of each project.

Oakman Boulevard

The Oakman Boulevard green stormwater infrastructure project is located in the southeast corner of the URT (Figure 5) and the project area experienced significant residential basement backups during the 2014 flood event.

The proposed project includes the installation of new storm sewers and surface and sub-surface stormwater management in the medians of Oakman Boulevard. The roadway medians have a consistent width of approximately 50 feet that can accommodate both surface and subsurface stormwater management practices. The project is intended to reduce the direct connection of flows from stormwater runoff to local combined sewers and provide both retention and detention management of stormwater. The proposed work includes routing stormwater runoff from the tributary areas to either the surface practices within the median or to the sub-surface storage practices based on elevation of the influent. The underground practices will provide detention and then gradually release runoff to two primary combined trunk sewers. The volume of individual practices was maximized based on space available for their specific tributary area. The system will reduce the overall amount of volume and control the rate into the combined sewer system. It may also help protect basements by rerouting storm flows away from small diameter easement sewers. Overall, the system has the capacity to store 1.75 MG. The final Engineering Opinion of Probable Construction Cost (EOPC) is \$5.4 million. Bid advertisement is expected by August 2018.

The landscape design of the medians has been coordinated with the local residents and is intended to upgrade the local aesthetic condition of these medians (Figure 17). Meetings were held in July and September of 2017 and February 2018 with local community members to gather input on visual appearance and provide updates on project progress. The contract will include local water main replacement to limit disruption to the residents and will also allow for resurfacing of the local streets.

The project location and tributary areas are shown in Figure 16. Work in FY2018 included continued progression of detailed design. The project design is complete and permitting is almost complete. DWSD will award this project in FY2019.

Figure 16 Oakman Boulevard, Selected Alternative Tributary Areas and Practice Footprints

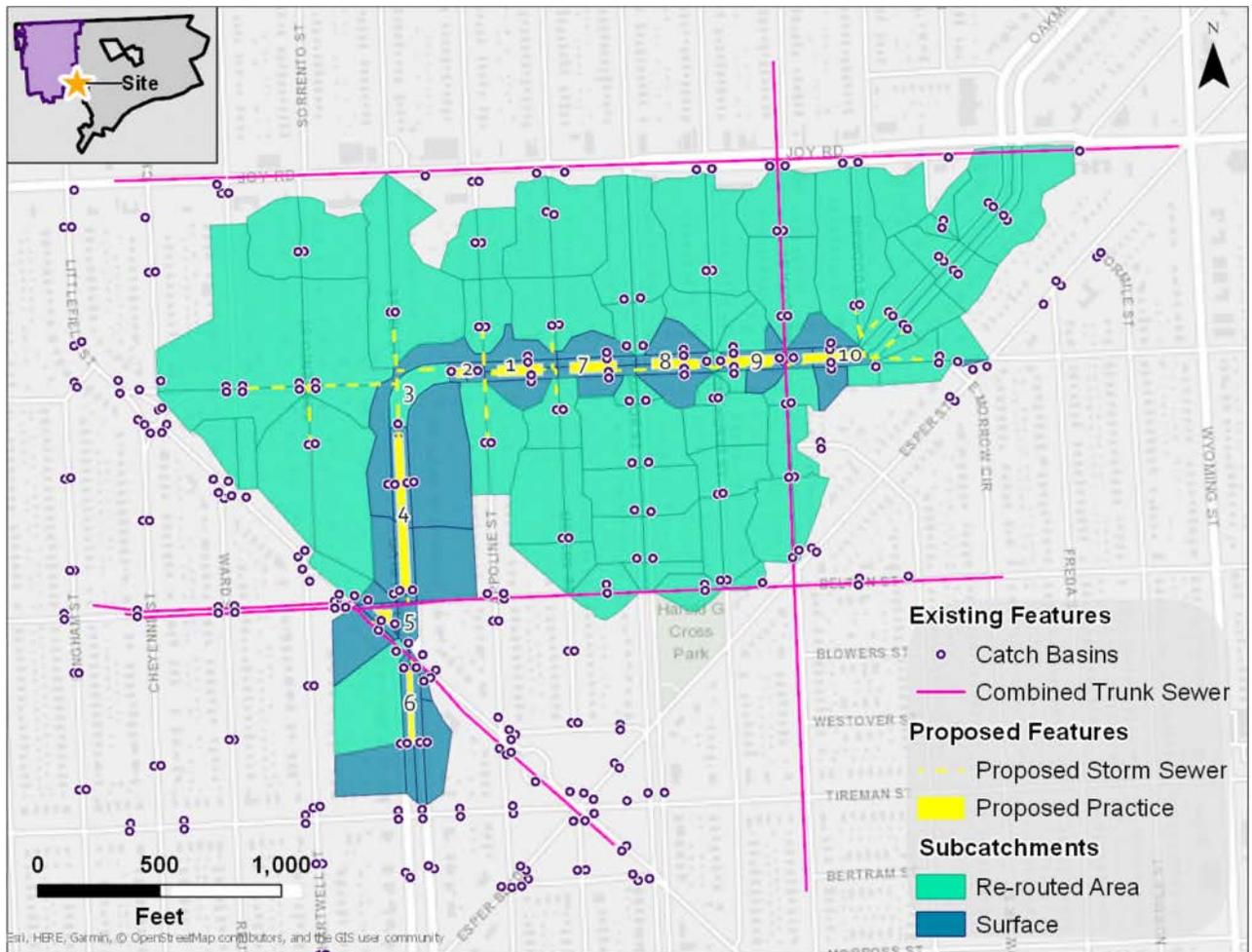


Figure 17 Oakman Boulevard Conceptual Landscape Rendering



Charles Wright Academy

Charles Wright Academy is in the northwest portion of the URT immediately adjacent to the Rouge River at 19299 Berg Road (Figure 5). The school is immediately adjacent to Ludington Magnet Middle School and bounded by Seven Mile Road on the south, Berg Road on the east, Pembroke Avenue on the north and the Rouge River on the west.

The combined school property of Ludington Magnet Middle School and Charles Wright Academy consists of approximately 43 acres, of which 14 acres are impervious. Some of the acres currently discharge to the river through a CSO outfall downstream of the regulator. Stormwater management of Ludington Magnet Middle School was excluded from the design since the vast majority of the runoff is currently conveyed to the CSO outfall downstream of the regulator. Approximately 5 acres of impervious cover would be removed from the system as a result of the proposed project.

The initial design includes two small bioretention systems and two larger GSI practices that collect and manage roof and site drainage from Charles Wright. Overflow from the GSI practices will be conveyed to the Rouge River via an overflow weir. Both sets of practices will be connected via new storm sewer and will provide complete removal of stormwater flows from the combined sewer system. The two GSI practices will be located to the south, east and north of the school. The concept for this project is shown in Figure 18.

Advancement of this project has been affected by challenges in coordinating a memorandum of understanding with Detroit Public Community School District (DPCSD). Following a preliminary agreement, work advanced to a design mostly complete for the school site. DWSD is currently evaluating concepts to capture more stormwater and expanding the project to include partial sewer separation of the adjacent neighborhoods. Further advancement of the design is awaiting the MOU being finalized and stakeholder input.

As currently envisioned, the project would result in the complete removal of flow from the 2-year, 24-hour storm event for 5.5 acres. This volume is approximately 0.24 MG. The opinion of probable construction cost of this project is \$1,500,000 which includes the expanded area that is currently under evaluation.

Figure 18 Charles Wright Academy Design



West Warren

The West Warren project area includes portions of area tributary to the Rouge River. The project will capitalize on prior work performed on Constance (Constance Phase I) and Tireman Streets (Tireman Phase I) as part of PW-6968 and the Tireman Phase II bioswale.

DWSD had originally looked at an opportunistic separation project coupled with stormwater quality management in Rouge Park for this area based on the existing infrastructure, utility conflicts, recent street paving and previous GSI implemented in the area. The proposed area impacted by the concept is reflected in Figure 19.

GLWA's wastewater master plan (WWMP) team suggested a comprehensive separation of this area. Further advancement of the GSI design elements will be evaluated once work by GLWA's WWMP team is complete.

Through FY2018, DWSD has performed field survey, geotechnical investigation and preliminary design of the opportunistic separation project. This project will proceed to final design once a project approach has been selected.

Rogell Regional Stormwater Practice

Project Identification

The Rogell site is a former golf course that provides an opportunity for recreational and stormwater management space. The Grand River/Northwest Planning Study has identified this site for potential recreation space. In addition, there is the potential for wetland mitigation on the property.

DWSD evaluated the potential tributary area that could be brought into the Rogell site, along with preliminary storm sewer routing and footprint and general location of stormwater practices. DWSD identified two potential drainage areas, east and south of the site where stormwater could be redirected to regional practices. These practices could include bioretention, ponds, or stormwater wetlands.

Currently, DWSD is actively coordinating with the MDEQ Surface Water Assessment Division to determine if additional soil testing is necessary and to determine a project design based on the environmental site constraints. Recent discussions with the MDEQ indicate that additional soil testing is needed. DWSD is coordinating this effort with the City Planning and Development (PDD).

Project Partners

The primary project partners include the Planning and Development Department (PDD), Housing and Revitalization Department (HRD), and the Michigan Department of Transportation (MDOT), and the Michigan Department of Environmental Quality (MDEQ).

Selected Project Description

The project concept includes sewer separation, potentially with local GSI practices, outletting to two regional stormwater practices within Rogell Golf Course. Each potential tributary area would likely function independently to take advantage of the topography in the site. The stormwater practices would discharge directly to the Rouge River, eliminating this area from the combined sewer tributary area. The project(s) would help alleviate local flooding and basement backup issues while creating an aesthetically pleasing, yet functional use of a significant green space (Figure 20).

Project Performance

Design criteria for the GSI practices within Rogell have been established to meet multiple sets of guidelines; practices will be designed to provide water quality treatment and release flows at a rate no greater than that of the 2-year event under existing conditions. In addition, per Wayne County Standards, the practices will have capacity to detain the 10-yr event volume to prevent local flooding. All stormwater directed to the practices would be completely removed from the combined sewer system. Volumes associated with both segments of the Rogell project would lie within the abandoned golf course. The practices would manage stormwater from approximately 170 acres; the 2-yr event runoff volume from this area is approximately 12.2 MG.

Cost

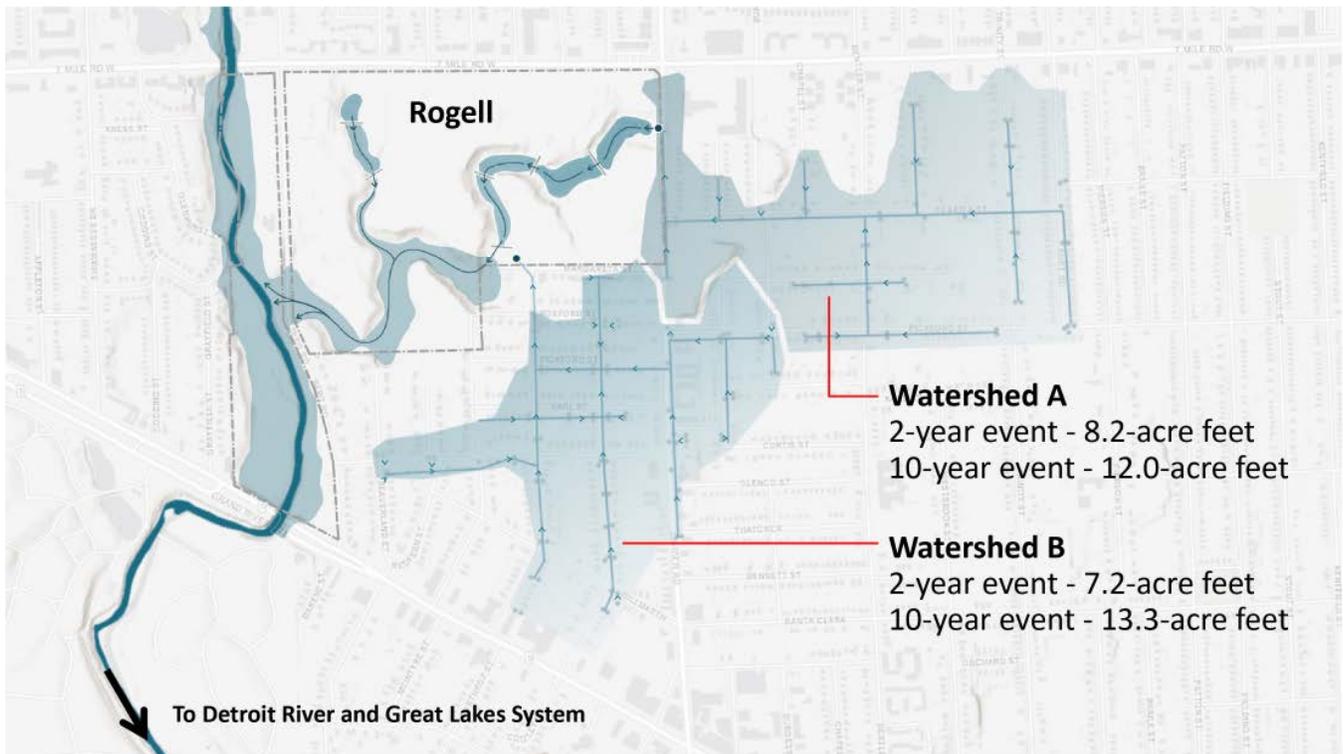
The cost for this project is dependent on what amount of tributary area is served. This is being evaluated.

Project Schedule

The project schedule will be determined following resolution of environmental assessment.

Figure 20 Rogell Golf Course Proposed Concept

(Graphic by Design Workshops)



Minock Park/Brightmoor

DWSD is currently evaluating a neighborhood scale GSI project in the Minock Park/ Brightmoor area. The project will be scheduled following completion of scoping efforts. Activities anticipated through FY2019 include project scoping, conceptual design and community outreach. The project provides opportunities for a large scale stormwater management practice and nature area in a highly vacated location along Blackstone Street. The site could be used to manage stormwater from the adjacent Minock Park subdivision.

Gompers

A MDEQ 319 grant application was submitted for implementation of this project. DWSD received notification that this project was awarded for the grant funding. While this project is in the URT, implementation goes above and beyond permit spend requirements.

This project will build on ongoing GSI implementation in Detroit by managing stormwater in approximately 4 acres from the Gompers School and surrounding neighborhood, including local churches and roadways. Concepts for this project include subsurface storage and green stormwater infrastructure on adjacent vacant property owned by the Detroit Land Bank Authority, as well as an additional surface green stormwater infrastructure feature located on the south side of the school that would provide educational opportunities. Social components project would include development of a stakeholder involvement plan and activities, educational GSI signage, and may include follow-up social monitoring.

Joy Road

DWSD previously committed funding of no more than \$225,000 for the construction of the Joy Road streetscape and drainage improvement project. The commitment was intended to fund stormwater management for the proposed project. DWSD is funding this project through the GSI program. The Intergovernmental Agreement (IGA) was signed on July 2, 2018.

Additional Projects

DWSD underwent a thorough evaluation of conceptual projects in FY2018 and developed a project prioritized scoring criteria for future work. Through this process several conceptual projects were placed lower in priority with projects that provide more benefit to the Upper Rouge area taking priority. Currently designs are planned to proceed on the projects detailed above. Additional conceptual projects have either been suspended or put on hold. As a result, several projects that have been discussed in previous annual reports are not projected herein to be implemented in the next reporting cycle. These projects are summarized as follows:

Orangelawn Street

In FY2017, DWSD reported on the Orangelawn project which had a concept developed and field work collected. DWSD has put this project on hold until the West Side Model is completed and more data is available for use in assessing its benefits to the CSO program.

DISTRIBUTED GSI IMPLEMENTATION

The City will continue the demolition program in FY2019. While this program continues, DWSD will shift the focus to managing existing impervious area and implement mechanisms to manage these impervious surfaces such as the post-construction stormwater management ordinance for new and redevelopments.

3.0 GSI PERFORMANCE MONITORING

Activities associated with long term performance over the period of FY2018 were focused on continuing the monitoring efforts of individual GSI practices.

Table 4 Long Term Performance Activities

No.	Activities	Planned Activities and Schedule	Actual Status	Activities and
Activity 4 - Long Term Performance				
4-2	Green Stormwater Infrastructure Performance Planning	Ecosite monitoring through fall 2017 Overarching monitoring objectives and work plan December 2017	Ecosite monitoring performed FY2018	
4-3	Green Stormwater Infrastructure Benefits Evaluation	Coordination with the University of Michigan Water Center	On-going	
4-5	Agreements for long-term sustainability	Ongoing activity	Ongoing activity	

ECOSITE MONITORING

Flow monitoring was performed for the Ecosite practices to assess their hydrologic performance in the summer of 2016. This information will help in the prediction of flow control benefits of these types of practices in broader application. Items addressed in the study included an evaluation of the practices:

- ability to reduce volume and peak flow rates prior to discharge into the sewer system.
- the impact on the groundwater table as a result of stored runoff in the practices.

In calendar 2017, two of the practices, Vaughan and Evergreen, were monitored again. The calendar 2017 monitoring work was intended to review the questions from calendar 2016 and evaluate the larger water balance around the practices. The additional question being studied was whether flow that entered the bioretention practice makes its way into the sewer system through pathways other than the underdrain connection. These pathways were expected to include:

- infiltration through the soil that later leaked into the sewer.
- seepage through bedding material in the underdrain pipe.

The fundamental conclusion of the calendar 2017 monitoring effort was that leakage through so-called “indirect pathways”, may result in volumetric performance that is somewhat less than implied by direct influent and effluent monitoring. However, the rate at which such dewatering occurs is very slow, which suggests that the practices are able to achieve their objective of reducing elevated system flows that would lead to CSO discharges.

FY2019 MONITORING

A final monitoring period is planned for the Vaughan vacant lot bioretention site following the completion of the Ecosite retrofits. The primary objective will be to perform multiple hydrant tests, each with a corresponding equivalent rainfall depth, and determine the relationship between inflow volume and volume discharged from the practice via indirect dewatering.

GSI BENEFITS EVALUATION

Broader objectives of the GSI Program include a reduction in CSO discharge, basement backups and street flooding, and an improved quality of life. The Long-Term Performance effort includes a wide variety of activities that aid in understanding the performance of GSI, approaches to increase its impact and reduce its costs, and coordination towards the development and placement of projects that will achieve multiple benefits.

In addition to field monitoring of GSI practices, the following activities were also implemented in FY 2018 to inform the discussion on broader benefits of GSI.

- Ongoing coordination with other research and study efforts being performed to assess the potential for GSI to benefit social stability of neighborhoods and assessment of characteristics that are most socially impactful.
- Ongoing efforts to define vision, mission, and metrics of GIS implementation with the GSI interdepartmental working group.

Specific activities planned for FY2019 include:

- Ongoing coordination with other research and study efforts being performed to assess the potential for GSI to benefit social stability of neighborhoods and assessment of characteristics that are most socially impactful.
- Ongoing efforts to define vision, mission, and metrics of GIS implementation with the GSI interdepartmental working group.

4.0 STAKEHOLDER AND COMMUNITY ENGAGEMENT

DWSD continued a wide range of internal and external stakeholder engagement and outreach activities during FY2018. GSI engagement and outreach activities occurred primarily through project implementation, the drainage charge credit program, and the City interdepartmental GSI coordination group. DWSD continues to explore processes and institutional structures for a coordinated, collaborative citywide green stormwater infrastructure outreach and engagement, including working with key City GSI partners such as the Erb Family Foundation and The Nature Conservancy. In the 2017 Annual Report, all the activities were converted to ongoing efforts rather than initiation efforts. A summary of FY2018 activities follows.

COORDINATION

DWSD's Stormwater Management Group (SMG) is responsible for all stormwater related activities, including the drainage charge program, the draft post-construction stormwater management ordinance, and DWSD funded GSI projects through the GSI Program. DWSD coordinated with numerous departments, agencies, and groups on GSI-related issues. A list of the internal and external stakeholders that DWSD has engaged on GSI activities during FY2018 is provided below.

Internal DWSD Groups

- DWSD Customer Service
- DWSD Finance Asset Management
- DWSD GIS Group
- DWSD Water Supply Operations
- DWSD Public Affairs
- DWSD Billing Department

City Government

- Buildings, Safety, Engineering and Environment (BSEED)
- Planning and Development (PDD)
- Department of Public Works (DPW)
- Housing and Revitalization (HRD)
- Public Health
- General Services
- General Services – buildings
- Neighborhoods
- City Planning Commission
- Sustainability Office
- Mayor's office (Planning, Housing, and Development Team (PHD))
- City Council

Agencies

- Detroit Land Bank Authority
- Wayne County Road Commission
- Michigan Department of Transportation (MDOT)
- Detroit Economic Growth Corporation (DEGC)
- Great Lakes Water Authority (GLWA)
- Michigan Department of Environmental Quality (MDEQ)
- United States Environmental Protection Agency (US EPA), Region V
- Detroit Public Community School District
- Detroit Housing Commission
- DTE Energy

Organizations

- Detroit Future City
- Sierra Club
- Erb Family Foundation
- Brightmoor Alliance
- Grandmont Rosedale Development Corporation
- The Nature Conservancy
- Bloomberg Associates
- Friends of Rouge Park
- Far West Detroit Civic Association
- Cody Rouge Neighborhood Partnership
- Cody Rouge Community Action Alliance
- Warrendale Community Organization
- Viola Liuzzo Park Association
- GFFD Community Center

Institutions

- University of Michigan
- Wayne State University
- Lawrence Tech University
- Wayne County Community College District

Groups

- City Council Green Infrastructure Task Force Blue/Green subcommittee
- Erb Family Foundation Blue Green Infrastructure Workgroup
- The Nature Conservancy/Greening of Detroit/Erb Family Foundation GSI Mapping and Knowledgebase Project Team
- GSI Interdepartmental Coordination Group (subcommittee of the Sustainability Office)

2018 OUTREACH ACTIVITIES

DWSD's green stormwater infrastructure stakeholder outreach is comprised of three components:

- Green stormwater infrastructure project-specific outreach.
- Overarching, collaborative green stormwater infrastructure public education campaign.
- Drainage charge reduction through green stormwater infrastructure implementation.

Green Stormwater Infrastructure Project-Specific Outreach

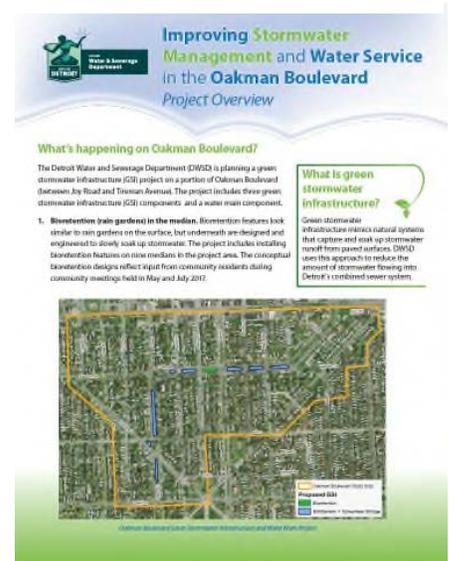
Project-specific outreach includes coordination with neighborhood groups and key stakeholders, such as Department of Neighborhood district managers, the City's council members, and project partners. For each project, DWSD creates a project fact sheet (which is updated throughout the life of the project), plans and facilitates public meetings to inform stakeholders and solicit early feedback on project concepts, coordinates informational mailings that include project facts and engagement opportunities, places temporary and permanent project signage, and conducts engagement events that are both educational and celebratory. DWSD creates tailored outreach and engagement strategies for each project and documents ongoing outreach efforts and needs. DWSD also conducted additional outreach for certain projects that experienced shifts in construction schedules to keep local stakeholders aware of progress.

Specific activities related to project outreach in FY2018 and anticipated outreach activities for FY2019 are summarized below.

Oakman Blvd. DWSD coordinated and facilitated community input meetings in July 2017 and February 2018 to provide residents with an opportunity to voice opinions on the landscaping concepts and plantings for surface bioretention. The meetings included a presentation on the overall project, renderings of the preliminary and updated concepts, and plantings discussion.

As this project progresses into a construction phase in FY2019, outreach efforts will focus on the construction schedule, regular progress updates, and fielding any concerns about construction activities voiced by residents. DWSD will provide regular progress updates to appropriate District Councilman leaders, neighborhood managers and associations. In addition, DWSD will schedule free conference calls so that residents can retrieve updates on the project and voice concerns.

Figure 21 Fact Sheet Example



Crowell Recreation Center. DWSD developed and hung educational posters to inform visitors about the project, including purpose, benefits, schedule, and where to find additional information about the project. DWSD displayed projects posters in the Crowell Recreation Center before construction started in April 2018. In addition, DWSD developed and posted temporary construction signage in both parking lots to inform center users of the project need and construction schedule. DWSD also developed permanent educational signage to be installed at the end of the construction process (Figure 22).

Figure 22 Crowell Permanent Educational Signage



Ecosite Trench Drain Installation. DWSD developed and mailed a project fact sheet that explained the need for the trench drains near the Vaughan Street and Stahelin Avenue bioretention gardens that were originally installed in FY2016. DWSD coordinated with Councilman Leland’s office and District 7 Department of Neighborhood managers to keep surrounding residents up-to-date on the construction project that started in May 2018.

O’Shea Park. DWSD developed a fact sheet on the GSI element of the overall park improvement project. A community meeting was held on May 22, 2018 at Faith Redemption Church. The focus of the meeting was to update the community on the progress of the project.

West Warren. DWSD created an updated project fact sheet that ties together all elements of the West Warren project and met with the Friends of Rouge Park and Far West Civic Association to provide an update on the progress of the phased GSI project.

DWSD will coordinate with the Friends of Rouge Park and Far West Civic Association to provide updates of the phased GSI project, including residential input on the conceptual design elements such as plant species for surface bioretention features. DWSD will also share conceptual designs reflecting community input to ensure all concerns are addressed and the design has community support. As with other outreach efforts, DWSD will provide regular progress updates to appropriate District Councilman leaders, neighborhood managers and associations with the progress of construction schedules and progress of project. DWSD plans to identify opportunities to provide community residents with a hands-on opportunity to get involved with the project (e.g., possible volunteer planting).

Liuzzo Park. DWSD has plans to participate in the dedication celebration with the Office of the Mayor. In early FY2017, DWSD developed an outreach video highlighting the work at Viola Liuzzo Park. DWSD will complete this video using footage from the dedication celebration.

Rogell. As DWSD continues to work with City of Detroit partners on the conceptual design for the recently purchased Rogell, DWSD will work with key departments to develop a joint outreach strategy that allows for early neighborhood participation in the conceptual design phase, including educating neighborhood residents on the purpose of GSI features and the options that are suitable for the Rogell property. DWSD will adapt the outreach strategy for Rogell based on the initial input from neighborhood residents. Outreach strategy planning for Rogell will follow the same protocol for outreach efforts as conducted on previous projects.

Gompers School. The outreach strategy for the Gompers School GSI project will involve continued partnership and coordination with Detroit Public Schools and the Detroit Land Bank Authority, as well as education and outreach to Gompers School administrators and staff, students, and surrounding community residents. The project will include an educational component tailored to the teachers and students, incorporating input opportunities and curriculum tailored to students. This GSI project is unique in that it will have a dedicated on-site stakeholder group that can incorporate aspects of GSI operation and maintenance into regular educational activities, such as visual inspection, monitoring, and basic maintenance (e.g., removal of weeds and litter).

Overarching, Collaborative Green Infrastructure Public Education Campaign

During FY2018, DWSD continued coordinating with the City's interdepartmental GSI group, a subcommittee of the City of Detroit's Office of Sustainability. DWSD facilitates this group to identify and resolve issues related to GSI projects and drainage credits on City property. DWSD also regularly convenes to collaborate on GSI projects based on department initiatives. During FY2018, DWSD has worked with the Office of Sustainability to provide input on GSI vision, definition, and goals for the citywide Sustainability Action Agenda for GSI.

DWSD also continued working on the GSI knowledge-based microsite, which is led by The Nature Conservancy (TNC) and funded by the Erb Foundation. During Phase 1, TNC collected current GSI practices throughout the City. In FY2018, TNC proceeded to Phase II of the project and has been working on identifying website content for DWSD review. Phase II of the project includes GSI mapping of practices for public education purposes and will include a public facing map tool.

Green Infrastructure Website

DWSD has and will continuously updated their website to improve communication and promote the installation of GSI.

Drainage Charge and Credit Outreach and Engagement

DWSD will continue outreach and engagement with the support of their public affairs team, including production of videos and public service announcements to ensure the public remains engaged in DWSD's drainage charge program efforts.

EFFORTS IN FY2019

In FY2019, stakeholder and community engagement will continue to be a fundamental component of each green stormwater infrastructure implementation project, the Drainage Charge Program and associated credits through GSI practices, and the post-construction stormwater ordinance development and the greening of the municipal code. DWSD will continue to work with key partners to collaborate on GSI stakeholder involvement and educational activities achieving stakeholder insight, implementation support, and balanced public policy. DWSD will continue to promote implementation of green stormwater infrastructure on privately-owned parcels. DWSD will continue to support the Interdepartmental GSI Work Group and collaborate on the development and implementation of Sustainability Action Agenda as it embodies GSI goals and actions.

Post-Construction Stormwater Ordinance and Greening of the Municipal Code Outreach

Education and training to support compliance with stormwater performance standards in Detroit's PCSWMO and associated stormwater design manual will be a high priority for DWSD in FY2019. DWSD will develop, coordinate, and facilitate workshops for the development community that focus on the stormwater post-construction performance standards and provide guidance on how to achieve the performance standards using GSI practices. DWSD will collaborate with key partners on the development and delivery of these workshops to effectively reach the development community.

Overarching, Collaborative Green Stormwater Infrastructure Public Education Campaign

GSI has gained momentum in Detroit through DWSD's stormwater management programs, initiatives, and projects implemented by key partners in Detroit. In FY2019, DWSD commits to working with key partners to amplify public education and outreach focused on the myriad of benefits of GSI for Detroit. The overarching, collaborative GSI public education campaign will aggregate past GSI education efforts, including videos, tours, speaking engagements, and GSI tool development (such as the GSI knowledge-based led by The Nature Conservancy with funding from the Erb Family Foundation and participation from DWSD among other Detroit GSI partners). The anticipated release of Detroit's Sustainability Action Plan in FY2019, which will include a GSI component, will help to spotlight DWSD's GSI implementation leadership and provide an opportunity to kick-off a more robust GSI public education campaign. DWSD will use existing collaboration mechanisms, including the Interdepartmental GSI Work Group and the biweekly drainage charge public relations meetings that involve representatives from key GSI partners, to facilitate the development of a comprehensive, collaborative GSI public education campaign with citywide messaging that all Detroit partners implementing GSI at any scale can use. Specific activities in the public education campaign will likely be shared among several Detroit GSI partners, and the goal will be to ensure consistency in GSI messaging, leverage resources to reach audiences, and create connections among all GSI initiatives in Detroit. The Detroit Collaborative Design Center created an inventory of current Detroit GSI resources and initiatives that illustrates the work of many partners at different scales that could contribute to a robust overarching, collaborative GSI public education campaign for Detroit.

5.0 INVESTMENT IN GREEN INFRASTRUCTURE

Since the inception of DWSD's Green Stormwater Infrastructure Program, a variety of implementation projects and coordination efforts have occurred.

The costs included in this report include the following:

- Efforts implemented through Contract CS-1522, which include professional services and construction.
 - Professional services items include: project selection, survey, geotechnical, field investigations, neighborhood characterizations, project conceptual and detailed design, project specific outreach and stakeholder engagement, interagency coordination, bid administration, construction administration, resident project representative (RPR) services, monitoring efforts and maintenance manuals and support.
 - Construction includes earned contract value (including unpaid retainage) and contract markup on contractors.
- Construction not implemented through CS-1522. These amounts include earned construction value that may include retainage which has not been released and/or agency administrative costs.

The costs in this report do not include the following:

- Efforts associated with the drainage charge program.
- Effort associated with locations outside of the URT.
- Efforts associated with the preparation of regulatory required reports.

The following costs have been prorated or adjusted:

- Codes and ordinance efforts were prorated as 27.1% of the total investment. This was based on the URT composed as 27.1% of the City.
- Work associated with the impervious cover analysis citywide was prorated to 27.1% as described for the codes and ordinance effort.

DWSD's permit requires a \$15 million spend by June 30, 2017, and a total spend of \$50 million by 2029. The net reported value for spend during FY2018 and the cumulative costs for this project are identified in Table 5 and Table 6 and displayed on Figure 23.

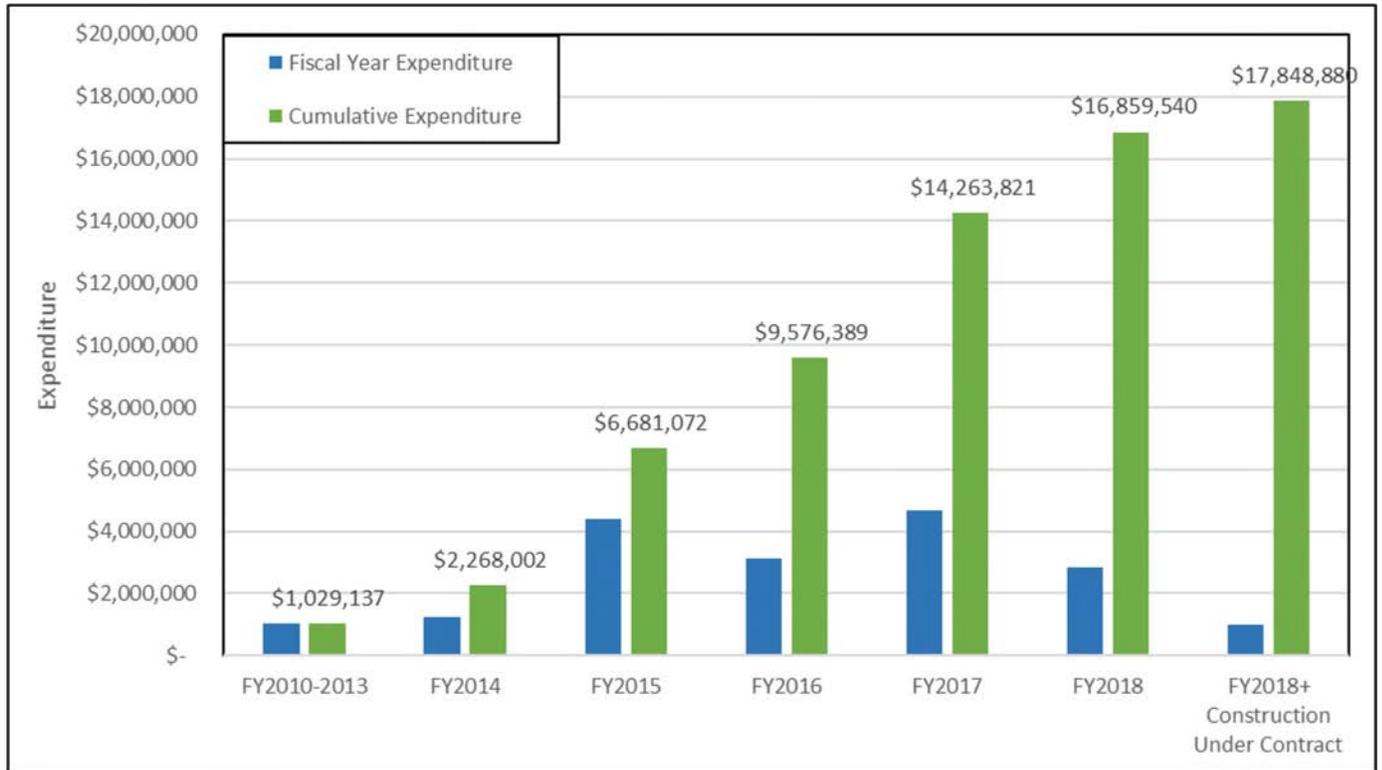
Table 5 DWSD Green Infrastructure Program Expenditures Summary

Fiscal Year	Expenditures	Adjustments	Revised Expenditures	Cumulative
FY2010-FY2013	\$ 1,029,137	\$ -	\$ 1,029,137	\$ 1,029,137
FY2014	\$ 1,238,864	\$ -	\$ 1,238,864	\$ 2,268,002
FY2015	\$ 4,413,070	\$ -	\$ 4,413,070	\$ 6,681,072
FY2016	\$ 3,121,040	\$ (225,724)	\$ 2,895,317	\$ 9,576,389
FY2017	\$ 4,687,432	\$ -	\$ 4,687,432	\$ 14,263,821
FY2018	\$ 2,845,519	\$ (249,800)	\$ 2,595,719	\$ 16,859,540
FY2018 Residual Contracts	\$ 989,340	\$ -	\$ 989,340	\$ 17,848,880

Table 6 Green Stormwater Infrastructure Program Cumulative Expenditures

Activity	Prior Years			FY2018 Annual Report					Totals			Notes
	FY2010- FY2017 DWSD & Professional Services	FY2010- FY2017 Construction	FY2010-FY2017 Totals	FY2010-FY2017 Adjustments Construction	FY2010- FY2017 Adjustments DWSD & Professional Services	FY2018 DWSD & Professional Services	FY2018 Construction (earned value)	FY2018 Construction (residual contract value)	FY2010- FY2018 DWSD & Professional Services	FY2010- FY2018 Construction	Cumulative Expenditures	
General Project Management	\$ 592,358	\$ -	\$ 592,358		\$ (41,935)	\$ 132,016			\$ 682,439	\$ -	\$ 682,439	SEMCOG 2010-2013; CS-1522 Program Administration FY2014-2018
Activity 1 – Policies, Procedures and Standards												
Codes and Ordinance Development (prorated)	\$ 162,775	\$ -	\$ 162,775			\$ 4,542			\$ 167,318	\$ -	\$ 167,318	Prorated relative to URT as share of City as a whole (27.1%). Includes only consultant work on the greening of the code/ post construction ordinance.
1-8 Tracking System	\$ 55,303		\$ 55,303			\$ 58,283			\$ 113,586	\$ -	\$ 113,586	GIS and data management; aerial for updated impervious cover (flight)
Activity 2 - Prototype Projects												
Small Scale Greening (site scale bioretention/vacant lots)	\$ 887,045	\$ 518,930	\$ 1,405,975	\$ 51,386	\$ (51,386)	\$ 142,120			\$ 977,779	\$ 570,315	\$ 1,548,095	Includes greening of vacant lots 2013; design and implementation of ecosites project; selection of additional sites and template designs; flow monitoring evaluations 2016 - 2018
Neighborhood Projects (previously "Large Scale Greening")	\$ 1,493,164	\$ -	\$ 1,493,164		\$ (76,335)	\$ 822,020			\$ 2,238,849	\$ -	\$ 2,238,849	Includes survey, geotech, planning, concept, detailed design and project specific outreach to date for the following projects: Oakman, Orangelawn, West Warren.
Public Facilities and Parks	\$ 1,785,066	\$ 1,056,974	\$ 2,842,041	\$ (20,723)	\$ (79,276)	\$ 378,912	\$ 593,589	\$ 941,091	\$ 2,084,702	\$ 1,629,840	\$ 3,714,542	Projects include: Stoepel, Liuzzo, Crowell (also includes ecosite modifications), O'Shea, Charles Wright. Professional services include planning, survey, design, construction, RPR, maintenance
Transportation Corridor Projects	\$ 665,463	\$ 2,773,957	\$ 3,439,421	\$ (31,415)	\$ (117)	\$ 61,686	\$ 128,333	\$ 48,249	\$ 727,032	\$ 2,870,875	\$ 3,597,907	Projects include PW-6968; Tireman Bioswale. Professional services include survey, design, construction administration, RPR and maintenance support
Activity 3 - Continued Implementation												
Downspout Disconnection	\$ 38,788	\$ 151,846	\$ 190,635						\$ 38,788	\$ 151,846	\$ 190,635	Costs after FY2015 are not included
Demolitions and Site Restoration	\$ 83,246	\$ 579,334	\$ 662,580						\$ 83,246	\$ 579,334	\$ 662,580	DWSD share of demolition costs
Tree Plantings	\$ 37,321	\$ 1,405,082	\$ 1,442,403						\$ 37,321	\$ 1,405,082	\$ 1,442,403	
Activity 4 - Long Term Performance												
2014 GI Plan	\$ 498,374	\$ -	\$ 498,374						\$ 498,374	\$ -	\$ 498,374	
Annual Reports	\$ 95,288	\$ -	\$ 95,288			\$ 47,867			\$ 143,155	\$ -	\$ 143,155	Current year costs include 2017 and 2018 reports
Ongoing Planning and Coordination	\$ 478,146	\$ -	\$ 478,146			\$ 153,063			\$ 631,209	\$ -	\$ 631,209	Development of future projects. FY2018 primarily associated with Rogell, Gompers, Minnock, and Ashton Street.
Practice Maintenance			\$ -			\$ 40,951			\$ 40,951	\$ -	\$ 40,951	DWSD investment (\$20k) plus consultant support to maintenance activities not directly related to projects
Activity 5 - Stakeholder and Community Engagement												
Outreach activities and stakeholder coordination	\$ 405,359	\$ -	\$ 405,359			\$ 82,138			\$ 487,496	\$ -	\$ 487,496	General outreach activities including interdepartmental coordination.
DWSD Staff	\$ 500,000	\$ -	\$ 500,000			\$ 200,000			\$ 700,000		\$ 700,000	
Total	\$ 7,777,697	\$ 6,486,124	\$ 14,263,821	\$ (752)	\$ (249,048)	\$ 2,123,598	\$ 721,921	\$ 989,340	\$ 9,652,247	\$ 7,207,293	\$ 16,859,540	

Figure 23 DWSD GSI Program Expenditures



6.0 VOLUMETRIC REDUCTIONS

QUANTIFICATION

The runoff volume estimates for discrete storm events are based on NRCS curve number hydrology calculations (Table 7). Green stormwater 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 10 for a single 2-year, 24-hour design 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 increases, the interception will increase and the corresponding runoff reduction estimates from tree plantings will increase.

Table 7 GSI Project Summary

	Project Name	Acres Managed	Estimated Construction Cost	2-year, 24-hour Cost Effectiveness (\$/gal)	2-yr Volume Managed (MG)	2-year, 24-hour Design Storm Performance (MG) ¹	% of 2-Year Design Storm	Annual Volume Removed (MG) ²	Status
Completed	Vaughan	0.79	\$125,635	\$4.49	0.028	Retain: 0.025* Detain: 0.003	100%	Retain: 0.44* Detain: 0.2	Complete
	Evergreen	0.70	\$154,224	\$7.71	0.020	Retain: 0.018 Detain: 0.002	100%	Retain: 0.14 Detain: 0.19	Complete
	Stahelin	0.71	\$139,743	\$4.82	0.029	Retain: 0.021* Detain: 0.008	100%	Retain: 0.37* Detain: 0.25	Complete
	Greenview	0.58	\$125,713	\$9.67	0.013	Retain: 0.011 Detain: 0.002	100%	Retain: 0.05 Detain: 0.16	Complete
	Stoepel Park (No. 1)	6.45	\$652,672	\$6.53	0.09	Retain: 0.09 Detain: 0.01	44%	Retain: 0.17 Detain: 1.86	Complete
	Liuzzo Park	3.10	\$488,625	\$5.43	0.09	Retain: 0.03 Detain: 0.06	33%	Retain: 0.28 Detain: 0.71	Complete
	Keeler Street	1.00	\$289,162	\$7.23	0.04	Retain: 0.04 Detain: 0	93%	Retain: 0.17 Detain: 0.5	Complete
	Artesian	5.30	\$457,161	\$4.16	0.11	Retain: 0.06 Detain: 0.05	47%	Retain: 0.53 Detain: 3.31	Complete
	Constance Sewer	15.10	\$497,162	\$0.87	0.57	Retain: 0.57 Detain: 0	100%	Retain: 5.86 Detain: 0	Complete
	Tireman I	6.48	\$1,217,960	\$60.90	0.02	Retain: 0.02 Detain: 0	7%	Retain: 0.11 Detain: 3.37	Complete
	Tireman Phase II	3.05	\$457,680	\$10.40	0.04	Retain: 0.14 Detain: 0.03	87%	Retain: 0.58 Detain: 0.9	Complete
	Subtotals	43.26	\$4,605,739		1.06			8.7	Retained Vol Only

	Project Name	Acres Managed	Estimated Construction Cost	2-year, 24-hour Effectiveness (\$/gal)	24-Cost Managed (MG)	2-yr Volume Managed (MG)	2-year, 24-hour Design Storm Performance (MG) ¹	% of 2-Year Design Storm	Annual Volume Removed (MG) ²	Status
FY2018	Crowell Recreation Center	2.48	\$731,809	\$8.13	0.09	0.09	Retain: 0.09 Detain: 0	100%	Retain: 0.32 Detain: 1.15	Under Construction
	O'Shea Park	3.72	\$582,543	\$7.32	0.08	0.08	Retain: 0.03 Detain: 0.05	37%	Retain: 0.24 Detain: 1.35	Under Construction
	Vaughan Retrofit	0.21	\$57,641	\$5.76	0.01	0.01	Retain: 0.01	100%	Retain: 0.44* Detain: 0.2	Under Construction
	Stahelin Retrofit	.41	\$57,641	\$5.76	0.01	0.01	Retain: 0.01	100%	Retain: 0.37* Detain: 0.25	Under Construction
	Subtotals	6.82	\$1,432,634			0.19			1.37	Retained Vol Only
FY2019/Project Development	Oakman Boulevard	63.10	\$5,400,000	\$2.74	1.97	1.97	Retain: 0.65 Detain: 1.32	49%	Retain: 11.7 Detain: 25.6	Pending Advertisement
	Charles Wright Academy	5.55	\$1,500,000			TBD	TBD		TBD	Initial design of school almost complete, evaluating expanding tributary area
	Joy Road		\$225,000			TBD	TBD		TBD	
	Subtotals	68.65	\$7,125,000			1.97			11.7	Retained Vol Only
Estimate of Runoff Reduction (MG)					3.22					

1 – Based on retained volume of 2-year design event

2 – Annual runoff to the practice is currently approximate for annual volume detention. Estimates may be refined in the future.

3 – For Crowell, amount in table includes \$76K paid by others.

4 – *Indicated estimated value based on the expectation that more runoff will be diverted into the garden following the construction of the Ecosite modifications and less water will inflow back into the sewer system once the anti seep collar is installed.

5 – Charles Wright numbers acres managed (5.55) include school only, design being evaluated to expand tributary area.

6 – Performance for Ecosites based on monitoring report dated 7/27/17.

7.0 ACTION PLAN FOR FY2019

Table 8 provides an overview of the action items planned for FY2019.

Table 8 Proposed FY2019 Activities

Activities	Proposed Activities and Schedule
Institutional Efforts	
Codes and Ordinances	Post-construction stormwater management ordinance presented to City Council
Stormwater Design Manual (for Stormwater Ordinance)	Final version available 2018
Drainage Charge Credit System	Ongoing program implementation
Tracking System	Tracking systems ongoing
Project Implementation	
Stoepel Park No. 1	Contractor Maintenance Period Continues in FY2019
Liuzzo Park	Contractor Maintenance Period Continues in FY2019
Crowell Recreation Center	Construction finalized in FY2019 Maintenance ongoing
Ecosites Retrofits	Construction finalized in FY2019 Maintenance ongoing
O'Shea Park	Construction finalized in FY2019 Maintenance ongoing
Oakman Blvd	Project bid and notice to proceed in FY2019
West Warren (Constance Phase II and Tireman Phase III)	Concept finalized and design underway in FY2019
Rogell	FY2019 in complete concept and schedule for implementation
Minock Park/ Brightmoor	Develop concept and schedule implementation in FY2019
Charles Wright Academy	Project bid and notice to proceed in FY2019
Additional GSI Projects	DWSD will consider additional opportunistic projects in collaboration with parks, facilities and DPSCD
Distributed GSI Implementation	
Downspout Disconnection - Homes	Coordination with faith-based and nonprofit groups for downspout disconnection programs in conjunction with drainage charge credit system and outreach
Downspout Disconnection - Multi-Family Residential, Commercial, and Industrial	Non-residential outreach to stimulate private investment
Demolitions and Site Restoration	Coordination with DLBA and DBA is ongoing
Tree Plantings	No additional plantings planned for FY2019

Activities	Proposed Activities and Schedule
Monitoring and Maintenance of Projects	
Green Stormwater Infrastructure Performance Planning	Ecosite monitoring through fall 2018
Green Stormwater Infrastructure Benefits Evaluation	Ongoing coordination with the University of Michigan Water Center
Legal agreements for long-term sustainability	Ongoing activity
Stakeholder and Community Engagement	
Project Related Outreach	Ongoing updates
Overarching, Collaborative Green Infrastructure Public Education Campaign	Ongoing activity
Drainage Charge and Credit Outreach and Engagement	Ongoing activity
Post-Construction Ordinance Outreach	Ongoing activity

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