Green Infrastructure Progress Report
Upper Rouge Tributary Area

March 1, 2020 – February 1, 2021

NPDES Permit No. MI0022802

Detroit Water and Sewerage Department
735 Randolph
Detroit, MI 48226

April 1, 2021

Green Infrastructure Program
Upper Rouge Tributary Area

Annual Progress Report

April 1, 2021

Portion of FY2020: March 1, 2020 – June 30, 2020
And
Portion of FY2021: July 1, 2020 – February 1, 2021

NPDES Permit No. MI0022802

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ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
BSEED	Buildings, Safety Engineering and Environmental Department
CSO	Combined Sewer Overflow
CIPMO	Capital Improvement Program Management Organization
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
EGLE	Michigan Department of Environment, Great Lakes, & Energy
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) through for FY2020 (March 1, 2020 – June 30, 2020) and a portion of FY2021 (July 1, 2020 through Februrary 1, 2021). 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 combined sewer overflow (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. DWSD's upcoming projects focus on having a larger impact through targeting specific neighborhoods where large scale projects can reduce or eliminate specific outfalls from having CSO discharges. DWSD's future large scale GSI projects will align with many key aspects of the recently published Great Lakes Water Authority's (GLWA) Waste Water Master Plan (WWMP).

PROGRESS OF MAJOR INITIATIVES IN FY2020/FY2021

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 revamping and redevelopment of institutional structures (i.e. Ordinance and Design Manual) 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.

In FY2020/FY2021, DWSD continued design of future projects through its CS-1884A professional services consultant. Under CS-1884A DWSD continued to execute and facilitate the major initiatives for compliance with the NPDES permit. DWSD has utilized its sewer and water main rehabilitation efforts under the Capital Improvement Program Management Organization (CIPMO) to expand GSI implementation.

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)

As stated in the previous report, DWSD worked 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 PCSWMOwas originally passed by City Council in November 2018, and there was ample feedback from the industry that revealed where updates and refinement to the oridinance needed to occur. Therefore DWSD took steadfast efforts to amend the Stormwater Ordinance to enforce feasibly implementable stormwater management for development within the City. December 9, 2020 marks the enactment of the amended ordinance as approved by City Council. (FY2021).

DWSD's approach as embodied in the Post Construction Stormwater Management Ordinance (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 additions or replacement of impervious cover above an established threshold of ½ acre.

DWSD also continued collaboration and coordination with other departments such as City Planning Commission (CPC), Housing and Revitalization Department (HRD), Planning and Development Department (PDD), and Building, Safety Engineering and Enviornmental Department (BSEED) to promote GSI during site plan reviews for redevelopment and development projects that are not necessarily required to comply with the ordinance. The engagement of these critical entities are a catalyst for ensuring compliance with the ordinance and reinforcing the need for the GSI implementation.

DWSD Implemented GSI Projects

During the course of FY2020/2021, construction project PC-801A – Oakman Boulevard Green Stormwater Infrastructure reached substantial completion and commenced the warranty, maintenance and establishment periods (see Figure 1).

For DWSD construction projects previously completed and contracts closed prior to FY2019, DWSD continued the maintenance responsibilities under the current DWS-904 Maintenance contract once the original contractual obligations were met by the construction contractor for maintenance and establishment. DWSD utilized in-house Maintenance & Repair staff for cleaning the hardscape infrastructure such as sumps, porous pavers, catch basins and trench drains. The projects falling under DWSD's responsibility for maintenance included Artesian permeable asphalt, Keeler Street pavers, Stoepel Park No. 1, Liuzzo Park, Ecological Sites, and Tireman bioswales.

DWSD has initiated a Capital Improvement Program Management Organization (CIPMO) to assess the water and sewer condition for neighborhoods. Upon the assessment, areas where sewer capacity is an issue and sewer interventions are being performed by open cut, GSI is being considered. The consultant for this program selects locations where GSI can be implemented. In the URT, a small scale GSI along Edinborough Street in the North Rosedale Park neighborhood has been incorporated into the project documents. In addition, GSI was incorporated into Cornerstone Village on Chandler Park Drive which is not within the URT but demonstrates DWSD's commitment to implementation of GSI citywide, when appropriate and effective. According to the North Rosedale and Cornerstone Village construction schedules, the GSI portion is projected to begin construction in 2021.

Monitoring of existing projects helped define the performance of constructed practices, and a better understanding of the geotechnical limitations (i.e. clayey soils) in the City of Detroit. The results led DWSD to shift 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 reducing peak flows. Therefore, FY2019/FY2020 focuses on the neighborhood scale projects for design of the Far West Detroit (formerly West Warren) project which incorporates suggestions from GLWA's WWMP. This project involves extensive storm sewer separation leading to GSI practices within Rouge Park that ultimately discharge to the Rouge River.

Figure 1 Oakman Boulevard Green Stormwater Infrastructure

Drainage Charge Credit System

DWSD continued to promote the drainage charge credit program as an institutional measure that provides an incentive for customers to implement GSI practices. The Capital Partnership Program (CPP) has awarded funding over the years but funding has been paused due to the impact of CoVid - 19. The budgeted monies may only be solicited for sites that propose a retrofit project for stormwater management. Any development that is required to comply with the ordinance is not eligible for CPP funding. Upon request, non-residential property owners have been able to receive a site assessment that summarizes opportunities for implementation of stormwater management that would also achieve a credit towards their drainage charge. Due to the CoVid-19 impacts, site assessments have been temporarily placed on hold. Typically site assessments include inspection and assessment of the property, and provide a report to the property owner explaining what can be done through implementation of GSI to reduce the drainage charge through green credits.

Demolition Program

The demolition program continued in FY2020 and continues in FY2021 which included 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 – 2021. DLBA has adopted standards of site restoration from DWSD to promote the reduction of runoff upon restoring the demolition site. The consistent removal of impervious cover and restoration conducive to the DWSD recommendations generate less runoff into the combined sewer system.

NPDES METRICS

DWSD's NPDES permit requires certain reporting and expenditure metrics. DWSD's NPDES permit was updated July 1, 2019 with EGLE. Since the new permit has been issued, DWSD has commenced operating under the requirements and conditions as permitted by EGLE. The progress reporting requirement of this permit is fulfilled by this annual report. This April 1, 2021 report encompasses a portion of FY2020 as well as FY2021 through February 1, 2021.

The NPDES permit established an expenditure timeline for the DWSD to adhere to. DWSD shifted from small-scale GSI to large-scale neighborhood projects, as outlined in the waste water masterplan, and transitioned the on-going design projects from CS-1522 to CS-1884A. With the transition, DWSD performed valued engineering to enhance project outcomes and maximize CSO reduction, thus an updated expenditure timeline was needed. DWSD proposed a revised expenditure schedule to EGLE to demonstrate that DWSD shall realign with the initial NPDES schedule for expenditures and maintain permit compliance. The proposed expenditure schedule was accepted by EGLE. DWSD was able to meet the revised expenditure schedule for this fiscal year's reporting period. EGLE and DWSD have established quarterly meetings to provide updates, assess past quarterly performance, and address new events that may affect projected expenditures. With the proposed projects PC-806 and PC-808, anticipated to begin construction in 2021, DWSD continues to monitor expenditures for reporting and compliance.

DWSD staff, CS-1884A consultants, and EGLE have continued meeting virtually and taken key measures to not impede the design and construction phases that will be a catalyst for achieving permit compliance and continue with design efforts serving customers and constituents for the furtherance of GSI implementation.

FY2020/2021 EXPENDITURES

In FY2020/2021, DWSD's Green Stormwater Infrastructure program expended funds for 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 FY2020/FY2021 Expenditure Summary

Effort	Expenditures March 1, 2020 – Feb 1, 2021	Cumulative Expenditures FY2010 - Feb 1, 2021	Comments
Code and Ordinance Efforts	$ 11,935*	$ 191,166	Work for ordinance development and implementation, prorated to URT share (27.1%) * Includes Outreach spend.
Project Management and Planning	$ 391,411	$ 3,168,832	DWSD staff and consultant services
Outreach	$ - **	$ 546,519	**Outreach efforts for this report are included in Project Implementation as well as Codes and Ordinance due to change in billing methodology for CS-1884A.
Tracking Impervious Cover Analysis	$ 48,780	$ 171,952	Impervious cover, prorated to URT share (27.1%); GIS data management
Project Implementation	$ 7,652,938*	$ 24,286,976	Planning, Design, and Construction of GSI *Includes Outreach spend.
Maintenance	$ 20,264	$ 145,725	Includes GSI maintenance under DWS-904
Total Spend	**$ 8,125,328**	**$ 28,511,170**	Includes CS-1522, CS-1884A, & PC-801A Oakman billings
Projected Upcoming Construction Project Spend:		$ 29,348,000	**Based on most recent updated values:** **1) Bid Values For:**Chandler Park Drive and Edinborough and Charles Wright **2) The Engineer's Estimate For:** Far West Detroit -which will be phased over 5 years Projection only includes construction dollars and does not include other eligible spend dollars.
Total with Future Construction		**$ 57,859,170**	

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 conventional CSO control facilities. DWSD is responsible for the implementation of the GSI program.

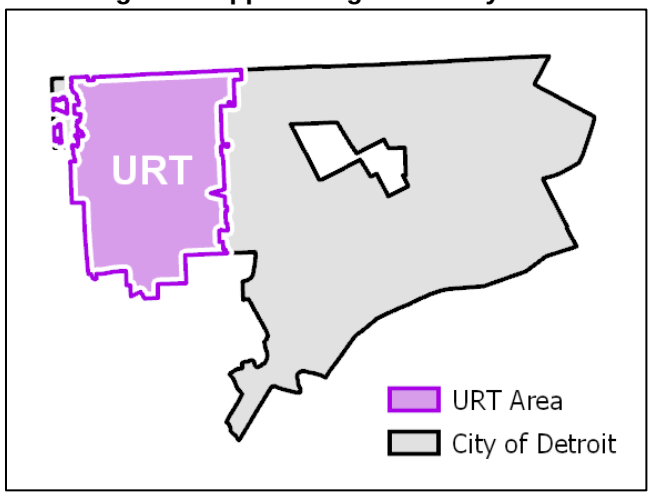
This document is the Green Stormwater Infrastructure Annual Progress Report for FY2020 and portions of FY2021, which corresponds to the time period of March 1, 2020 – Februrary 1, 2021. An annual progress report is required according to the permit (NPDES MI0022802 Part I.A.15.d.5.a) that:

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.*

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.

Figure 2 Upper Rouge Tributary Area



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 2018 were discussed in previous reports.

With the City's approximate 138 square miles, GSI opportunity is abundant. 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 continue to be cooperative and positive.

The focus of activities for DWSD in FY2020 and portions of FY2021 has continued with GSI project implementation, identification and development of future projects, the 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 FY2020 and portions of FY2021. As DWSD's stormwater hub website continues to gain ground and momentum to spark interest amongst Detroiters, we hope to see more GSI installations from the private sector.

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 has implemented a three-pronged approach for better stormwater management. The three approaches, as seen inFigure 3, include code modifications and ordinance enactment, implementation of a drainage charge green credit program, and project implementation in coordination with other activities and partners.

Figure 3 DWSD's Approach to Stormwater Management

2.0 PLAN IMPLEMENTATION – FY2020/FY2021

The Green Stormwater Infrastructure Plan was first a requirement for DWSD under the NPDES permit (Permit No. MI0022802), issued by MDEQ (State of Michigan Department of Environmental Quality, 2013). The permit required DWSD to develop and implement a plan for locating, designing, constructing, operating, and evaluating GSI in the sewer sheds for 17 CSO outfalls to the Rouge River. The permit identified specific elements that should 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 per the May 2013 permit and programmatic and policy type elements. The 2014 GI Plan was submitted to MDEQ on August 1, 2014, and was conditionally approved by MDEQ on May 8, 2016. The Green Stormwater Infrastructure Plan was also included in the new NPDES permit (Permit No. MI0022802) issued by EGLE on June 28, 2019 with an effective date of July 1, 2019. The new permit has updated language that refers to GSI best management practices (BMPs).

The GSI related requirements from the May 2013 permit and the recent July 2019 permit essentially remain the same stating the provisions (downspouts, demolition, GSI/BMPs, outreach, etc.) that shall be established and implemented by DWSD. The Upper Rouge Tributary area and outfalls are still the primary target areas to address. With the new expenditure requirement allowing for 1/3 of the total spend to be utilized outside of the URT, for project constructed in areas tributary to an untreated CSO.

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 by DWSD on GSI projects. These activities include planning, design, construction, and public outreach.

A summary of activities in FY2020 and portions of FY2021 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 (GSD), 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:

- Enacted the amended Post-Construction Stormwater Management Ordinance developed from the assessment of the initial ordinance implementation/roll-out to establish more cohesive parameters for green infrastructure implementation which was passed by City Council Decemeber of 2020.
- Revise and Refined the Stormwater Management Design Manual that accompanies the Post-Construction Stormwater Management Ordinance for use by developers within the City.
- Held an outreach workshop/seminar with designers and consultants to advise on the updates to the ordinance and design manual in January 2021.
- Continued oversight and review of stormwater projects for new and redevelopment within the City.

Continued Significant DWSD events include:

- Augmented SMG staff by hiring of multiple staff with the focus on long term implementation and management of DWSD's stormwater programs and policies.
- Developed new maintenance contract for advertisement and continued to train DWSD Maintenance and Repair crews on the use of permeable pavement cleaning equipment and other project hardscape for continued functionality of green stormwater infrastructure projects. Updated the Municipal Stormwater Maintenance Manual for use by the DWSD maintenance personnel responsible for maintaining DWSD practices.

Status of GSI Plan Activities

No.	Activities	Proposed Activities and Schedule	Current Status
Activity 1 – Policies, Procedures and Standards			
	Codes and Ordinances	Code updates "greening of the code" September 2017	Passed City Council November 2017
		Post-construction stormwater management ordinance August 2018 Post-construction stormwater management amended ordinance 2020	Passed November 2018; Amended 2020 and passed by City Council and enacted December 2020
	Stormwater Design Manual (for Stormwater Ordinance)	Published on November 13, 2018 Revision 2 completed December 2020	Located on DWSD's website
	Public Stormwater Maintenance Guidance	Expand existing information into a guidance document by December 2017	Complete October 2017
	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, fee-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 Management Ordinance (PCSWMO) was passed November of 2018 by City Council. DWSD has revised the ordinance based upon the lessons learned since its enactment in 2018. Feedback from developers and consultants along with the plan review process has allowed DWSD staff to work with its Legal department to remove barriers that make compliance too difficult yet still exceed the goals established by the NPDES permit. The revised ordinance is enacted as of December 2020.

Simultaneous with 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 requirements that removed language requirements for "raised islands and including language allowing inlets at island curbing.
- Removal of barriers and allowing more flexibility regarding permeable parking lot surfaces.
- Support of multi-use of screening areas and allowing for vegetative barriers.
- Allowing trees to count toward shade tree requirements.
- Allowing 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 FY2020/2021, DWSD continued to advance updating the PCSWMO. It should be noted that all actions described below were subject to the legislative process which dictated the implementation schedule. The following activities were part of FY2020/2021:

- Post-construction stormwater management ordinance:
  - Continued the redevelopment and revising of post-construction stormwater management ordinance.
  - Presented draft final ordinance to the City Council for review and approval. The updated ordinance was passed and enacted on December 9, 2020 (FY2021).
- Continued coordination with BSEED, PDD, DPW and other relevant departments that manage the zoning, building codes and site reviews/ permitting in the City.
- Developed and published the updated Stormwater Management Design Manual. DWSD continues to update the manual as needed based upon feedback from the community and lessons learned.

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 Post-Construction Stormwater Management Ordinance. As part of the review, technical experts in other City Departments and committees reviewed the document and provided comments which were incorporated by DWSD.

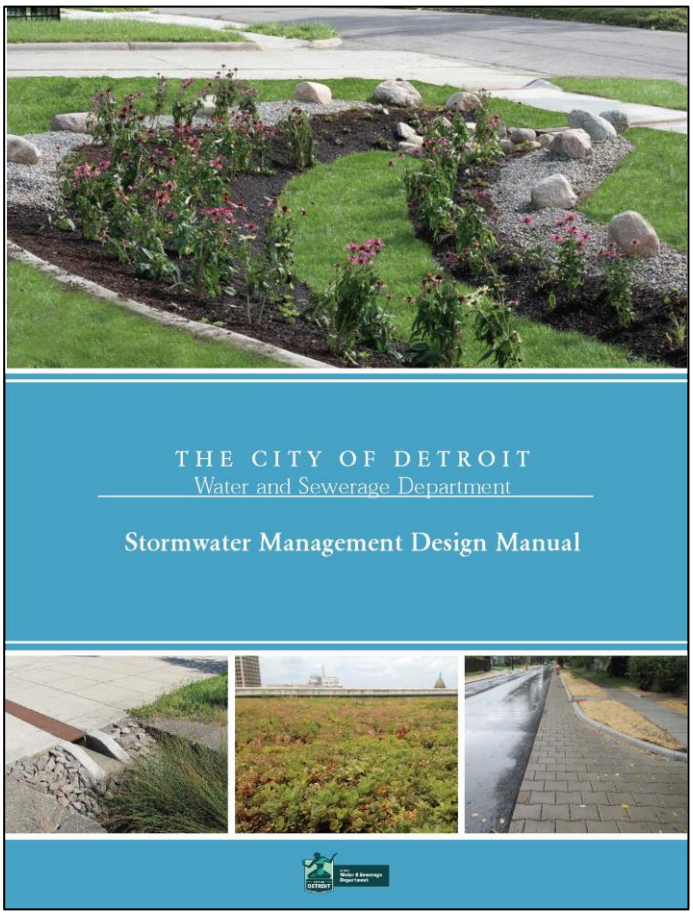
This manual serves as a resource for both applicants and City personnel to ensure development is compliant with the Post-Construction Stormwater Ordinance. The manual also addresses the permit requirements (Part I.A.15.f.c.2) pertaining to stormwater controls for projects requiring a Part 41 construction permit issued by EGLE. In addition to general green stormwater infrastructure design guidance, the manual provides information on the following:

- Applicability of the requirements for new development and redevelopment.
- 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 separated storm sewer areas are 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 was updated and republished in December 2020 in coordination with the amended ordinace that took effect December 9th, 2020. The manual is divided into the following chapters and located on the City of Detroit website for public access and use. Many of the December 2020 updates were clarifications to content already in the manual. The format and overall chapter content did not change.

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

Figure 4 Design Manual Cover



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.

December 2020 Updates

- Added detail for the required elements of a Post-Construction Stormwater Management Plan
- Updated definitions for development site, construction area, and impervious surface.
- Provided clarifications on exemptions to the Stormwater Ordinance.
- Added an option for onsite alternative compliance (Extended Detention) under extraordinarily difficult site conditions.
- Added a cutoff value for measured in-situ infiltration (0.20 inches/hour) that would establish an extraordinarily difficult site condition.
- Provided more detail on performance standards.
- Updated hyperlinks to external resources.
- Updated the application forms for Alternative Compliance Requests and the Post-Construction Stormwater Management Plan.
- Added a requirement to include Drainage Fee Credit calculations in the site plan submittal.
- Added a Certification Statement for the construction and perpetual maintenance of the proposed Stormwater Control Measures.
- Added two site plan examples with step-by-step calculations.

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 sources to precipitation data, as well as acceptable methods and modeling software for calculating runoff volumes and peak discharge rates.

December 2020 Updates

- Added statement encouraging (but not requiring) design consideration for climate change impacts on rainfall intensities.
- Provided additional references to acceptable hydrologic/hydraulic model platforms.
- Simplified the equation for required Retention Volume.
- Included an equation for Extended Detention Volume (onsite Alternative Compliance).
- Added a site area cutoff (<20 acres) for the use of the Modified Rational Method for detention pond volume determination.
- Added clarifications for time of concentration calculations.
- Added runoff coefficients for open water and additional guidance on the use of runoff coefficients.

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.

December 2020 Updates

- Added a clarification for energy dissipation design.
- Added a clarification for the use of underdrains based on in-situ infiltration rates.
- Edited the details on requirements for safety grates on culverts and outlets.
- Edited the design criteria on inlet spacing.

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.

December 2020 Updates

- Added a statement clarifying parking lot detention; prohibiting the practice for parking areas used by passenger vehicles and allowing it only on industrial lots with only truck/trailer traffic.
- Added a statement clarifying the dewatering period for sediment forebays, setting this at 24 hours.
- Corrected an error on the freeboard elevation for stormwater practices; set the maximum surface ponding elevation to be one foot below basement floor elevations (previous standard had the freeboard elevation at one foot above basement floor elevations.
- Added a design requirement for a backup power source for pumped stormwater facilities.

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 support 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 (MSMM) was developed in FY2018 to identify specific methods and approaches to maintaining the structures constructed for each GSI practice. The MSMM was updated in FY2019 and portions of FY2020 to include completed GSI projects, O'Shea Playground, Crowell Recreation Center, and Ecosite Retrofits. Each component of the GSI practice has a standard operating procedure (SOP) outlining the required maintenance tasks and the inspection frequency. Site specific information packets detailing the site location and SOPs needed during inspections at each site were also developed. All structural tasks, including trench drains, catch basins, inlet structures, outlet structures and underground pipes, will be maintained by DWSD's in-house Maintenance & Repair staff. Maintenance of the vegetation components is currently conducted under DWSD's contract DWS-904. During FY2020/2021, DWSD developed a new maintenance contract with broader scope to ensure DWSD has greater flexibility in maintaining practices which will be advertised for bid in the near future. PC-801A Oakman Boulevard Maintenance Manual component is under development.

During FY2020/2021, DWSD implemented Cityworks, a GIS-based asset management program, to perform and track GSI practice inspections such as DWS-904 tasks and Maintenance & Repair staff as noted above. The content developed in the maintenance manual has been imported into a Cityworks workflow that automatically flags when inspections need to be performed for each asset within a GSI practice. 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 complete. DWSD will use and refine the tool as necessary in the future. DWSD also implemented regularly inspections for each constructed site to determine if maintenance is necessary or any other corrective actions needs to be taken.

Impervious Cover Reduction

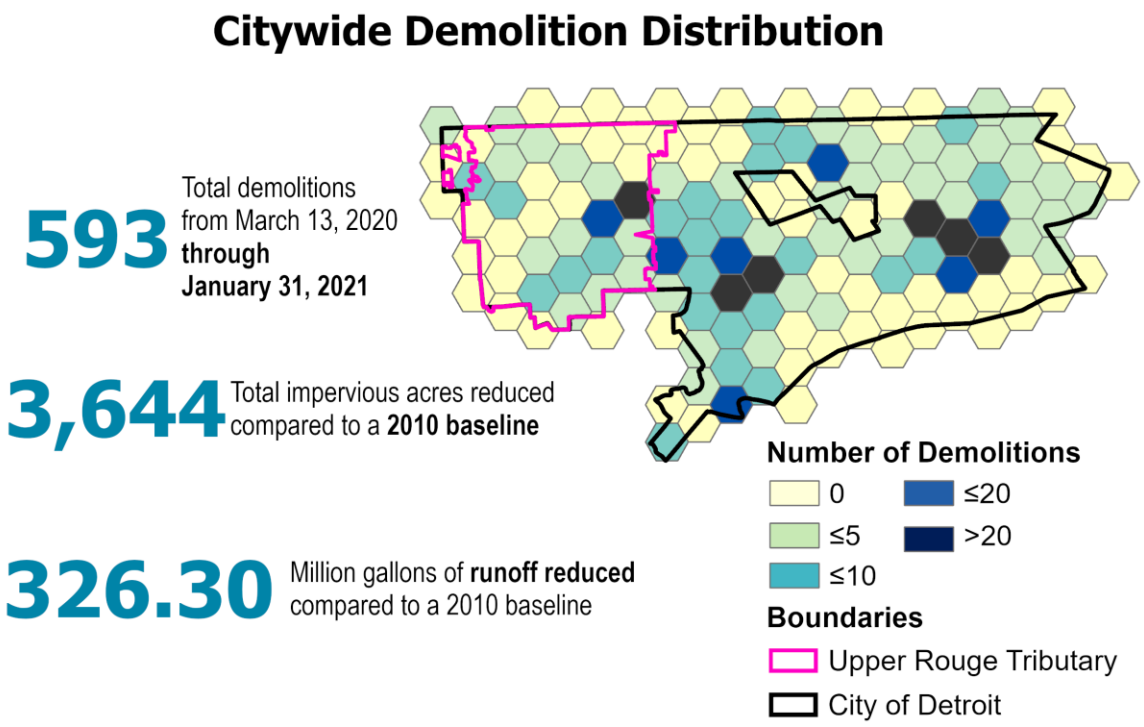
DWSD has tracked impervious cover in the City of Detroit for stormwater management and drainage charge related purposes. Demolitions have historically resulted in significant removal of impervious cover. DWSD has tracked the overall impervious cover change as a result of demolitions since 2010. Calculations reported in this report are based on the 2010 impervious cover layer, the 2015 and 2019 impervious cover layers and the demolition tracking that is in the City's "demolition tracker". Future efforts have continued to focus on the runoff reduction for GSI implemented projects and management of stormwater from new and redevelopment projects. This is validated by the ordinance compliance efforts and large-scale DWSD project(s) consisting of storm sewer and green storm water infrastructure with direct discharge to the Rouge River.

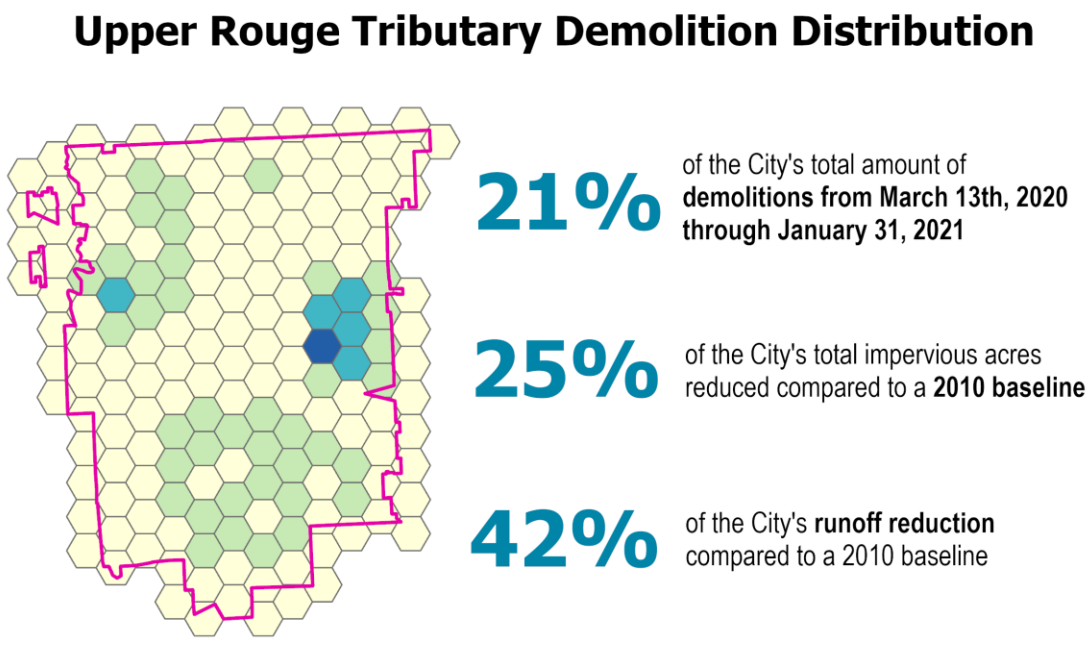
The estimated recent and cumulative impact of demolitions is summarized in Table 2. Locations of URT demolitions that occurred in FY2020/2021 are shown inFigure 5. There were 593 total demolitions within the City and 124 documented demolitions in the URT between March 13, 2020 through February 1, 2021, (FY2020/2021). Demolitions within the City were reduced due to the financial impacts of CoVid-19 Pandemic.

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
Demolition (acres) in FY2019	40	152
Demolition (acres) in FY2020 (through March 12, 2020)	22	83
Demolition (acres) in FY2020/2021 (3/12/202 – 2/1/2021)	4	16
Total Change in Impervious Cover (FY2010 – February 1, 2021)	1546	3644
Estimated Runoff Reduction (MG)	**46.51**	**110.91**

Figure 5 URT Area Demolitions, March 13, 2020 – January 31, 2021





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.
- Parcels that directly discharge to the Detroit or Rouge Rivers and privately owned green stormwater infrastructure practices that qualify for drainage charge credits.
- General land use cover change over time.

Activities executed for FY2020/2021 include:

- Acquired April 2019 aerial imagery through the Michigan Statewide Authoritative Imagery & LiDAR, which will be used to update impervious areas within the City.
- Finalized 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

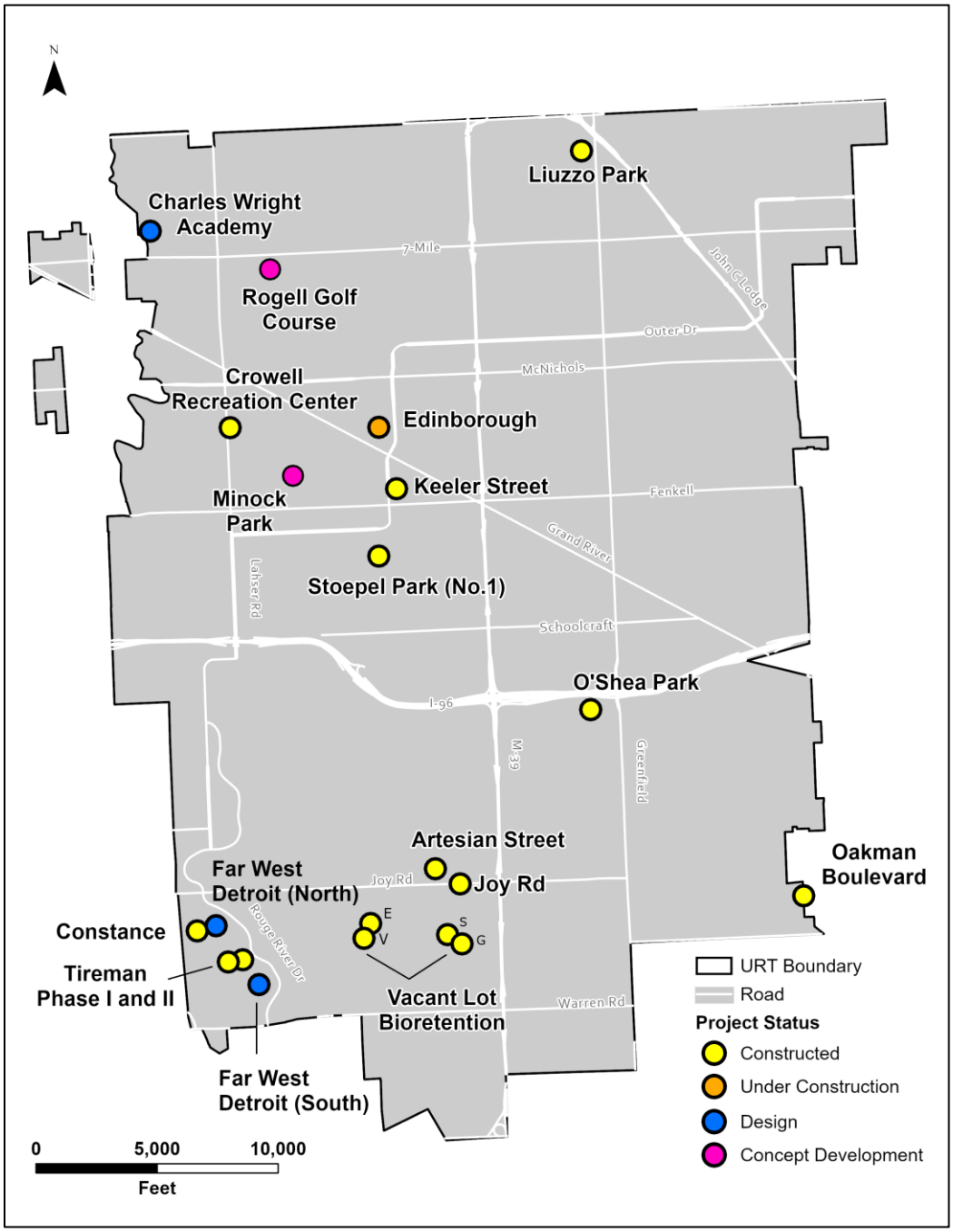
DWSD began implementation of GSI projects in 2015, additional projects are in various phases of construction, design or development. Table 3 provides a summary of the projects and Figure 6 shows the locations of these projects.

Table 3 Implementation Activities

Activities	Anticipated Status (as of April 2021 Report)	Actual Status (FY20/21)
Project Implementation	**Action Plan**	
PW6968 (Transportation Projects Artesian, Keeler, Constants, Tireman Residential)	Construction complete. Contract closeout in FY2018	Complete. Contract closed out
Stoepel Park No. 1	Construction complete.	Complete. Maintenance ongoing
Liuzzo Park	Construction complete.	Complete. Maintenance ongoing
Tireman Phase II (Bioswales in Rouge Park)	Construction complete.	Complete. Maintenance ongoing
Crowell Recreation Center	Construction complete	Complete. Maintenance ongoing
Ecosite (Greeniew, Evergreen, Vaughn & Stahelin)	Construction Complete.	Complete. Maintenance ongoing
O'Shea Park	Substantially complete construction in FY2019. Contract maintenance period continued in FY2020/2021	Complete. Maintenance ongoing

Activities	Anticipated Status (as of April 2021 Report)	Actual Status (FY20/21)
Oakman Blvd	Substantially complete construction in FY2021 (November 2020). Contract maintenance period initiated in FY2021.	Complete. Maintenance ongoing
Far West Detroit Project (Formerly West Warren - Constance Phase II and Tireman Phase III)	Design at 100% during FY2021. In procurement withprojected construction FY2022 - FY2027	Design to align with Wastewater Master Plan
Rogell	FY2020/2021 no changes to concept. Schedule implementation pending coordination with other City departments.	Requires additional environmental evaluation.
Charles Wright Academy	. Notic to Proceed with construction March 2021.	Awarded with construction to start March 2021
Additional GSI Projects (outside of URT)	DWSD considers additional opportunistic projects in collaboration with CIPMO, GSD, PDD, and DPSCD. Cornerstone Village neighborhood consists of a GSI project in the right of way of Chandler Park Drive.	Ongoing
Edinborough Street (CIPMO)	Designed GSI for CIPMO Project during FY2019. Project is within the URT. Project awarded.	Ongoing
Ordinance Compliance	Review and Approval of stormwater management practices as part of development compliance with stormwater regulations.	Ongoing
Activity 3 – Distributed GSI Implementation		
Downspout Disconnection – Homes	DWSD determined that downspout disconnection programs in conjunction with drainage charge credit system was unfeasible in FY2019. DWSD continues to coordinate outreach and downspout disconnection coordination opportunities with nonprofit groups	DWSD Service Credit Program was determined to not be feasible; however, coordination continues for downspout disconnections
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
Demolitions and Site Restoration	Coordination with DLBA and DBA is ongoing	DLBA continues demolitions
Tree Plantings	No additional plantings planned unless incorporated into DWSD Construction Projects	N/A

Figure 6 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 west side. Each of the four bioretention sites were constructed on a two-parcel vacant lot and serve an approximate drainage area between 0.5 - 1 acres for each site. An example of one of these sites can be seen in Figure 7. 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 Vaughn & Stahelin were constructed in FY2019. See Ecosite Retrofits for information about these sites and their modifications.

Figure 7 Evergreen Vacant Lot Bioretention – Site

Stoepel Park No. 1

Stoepel Park No. 1 is approximately 30 acres in size, and is located at Evergreen Road & Outer Drive in Detroit's Brightmoor Neighborhood within the designated URT priority area (Figure 2). 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 8). The project was completed November 1, 2016. The contractor completed the three-year maintenance and plant establishment period in FY2019. Maintenance continues under DWS-904 Maintenance contract for the plantings. The hardscape infrastructure maintenance is conducted by DWSD.

Figure 8 Stoepel Park Bioretention and Parking Area

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 9). 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 completed the three-year maintenance and plant establishment period in FY2019/FY2020. Maintenance continues under DWS-904 Maintenance contract for the plantings. The hardscape infrastructure maintenance is conducted by DWSD.

Figure 9 Liuzzo Park Bioretention Improvements

DPW 6968

To capitalize on cost-sharing efforts and promote coordination with other City departments, several GSI projects (Tireman Phase I, Constance, Artesian, and Keeler) 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.

Tireman Bioswales

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 (b). 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 11). 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 was completed and deemed the PC-808 Far West Detroit. PC-808 Far West Detroit is a storm sewer/GSI project that will manage approximately 217 acres in the Far West Detroit neighborhood. Once the project is constructed, the overflow from the larger bioswale in Tireman Phase II, as well as Tireman Phase I, will be routed to the newly designed PC-808 Far West Detroit GSI practice and ultimately discharge to the Rouge River.

Other planning efforts performed in FY2020/FY2021 were for additional restoration of the Tireman Bioswales Phase I (Figure 10a), as some residential swales were not fully established and maintained to the intended design. Maintenance and reseeding occurred in the fall of 2020 for some of the bioswales. The remainder will be reseeded and replanted in the Spring of 2021. In late 2020, Tireman Phase II was prepared for reseeding and replanting spring/summer of 2021.

Figure 10 Tireman Bioswales – Completed Modifications

a) Tireman Phase I

b) Tireman Phase II

Figure 11 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 (Figure 12) and replacement of the center section of parking stalls with permeable block pavement and bioretention islands. Conventional HMA pavement was placed for the remaining portions of the parking lot with new curb installed around the perimeter of the parking lot. Both parking lots were 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 has two endcap bioretention islands that will overflow to the permeable block pavement. Stormwater enters 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 substantial completion was achieved Spring 2019 (FY2019). Warranty and Maintenance is ongoing under the contract PC-799 – Crowell Recreation Center.

Figure 12 Crowell Recreation Center Parking Lots

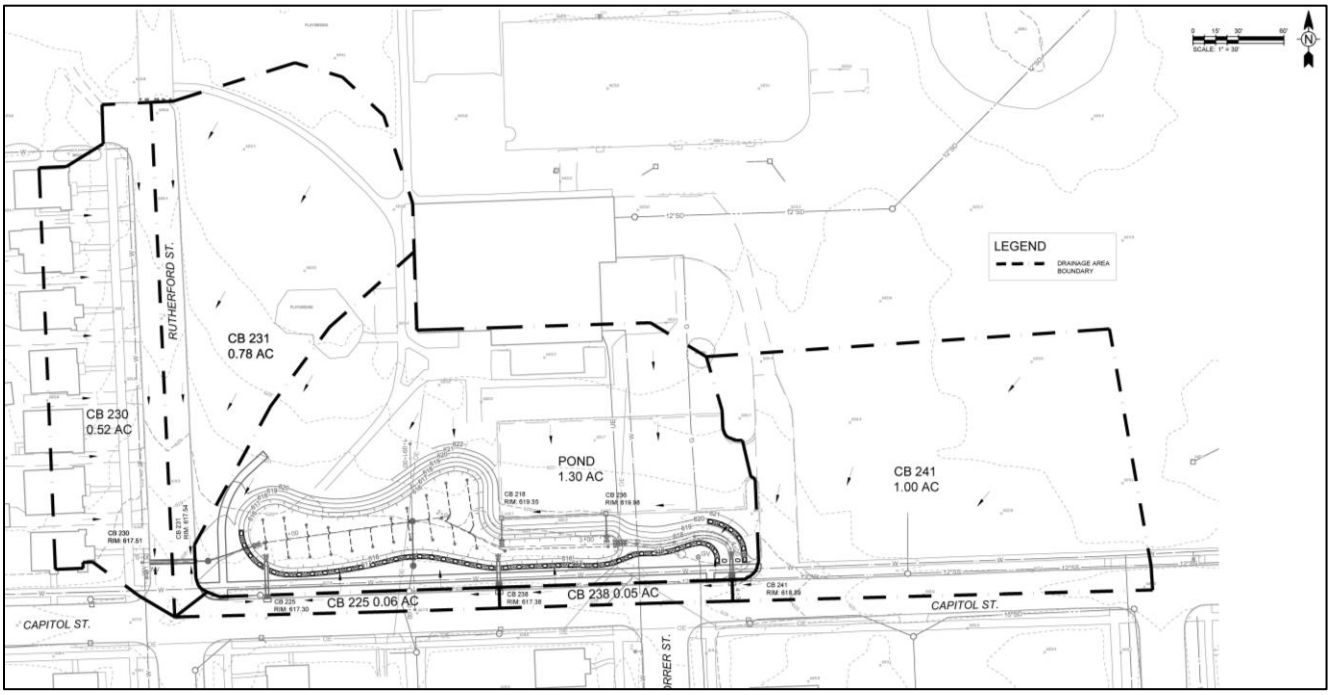
O'Shea Park

O'Shea Park is a 20-acre park located just south of I-96 and east of M-39 (Figure 6). A complete park renovation was completed through the collective efforts of PDD, DWSD, GSD, and DTE. The park renovation included demolition of the abandoned recreation center on site and construction of the largest urban solar array at 9 acres, an open park space, a basketball court, walking paths and an overlook for the solar array. DWSD collaborated with GSD and PDD to incorporate a stormwater management feature into the overall park improvements.

The GSI practice (Figure 13) 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 which is conveyed to the bioretention practice via inlets along the parking lot curb, along the southern edge of the bioretention practice, and a trench drain inlet on the west side of the bioretention practice.

Figure 13 O'Shea Park Bioretention Improvement Rendering

Figure 14 O'Shea Park Drainage Areas



The practice was constructed with underdrains that will dewater the system and discharge back to the combined sewer at a reduced/throttled rate (Figure 14). As part of the GSI monitoring effort, cameras were installed at this location to generate time lapse footage of construction activities (Figure 15). This allowed 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 reached substantial completion in November 2018 (FY2019). Maintenance and replanting continues in FY2020/2021.

Figure 15 O'Shea Park Construction

Ecosite Retrofits (Vaughn & Stahelin)

Two of the initial ecological restoration sites, Vaughan and Stahelin, underwent additional construction in FY2019. Work included 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 16). 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 the retrofit portion achieved substantial completion in late Summer 2018 (FY2019). As noted in Table 7, additional acreage and more volume is now managed by Vaughn (.21 acres & .64 MG) and Stahelin (.41 acres and .62 MG) based upon the completion of the retrofits.

Figure 16 Eco Site Retrofits

Joy Road

This project consists of GSI practices at intersections along Joy Road and was constructed under a Wayne County contract. These three intersections include Westwood, Faust Avenue and Artesian. This project is within the URT and provided an opportunity to partner with Wayne County; therefore, DWSD provided funding for the GSI portions of the project. The project was completed during the FY2019 and has been a nice amenity along the Joy Road corridor from Southfield Road (M39) to Rouge Park. The project consists of permeable brick pavers for the sidewalks and bioretention with curb cuts at intersections along Joy Road. DWSD disbursed funds for $225,000 for the construction of the Joy Road streetscape and drainage improvement project. The Intergovernmental Agreement (IGA) was signed on July 2, 2018 (FY2019). DWSD, through the GSI program, transmitted funds to Wayne County in Spring 2019 (FY2019).

FY2020/2021 Construction

The following GSI project was undergoing construction in FY2020/2021. This section provides a summary of the project.

Oakman Boulevard

The Oakman Boulevard green stormwater infrastructure project is located in the southeast corner of the URT (Figure 6) and the project area experienced significant residential basement backups during the 2014 flood event.

The project installed 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 shall reduce the direct connection of flows from stormwater runoff to local combined sewers and provide both retention and detention management of stormwater. The work included 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 approximately 1.75 MG. The design was finalized in FY2019 with bid advertisement in Spring 2019 (FY2019). The project construction commenced in FY2020 and achieved substantial completion in November 2020 (FY2021).

The landscape design of the medians has been coordinated with the local residents and will upgrade the local aesthetic condition of these medians (Figure 18). 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. Follow up meetings were held with key residents and District 7 Council leaders on July 11, 2019 (FY2020) at the Detroit Association of Black Organizations (DABO) Center and the main project kick-off meeting for all residents was held on February 20, 2020 (FY2020) at Rippling Hope. The contract included water main replacement to limit disruption to the residents.

To avoid delay in design and construction and to help prevent the spread of CoVid-19, the City of Detroit and DWSD implemented safety protocols. Each active contractor and subcontractor had to submit a CoVid-19 safety plan for review and acceptance as to what steps will be taken to perform the necessary scope of work while promoting social distancing and monitoring the health of each worker. Governor Gretchen Whitmer deemed construction essential and DWSD went into action to continue construction in a safe manner. Through the standards set forth and practiced in the field, PC-801A was able to proceed and utilize an aggressive schedule to achieve substantial completion allowing DWSD to exceed projected expenditures as agreed to by EGLE. These are just a few practical steps set in place to cope with the pandemic and remain steadfast on the expenditure schedule.

The project location and tributary areas are shown in Figure 17.

Figure 17 Oakman Boulevard, Selected Alternative Tributary Areas and Practice Footprints

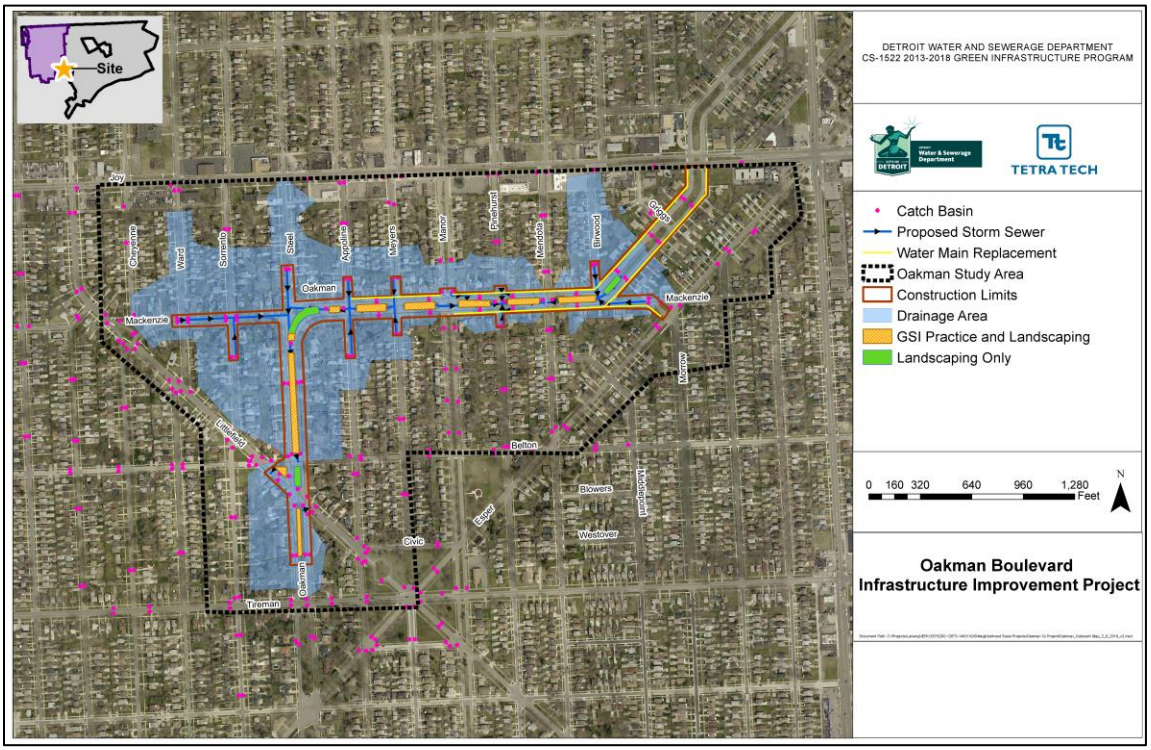


Figure 18 Oakman Boulevard Conceptual Landscape Rendering

FY2020 & FY2021 Project Design and Development

FY2020 consisted the continued design and development of Charles Wright Academy and Far West Detroit. The Far West Detroit project specifically targets large-scale practices that will have the potential to dramatically improve local conditions with respect to flooding and basement backups. This section provides a summary of each project.

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 19). 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.

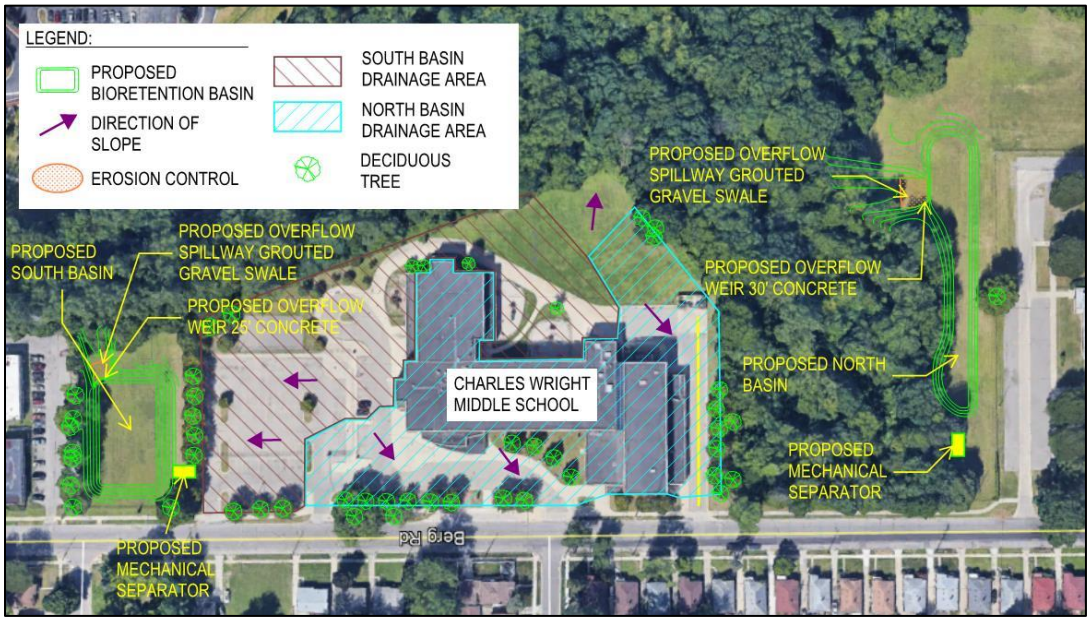
The combined school property of Ludington Magnet Middle School and Charles Wright Academy consists of approximately 43 acres, of which 14 acres are impervious. Some of the acres currently discharge to the river through a CSO outfall downstream of the regulator. Stormwater management of Ludington Magnet 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 design includes two GSI practices that collect and manage roof and site drainage from Charles Wright Academy. Overflow from the GSI practices will be conveyed to the Rouge River via an overflow weir. Both practices will receive flow from new storm sewers installed on site. All stormwater generated at Charles Wright Academy will be completely removed from the combined sewer system. The two GSI practices will be located to the south and north of the school. The concept for this project is shown in Figure 19.

DWSD has determined the expanded area discussed in the FY2018 annual report for an attempt to capture more stormwater by expanding the project to include partial sewer separation of the adjacent neighborhoods was cost prohibitive in FY2019. DPSCD School Board voted to approve the MOU between DWSD and DPSCD on November 12, 2019 (FY2020).

As designed, the project would result in the complete removal of flow from the 2-year, 24-hour storm event.

Figure 19 Charles Wright Academy Design



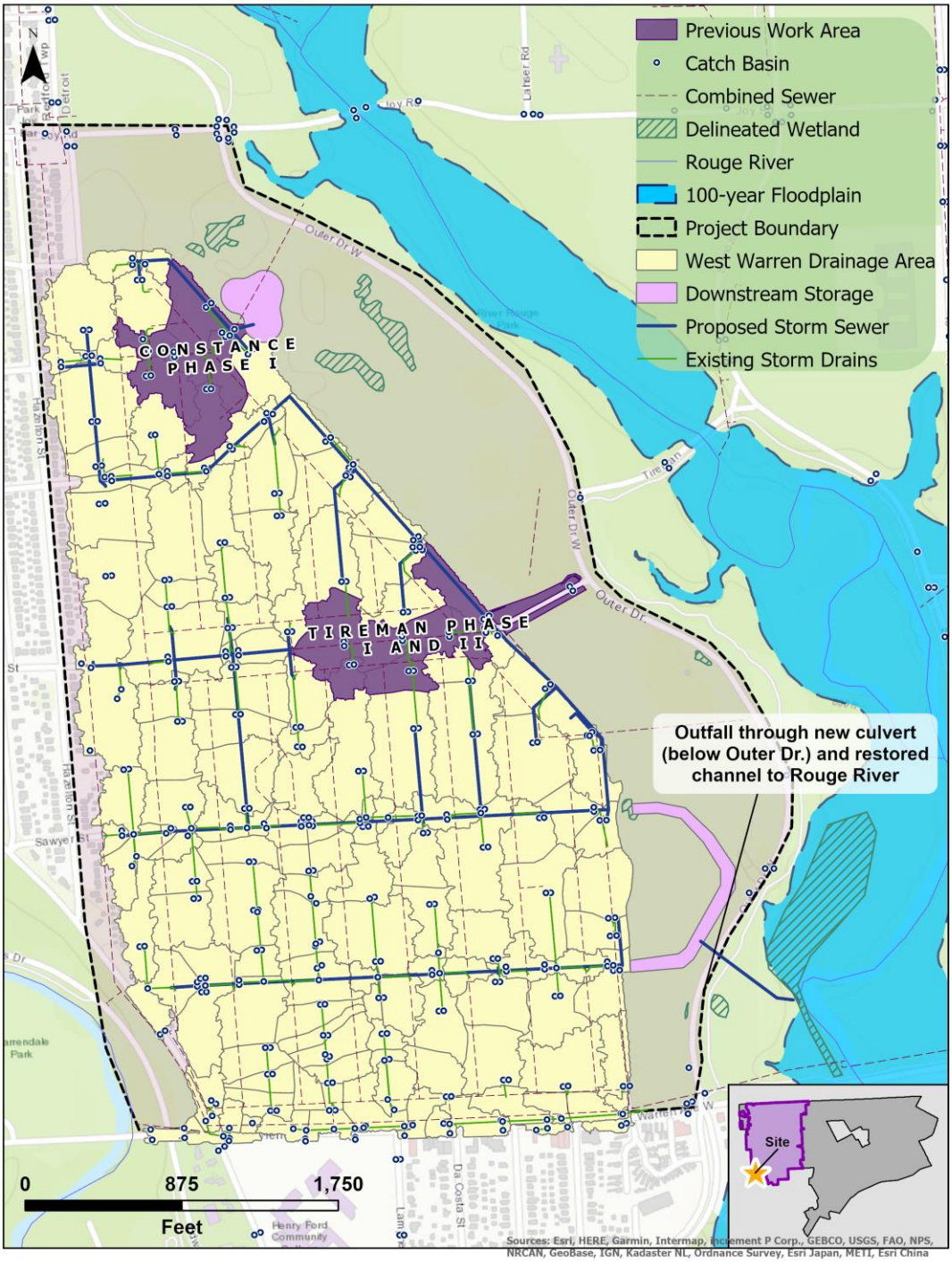
PC-808 Far West Detroit

The PC-808 Far West Detroit project includes portions of area tributary to the Rouge River. The project will capitalize on prior work performed on Constance (Constance Phase I) and Tireman Residential Bioswales (Tireman Phase I) as part of PW-6968 and the Tireman Phase II bioswale.

DWSD 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. GLWA's wastewater master plan (WWMP) team suggested a complete sewer separation of this area. However, DWSD's design is a partial sewer separation; the area will remain a combined sewer area as the footing drains will remain connected to the sanitary laterals which connect to the combined sewers within the alley. In FY2020/2021, CS-1884A has revised the design to consist of an open ravine for TSS removal and peak flow storage as shown in Figure 20.

Through FY2019, DWSD performed field survey, geotechnical investigation and preliminary design of the opportunistic separation project. This project was transitioned from CS-1522 to CS-1884A in FY2020 at 60% design phase and has reached 100% final design (FY2021).

Figure 20 Far West Detroit GSI Concept



Current Concept

Rogell Regional Stormwater Practice

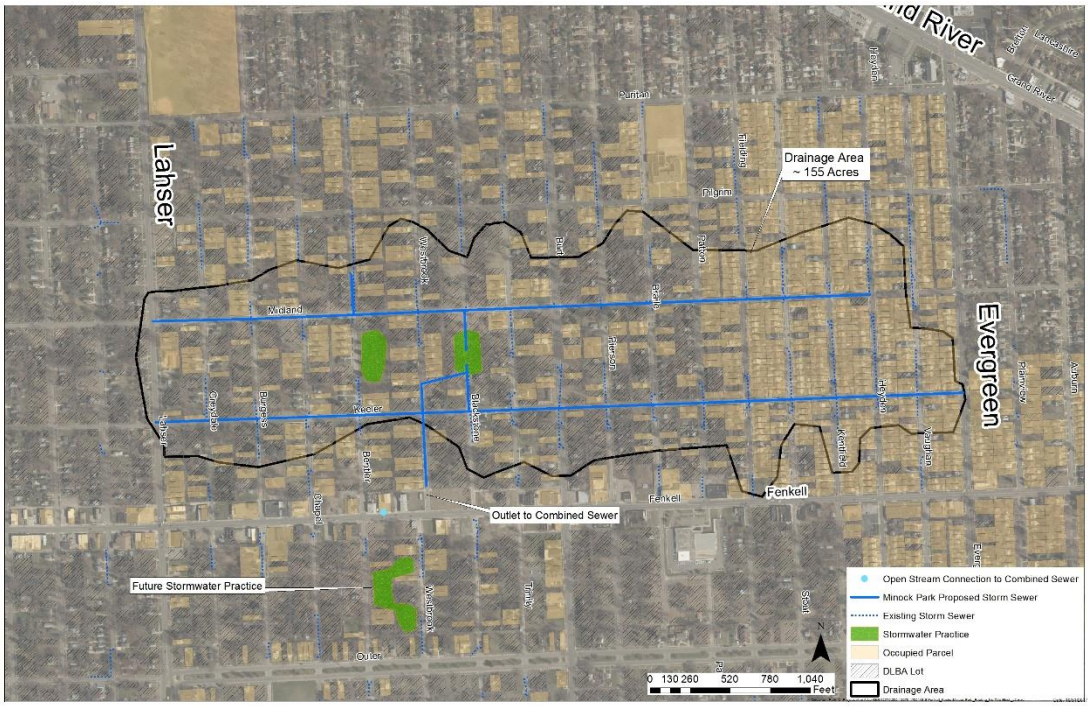
The Grand River/Northwest Planning Study has identified the Rogell site for potential recreation space. In addition, there is the potential for wetland mitigation on the property. DWSD partnered with the PDD and GSD to determine if there was a viable stormwater management opportunity at the site. Conceptual stormwater and/or wetland mitigation concepts were identified as illustrated in Figure 21. Through soil testing efforts and the preliminary design evaluations to determine the feasibility of conveying stormwater from the surrounding neighborhood, this project proved to be cost prohibitive.

Figure 21 Rogell Golf Course Proposed Concept

Minock Park/Brightmoor

DWSD is currently evaluating a neighborhood scale GSI project in the Minock Park/ Brightmoor area for project feasiblity. There is a highly vacated area along Blackstone Street in Brightmoor that may be used to manage stormwater from the adjacent Minock Park subdivision. DWSD is evaluating the ability to expand the project limits beyond Minock Park to create a large scale continuous stormwater management feature. Upcoming activities include project scoping, conceptual design and partnering with City stakeholders. If the project is deamed feasible, the project will be scheduled following completion of successful scoping efforts. The initial concept for what may be the first phase of this project is illustrated in Figure 22.

Figure 22 Minock Park Proposed Concept



3.0 GSI PERFORMANCE MONITORING

There was no GSI performance monitoring conducted during the FY2020/2021 period. Some meetings were held between DWSD and CIPMO in FY2019 for potential coordination needed for long term performance monitoring in future fiscal years for individual GSI practices. DWSD is coordinating with GLWA for large scale monitoring at the B54 outfall to monitor the PC-808 Far West Detroit project impact DWSD has obtained and reviewed data from GLWA for the outfall. DWSD through CS-1884A, developed a monitoring plan to install monitoring equipment upstream of the outfall location in the sewer system. This location will capture the flow data from the Far West Detroit neighborhood that contributes to the outfall.

Table 4 Long Term Performance Activities

Activities	Planned Activities and Schedule	Actual Activities and Status
Activity 4 - Long Term Performance		
Green Stormwater Infrastructure Performance Planning	Ecosite monitoring post retrofit installation at Vaughn and Stahelin.	Ecosite monitoring performed FY2018
Green Stormwater Infrastructure Benefits Evaluation	Coordination with the University of Michigan Water Center	Completed Publication
Agreements for long-term sustainability	Ongoing activity	Ongoing activity
Far West Detroit	Monitoring CSO discharge and Flows from Neighborhood	Ongoing activity

ECOSITE MONITORING

Flow monitoring was performed for the Ecosite practices to assess their hydrologic performance in the summer of 2016. This information helped in the prediction of flow control benefits of these types of practices in broader applications. 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 year 2017, two of the practices, Vaughan and Evergreen, were monitored again. The calendar year 2017 monitoring work was intended to review the questions from calendar year 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 year 2017 monitoring effort was 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.

FY2020/2021 MONITORING

No monitoring was done in FY 2020/2021 for the Ecosites. The retrofit construction is fully complete. New monitoring efforts are being evaluated through contract CS-1884A. The primary objective for follow up monitoring is to conduct 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.

Ongoing coordination with other research and study efforts from University of Michigan School of Environment and Sustainability 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 and Office of Sustainability.

Specific activities planned for FY2020 include 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.

4.0 STAKEHOLDER AND COMMUNITY ENGAGEMENT

DWSD continued a wide range of internal and external stakeholder engagement and outreach activities during FY2020 and FY2021 through February 1, 2020. GSI engagement and outreach activities occurred primarily through project implementation, project correspondence and ordinance related activities. and the City interdepartmental GSI coordination groupDWSD 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, Detroit Future City, the Sierra Club, and The Nature Conservancy. In the 2017 Annual Report, all the activities were converted to ongoing efforts rather than initiation efforts. A summary of FY2020 and portions of FY2021 activities follows. The frequency of outreach is dependent upon the level of criticality and complexity of the project or task. DWSD utilizes the stormwater hub website and advisory group to engage the community in the different aspects of GSI implementation and collaboration on the methods for managing stormwater. DWSD leads the advisory group which yields a transparent and consistent message for the basic criteria for GSI amongst constituents and stakeholders.

COORDINATION

DWSD's Stormwater Management Group (SMG) is responsible for all stormwater related activities, including the drainage charge program, the enacted amended post-construction stormwater management ordinance (December 2020), 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 to date 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)
- DTE Energy
- Michigan Department of Environmental Quality (MDEQ)
- United States Environmental Protection Agency (US EPA), Region V
- Detroit Public Community School District
- Detroit Housing Commission

Organizations

- Detroit Future City
- Sierra Club
- Erb Family Foundation
- Brightmoor Alliance
- Grandmont Rosedale Development Corporation
- The Nature Conservancy
- Bloomberg Associates
- The Moross Greenway Association
- The Cornerstone Village Neighborhood Association
- 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
  The North Rosedale Neighborhood Association
- East Side Community Netword
- Detroit Colaborative Design Center

Institutions

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

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)

2020/2021 OUTREACH ACTIVITIES

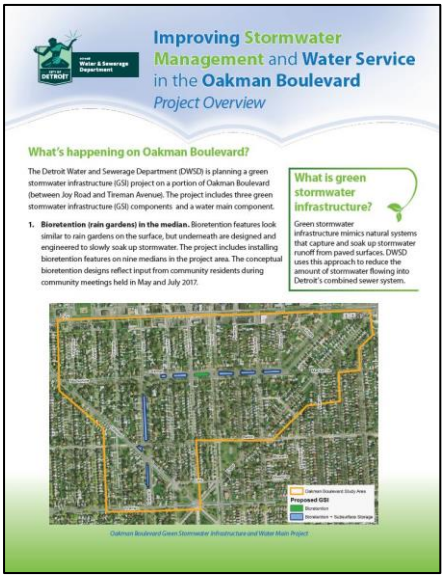
DWSD's green stormwater infrastructure stakeholder outreach is comprised of four components:

- Green stormwater infrastructure project-specific outreach.
- Overarching, collaborative green stormwater infrastructure public education campaign.
- Drainage charge reduction through green stormwater infrastructure implementation.
- Post Construction Stormwater Management Ordinance Outreach

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 conducts additional outreach for certain projects that experience shifts in construction schedules to keep local stakeholders aware of progress.

Figure 23 Fact Sheet Example



Specific activities related to project outreach in FY2020 and outreach activities for FY2021 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.

This project was bid and awarded during FY2019 with Notice to Proceed (NTP) issued on August 1, 2019 (FY2020). Due to the date of award, construction was unable to commence until March 2020 (FY2020). Though the timeline has shifted, this has not hindered DWSD from performing outreach efforts which focus on the construction schedule, regular progress updates, and fielding any concerns about construction activities voiced by residents. In addition, DWSD has worked with the contractor since the NTP to review shop drawings and RFIs, and perform utility coordination. DWSD engaged residents to meet on July 11, 2019 and February 20, 2020 (both FY2020), where DWSD presented and answered several questions from residents. DWSD provided regular progress updates to appropriate District Council leaders, neighborhood managers and associations during construction. In addition, DWSD provided the contact information for the Project Manager and DWSD Inspector to give direct access where residents can retrieve updates on the project and voice concerns. The generic phone line has been criticized by residents for not receiving a follow up call therefore DWSD has provided direct access for the residents.

Figure 24 Edinborough Outreach Handout

Figure 25 Far West Detroit Survey Handout

Far West Detroit (formerly West Warren). During FY2020/2021 DWSD continued its focus on engaging in outreach with key stakeholders and impacted residents with the design for the Far West Detroit project. There were concerns voiced from the stakeholders and residents with regards to the quality of the restorartion of Rouge Park from previous projects and that would be conducted for the proposed project. There were coordination meetings held with constituents from Friends of Rouge Park (FORP) and GSD in September 2020 and October 2020 (FY2021). As the design has changed to an open ravine concept, the placement of the conveyance sewer was a quintessential element for outreach. DWSD facilitated a survey of the immediately impacted residents going door to door with safety measures in place (CoVid-19 procedures) on August 15, 2020. , DWSD addressed the various concerns from the General Services Department, Friends of Rouge Park, and Far West Civic Association prior to finalizing the design.

DWSD will continue to 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 plant species for surface bioretention features once the project commences. With the executed coordination thus far in FY2020/2021, it has become evident that DWSD plans to minimize the impact of the construction on the trees throughout the project area by locating the larger conveyance sewer within the park,. Survey results from residents were supportive of minimizing road impacts as Parkland street was recently replaced. DWSD has also shared the conceptual design 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 Council leaders, neighborhood managers and associations with the progress of the project and construction schedules. DWSD still plans to identify opportunities to provide community residents with a hands-on opportunity to get involved with the project (e.g., possible volunteer planting).

Charles Wright Academy. The coordination with DPSCD to finalize the MOU and coordinate the construction schedule was an ongoing task that DWSD performed throughFY2021 and was paramount in allowing this project to be bid and awarded. The multiple levels of coordination by both parties exhausted all avenues to bring about a quality project that will serve as an educational benefit for the school to incorporate green stormwater infrastructure into the curriculum for students to learn and appreciate.

Rogell. DWSD continues to work with City of Detroit partners on PDD's conceptual design for Rogell; however, as noted in the previous report, efforts revolved around the logistics for potential funding and on-boarding of PDD consultants along with soil sampling requirements, DWSD's community outreach shall commence if and when the project feasibility is determined.

Overarching, Collaborative Green Infrastructure Public Education Campaign

During FY2020/2021, DWSD leads the City's interdepartmental GSI group. DWSD facilitates this group to identify and resolve issues related to GSI projects throughout the City. DWSD also regularly convenes to collaborate on GSI projects based on department initiatives and has been engaged in different departments monthly office meetings and Strategic Neighborhood Funding meetings.

The Detroit Stormwater Hub (the Hub) has evolved with an increasing number of GSI projects within the City limits. The site allows anyone to submit a GSI project. DWSD verifies the projects existence and capacity before publishing it to the site. All of the data collected is available for public download via the detoritstormwater.org. Data reported on the Hub includes estimated values for projects that are not credit eligible; however, promote stormwater management. Therefore, these numbers are not reportable and should not be used to estimate CSO reduction. During FY2020/2021, DWSD continued to lead a stormwater advisory group made up of academia staff, non-profits, and local engineering firms.

DWSD Website - Green Infrastructure Page

DWSD's website provides material for GSI guidance and implementation. The ordinance and design manual (most recent updated version December 2020) are on the website and DWSD continuously updates the website to improve communication and promote the installation of GSI.

Drainage Charge and Credit Outreach and Engagement

DWSD has continued 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. DWSD continues to present to non-profit ambassadors for GSI on the drainage program and ordinance compliance. Due to the pandemic, efforts have been postponed or conducted virtually. DWSD will continue participation in tours and workshops hosted by funders and non-profits to explain the drainage charge and credits for providing a better understanding for the community and attendees. Outreach for the Capital Partnership Program and Site Assessments as well as applications are located on the website, both of which promote GSI.

EFFORTS PLANNED IN FY2021/FY2022

In FY2021/2022, depending on the impact of the pandemic and specific need for stakeholder outreach and community engagement, DWSD will facilitate with safety protocols in place to support green stormwater infrastructure implementation. As PC-806 and PC-808 projects commence, DWSD will keep all pertinent stakeholders updated through outreach and engagement on the construction. As-needed efforts for outreach shall continue for CIPMO design and construction; CS-1884A design and construction; the Drainage Charge Green Credit Program;, and the post-construction stormwater ordinance and associated design manual.

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 Working Group and collaborate on the development and implementation of Sustainability Action Agenda as it embodies GSI goals and actions. DWSD will be working with entities like Detroit 2030, a nonprofit that helps building owners reduce energy, water, and operating expenses and becoming overall more sustainable to promote GSI.

Post-Construction Stormwater Management Ordinance Outreach

In FY2021, DWSD presented the newly amended PCSWMO performance standards to developers and designers on January 27, 2021. The presentation walked designers and developers through the updated design manual and amended ordinance allowing attendees to ask questions through each section of the 3 hour presentation. Whether through the BSEED submission process or simply direct interaction with DWSD's SMG staff, DWSD has made themselves available for questions as developers design projects to comply with the PCSWMO.

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 FY2021/2022, DWSD stays committed 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 non-profits with funding from the Erb Family Foundation and participation from DWSD among other Detroit GSI partners).

The release of Detroit's Sustainability Action Plan includes GSI components. With the agenda published June 2019, DWSD will continue to use existing collaboration mechanisms that involve representatives from key GSI partners, to facilitate the development of a comprehensive, collaborative GSI public education. 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. DWSD proactively requests the ability to provide review of GSI partners literature and materials for documenting a more consistent message.

In creating the Detroit Stormwater Hub, DWSD has strengthened its relationships with many nonprofits and companies involved with GSI across Detroit. The group of professionals that serve as the Stormwater Hub's advisory group are great resources for spreading information and education.

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 Contracts CS-1522, CS-1812 (CIPMO), and CS-1884A, 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 (Exception: Chandler Park Drive efforts).
- 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 FY2020 and FY2021 through February 1, 2021 and the cumulative costs for this project are identified in Table 5 and Table 6 and and displayed on Figure 26.

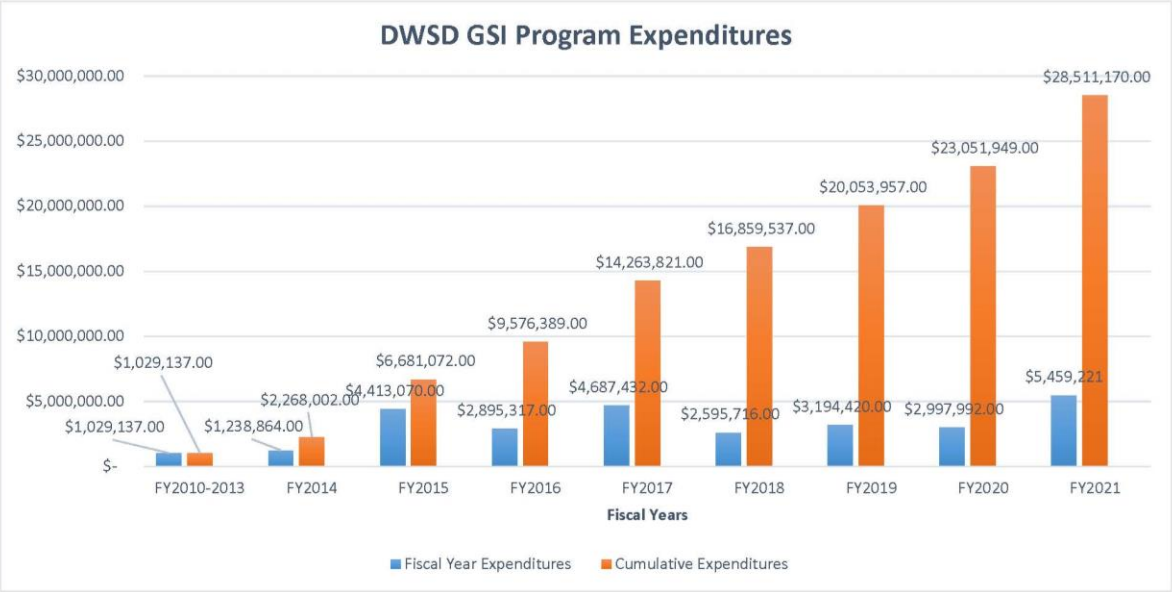
Table 5 DWSD Green Infrastructure Program Expenditures Summary

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	$ 2,845,516	$ (249,800)	$ 2,595,716	$ 16,859,537
FY2019	$ 3,194,420	$ -	$ 3,194,420	$ 20,053,957
FY2020	$ 2,997,992	$	$ 2,997,992	$ 23,051,949
FY2021 through February 1,2021)	$ 5,459,221	$	$ 5,459,221	$ 28,511,170

Table 6 Green Stormwater Infrastructure Program Cumulative Expenditures

Activity	Prior Years			March 1, 2020 - February 1, 2021 Annual Report					Totals			Notes
	FY2010- March 1, 2020 DWSD & Professional Services	FY2010- March 1, 2020 Construction	FY2010 - March 1, 2020 Cumulative Expenditures	FY2010-FY2021 Adjustments Construction	FY2010- FY2021 Adjustments DWSD & Professional Services	March 1, 2020 - February 1, 2021 DWSD & Professional Services	March 1, 2020 - February 1, 2021 Construction Earned Value	March 1, 2020 - February 1, 2021 Construction Residual Value	March 1, 2020 - February 1, 2021 DWSD & Professional Services	March 1, 2020 - February 1, 2021 Construction	March 1, 2020 - February 1, 2021 Cumulative Expenditures	
General Project Management	$804,682		$804,682			$57,744			$862,426		$862,426	SEMCOG 2010-2013; CS-1522 FY2014-2019; CS-188A FY2020
Activity 1 – Policies, Procedures and Standards												
Codes and Ordinance Development (prorated)	$179,231		$179,231			$11,935			$191,166		$191,166	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	$123,172		$123,172			$48,780			$171,952		$171,952	GIS and data management; aerial for updated impervious cover (flight)
Activity 2 - Prototype Projects												
Small Scale Greening (site scale bioretention/vacant lots)	$1,304,944	$795,315	$2,100,259						$1,304,944	$795,315	$2,100,259	Includes greening of vacant lots 2013; design and implementation of ecosites project; selection of additional sites and template designs; flow monitoring evaluations 2016 - 2018; CIPMO sites; Joy Road
Neighborhood Projects (previously "Large Scale Greening")	$3,348,643		$3,348,643			$823,011	$6,745,002		$4,171,654	$6,745,002	$10,916,656	Includes survey, geotech, planning, concept, detailed design and project specific outreach for large scale projects: Orange Lawn; Oakman; West Warren
Public Facilities and Parks	$2,207,867	$2,766,442	$4,974,309			$72,805			$2,280,672	$2,766,442	$5,047,114	Projects include: Stoepel, Liuzzo, Crowell (also includes ecosite modifications), O'Shea, Charles Wright. Professional services include planning, survey, design, construction administration, RPR, maintenance support
Transportation Corridor Projects	$727,032	$2,870,875	$3,597,907						$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	$190,634						$38,788	$151,846	$190,634	Costs after FY2015 are not included
Demolitions and Site Restoration	$83,246	$579,334	$662,580						$83,246	$579,334	$662,580	DWSD's 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	$160,459		$160,459						$160,459		$160,459	Costs includes FY2019 billing for 2018 annual report
Ongoing Planning and Coordination	$631,209		$631,209			$12,120			$643,329		$643,329	Development of future projects March 1, 2020 through February 1, 2021 continued to focus on large scale projects; Minock Park
Practice Maintenance	$125,461		$125,461			$20,264			$145,725		$145,725	DWSD M&R; contract expenditures; consultant support to maintenance activities not directly related to projects
Activity 5 - Stakeholder and Community Engagement												
Outreach activities and stakeholder coordination	$546,519		$546,519						$546,519		$546,519	Outreach efforts for this report period are included in the codes and ordinance and project actives.
DWSD Staff	$1,000,000		$1,000,000			$333,668			$1,333,668		$1,333,668	
Total	$11,816,948	$8,568,894	$20,385,842			$1,380,326	$6,745,002	$0	$13,197,274	$15,313,896	$28,511,170	

Figure 26 DWSD GSI Program Expenditures



6.0 VOLUMETRIC REDUCTIONS

QUANTIFICATION

The methodologies used to calculate the 2-year and annual volumes managed were reviewed and updated for simplicity and consistency. The annual volume managed was updated to be consistent with DWSD's Drainage Charge annual volume retained calculation methodology. Calculations of the retained and detained volumes for the 2-year storm follow one of several different methods depending on the complexity of the design. The methods included two different spreadsheet approaches (a simple lumped method and a more robust runoff routing method) and a SWMM model for complex designs. Flow monitoring data also showed that the several project sites were managing more runoff than previously predicted.

The spreadsheet approaches estimate runoff volume for discrete storm events based on NRCS curve number hydrology calculations. 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).

The following bullet points detail how the reported values in were updated from last year's report.

- All the Annual Volume Removed calculations were re-calculated using the volume credit calculation method outlined in the Drainage Charge Guide. To be consistent with the Drainage Charge, all annual volume calculations in the Annual Report were re-calculated using the equivalent rainfall depth method. The volume of water detained was not included in this calculation since the water is slowly released back into the system.

- For the Eco-Sites, the drainage areas and 2-year volumes managed were updated based on information that was gathered during the 2016 and 2017 flow-monitoring testing.
- The three methods used to calculate the 2-year volumes retained/detained include SWMM modeling, GSI Equivalent Water Depth (EWD) Storage, and SDST Inflow and Outflow. This simplification resulted in the following changes:
    - The Constance Project's volumes managed were converted to the SWMM results.
    - The Oakman Blvd Project's volumes were updated with recent SWMM model results.
- For projects using the GSI EWD Storage to calculate the volume managed, a closed valve was used in the original calculations. These values were recalculated using an open valve and resulted in a change in the 2-year, 24-hour retained/detained values for Artesian, Keeler, Tireman Bioswale, and Tireman Bioretention Projects.
- The percent of the 2-year design storm managed was modified so that it only includes the volume of water retained.

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 Costs	2-yr 24-hr Cost Effectiveness	2-yr Volume Managed	2 year, 24-hr Design Storm Performance - Retained	2 year, 24-hr Design Storm Performance - Detained	Direct Discharge	% of 2 Year Design Storm	Annual Volume Removed - Retained & Direct Discharge
		Acres		($/gal)	(MG)	(MG)	(MG)			(MG)
Completed	VLB: Vaughan	0.79	$ 125,636.00	$ 2.37	0.053	0.050	0.003	NA	100%	0.66
	VLB: Evergreen	0.7	$ 154,225.00	$ 3.43	0.045	0.044	0.001	NA	100%	0.58
	VLB: Stahelin	0.71	$ 139,744.00	$ 2.59	0.054	0.046	0.008	NA	100%	0.59
	VLB: Greenview	0.58	$ 125,713.00	$ 6.57	0.019	0.005	0.014	NA	28%	0.48
	Stoepel Park	6.45	$ 652,672	$ 4.22	0.155	0.063	0.092	NA	82%	5.31
	Liuzzo Park	3.10	$ 488,625	$ 6.40	0.076	0.031	0.046	NA	83%	2.59
	Keeler Pave Drain	1.00	$ 289,162.00	$ 7.40	0.04	0.005	0.034	NA	12%	0.833
	Artesian Porous Asphalt	5.30	$ 457,161.00	$ 4.35	0.105	0.016	0.089	NA	7%	4.238
	Constance	NA	$ 497,162.00	NA	NA	NA	NA	NA	NA	NA
	Tireman Bioswale	6.48	$ 1,217,960.00	$ 71.41	0.017	0.001	0.016	NA	0%	1.946
	Tireman Large Bioretention	3.05	$ 457,680.00	$ 1.68	0.273	0.033	0.240	NA	26%	2.55
	Crowell Recreation Center	2.48	$ 731,809	$ 7.81	0.09	0.09	0.00	NA	100%	2.07
	O'Shea Park	3.72	$ 582,543.00	$ 7.42	0.079	0.034	0.045	NA	37%	3.11
	VLB: Vaughan (Retrofit)	0.21	$ 57,641.00	$ 7.84	0.007	0.000	0.007	NA	0%	0.18
	VLB: Stahelin (Retrofit)	0.41	$ 57,641.00	$ 5.96	0.010	0.000	0.010	NA	0%	0.34
	Oakman	63.06	$ 5,400,000.00	$ 4.06	1.329	0.536	0.793	NA	40%	*11.7**
	Subtotals	**98.04**	**$ 11,435,374.00**		**2.35**	**0.96**	**1.40**	**NA**	**7.15**	**25.47**
FY2020/2021	Charles Wright	6.40	$ 1,918,303.00	$ 6.85	0.280	0.157	0.123	0.400	100%	4.00
	Edinborough Street	0.33	$ 98,000.00	$ 19.60	0.005	0.004	0.002	NA	100%	0.10
	Chandler Park Drive	1.61	$ 299,860.00	$ 16.04	0.019	0.005	0.014	NA	100%	0.29
FY2021/2025	Far West Detroit	218.00	$ 28,960,000.00	$ 4.33	6.690	0.090	NA	96.700	100%	100.59
	Subtotals	**226.34**	**$ 31,276,163.00**		**6.99**	**0.26**	**0.14**	**97.10**	**4.00**	**104.98**
	Total		$ 42,711,537.00							

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 6.85) include school only.
6 – Performance for Ecosites based on monitoring report dated 7/27/17.
7 – For demolitions, refer to Table 16, DWSD Green Stormwater Infrastructure Program Progress Report, 2017. No DWSD funded demolitions in FY2018.
8 – For trees, based on a total of 7,117 trees planted in the URT since FY2011. There were no targeted efforts to plant trees in FY2018. Refer to Table 11 and Table 16, DWSD Green Stormwater Infrastructure Program Progress Report, 2017.2 – Annual runoff to the practice is currently approximate for annual volume detention. Estimates may be refined in the future.
9 – Joy Road project only shows DWSD's portion of funding. Total expenditures for GSI on this specific project is not reflected as Wayne County funded remainder.
10 – Constance was constructed under DW6968 and to be finalized under Far West Detroit.
11- Far West Detroit direct discharge and retention values are for the northern and southern basin in Rouge Park.
* - Oakman annual removed is being evaluated based upon as built conditions and will be update in the future.

7.0 ACTION PLAN FOR FY2021/2022

Error! Reference source not found. Table 8 provides an overview of the action items planned for FY2021/2022.

Table 8 Proposed FY2021/2022 Activities

Activities	Proposed Activities and Schedule
Institutional Efforts	
Codes and Ordinances	Updates by DWSD and City
Stormwater Design Manual (for Stormwater Ordinance)	Final version after chapter updates to be uploaded to the website
Drainage Charge Credit System	Rate adjustment annually
Tracking System	Tracking systems ongoing
Project Implementation/Maintenance	
Stoepel Park No. 1	Maintenance Continues
Liuzzo Park	Maintenance Continues
Crowell Recreation Center	Maintenance Continues
Ecosites Retrofits	Maintenance Continues
O'Shea Park	Punchlist and Maintenance Continues
Oakman Blvd	Construction to Begin April 2020
West Warren (Constance Phase II and Tireman Phase III)	Revised concept design underway in FY2020
Rogell	Awaiting soil sampling and results
Minock Park/ Brightmoor	Project on Hold
Charles Wright Academy	Design to be finalized. Project bid and notice to proceed in FY2021
Additional GSI Projects	DWSD will consider additional opportunistic projects in collaboration with parks, facilities and DPSCD in alignment with GLWA's WWMP
Distributed GSI Implementation	
Downspout Disconnection - Homes	Coordination with 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
Monitoring and Maintenance of Projects	
Green Stormwater Infrastructure Performance Planning	Ecosite monitoring being planned
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