Washtenaw County
Water Resources Commissioner

Amendment to the
Huron River 2013 SRF Project Plan

Prepared For:

Huron River Green Infrastructure Drainage District

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HRC JOB NO. 20140309

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Changes Made Since Draft Publication

The following items summarize corrections and/or changes made from the draft Project Plan Amendment made available for public review (dated, May 23, 2014) to the final version of this Project Plan Amendment, issued on July 1, 2014.

1. The public hearing information and information related to approval of the Project Plan were updated.
2. The adopted resolution was added to Appendix C, additional correspondence made after publishing of the draft Project Plan was added to Appendix B, and the public hearing notice and transcripts were added to Appendix B.

Section I - Introduction

The Washtenaw County Water Resources Commissioner's office (WCWRC) submitted a project plan for SRF funding on July 1, 2013. This project plan amendment is intended to revise several existing projects from that plan, and provide an opportunity for funding for several new projects that were not included in a previous project plan.

The Huron River Green Infrastructure Drainage District (HRGIDD), with the support of the Washtenaw County Water Resources Commissioner (WCWRC) and the City of Ann Arbor (City) has chosen to take action to improve water quality in the Mallett's, Allen, Millers, Traver, Fleming, and Swift Run Creek watersheds, as well as the watershed which directly discharges to the Huron River. The purpose of this Project Plan is to help reduce non-point source stormwater pollutants (NPS), flooding, and flow to the Huron River and the surrounding community by detention and treatment or retention and infiltration of stormwater runoff.

Focusing on NPS pollutant removal will help the County and City achieve the Michigan Department of Environmental Quality's (MDEQ) enforced Total Maximum Daily Loads (TMDL) for phosphorous, *Escherichia coli* (*E. coli*), and biota along the Huron River. Associated volume reductions will improve hydrologic conditions throughout the basin and limit downstream hydraulic impacts.

In 2005, the County and City developed a SRF Project Plan for the Doyle Park project located in the Mallett's Creek watershed. In 2008 and 2009, the County and City developed two similar SRF Project Plans to reduce NPS pollution in the Allen Creek watershed. An expanded SRF Project Plan was compiled in 2010, reaching out to the four remaining subwatersheds within the City. This plan was updated with an amendment in 2011. With a history of successfully completing SRF Projects, the County is very familiar with the SRF process and is committed to completing these projects as funding allows.

The Huron River watershed experiences high amounts of runoff due to urbanization which causes neighborhood flooding and poor downstream water quality. The previous Project Plans recommended various types of stormwater improvement projects to address these issues. A number of the improvements have been or are being implemented, with construction of the first SRF NPS funded project started in 2006 with the Doyle Park Project. The County has completed limited monitoring of the impacts and benefits resulting from the implemented projects, and will continue to use the information collected in order to evaluate alternatives and systematically plan for NPS pollution reduction both in the City as well as in portions of the neighboring Townships.

On February 18, 2014, the City of Ann Arbor passed Resolution – R-14-051: Adopting a Green Streets Policy Statement for Stormwater Guidelines for Public Street Construction and Reconstruction. The purpose of the policy is to use an array of products, technologies, and practices that use natural systems – or engineered systems that mimic natural processes – to enhance overall environmental quality and provide stormwater management services. Maximized infiltration based on site conditions is the stormwater goal for this policy. This policy is consistent with the objectives of the Project Plan, including maximizing infiltration and pollutant removal. Thus, where feasible, the Green Street Policy is incorporated with the preferred alternatives. The Green Streets Policy is include in Appendix J and has varying levels of infiltration goals based on slopes, proximity to the floodplain and soil conditions. However, the levels of infiltration that the City is targeting ranges from 1" to 3.26" depending on specific site conditions.

The locations and projects presented in this Project Plan were individually evaluated to determine the quantity of stormwater runoff and/or pollutants that could be captured and mitigated. Best Management Practices (BMPs) were then selected based on watershed storage or stream bank protection needs,

together with individual site conditions and constraints. The data was then used to preliminarily design each BMP to maximize the pollutant removal, with emphasis on total suspended solids (TSS), total phosphorous (TP), and *E. coli* removal, as well as onsite infiltration. The 20 projects that will be presented in this year's Project Plan are listed herein. Projects were selected based on those included in the City's Capital Improvement Plan (CIP). The CIP is developed based on inventory, assessment, and coordinated asset maintenance and improvements. All projects involving road reconstruction will include components in order to treat and detain at minimum the first flush or larger volumes per City and County standards. Infiltration will be used to the extent necessary based on soil conditions. While some soil conditions are known, additional infiltration may be able to be proposed during design based on more comprehensive soil information. Where infiltration is not used, oversized pipes for extended detention, including sumps for maintenance, or stone reservoirs with underdrains, will be used to promote storm water quality.

- Geddes Avenue (Arlington Boulevard to Huron Parkway) – Complete reconstruction. As part of the roadway design, stormwater treatment/storage options have been evaluated to treat the first flush***, infiltrate the required Green Street Policy Volumes,*** detain bankfull volume where possible and to provide ***surface*** stormwater quality enhancements. ***The road footprint may be expanded to include a bike lane and sidewalk.***
- Detroit Street (Catherine Street to Division Street) – Replacement of brick pavers similar to the existing roadway to maintain historic appearance of the area. Stormwater management incorporated into the design to treat the first flush volume***, infiltrate the required Green Street Policy Volumes,*** and detain bankfull volume and provide stormwater quality enhancements. Based on the preliminary soil borings, this site is not suitable for infiltration.
- Farmers Market Parking Lot – This parking lot is to be reconstructed and will provide enhanced storm water management, including infiltration and capture opportunities. The currently paved areas will be repaved and the gravel area adjacent to the area will also be paved.
- Briarwood Mall Ponds – Water quality improvements at Von Maur, Holiday Inn Express, and Plaza Drive ponds. The Plaza Drive pond will be dredged and retrofitted for phosphorus and TSS removal and future maintenance. ***The Plaza Pond project will also include upstream improvements as described herein.***
- Street Tree Planting – Throughout City Rights-of-way, easements, and public properties.
- Mallett's Creek Streambank Stabilization – Various areas as noted herein:
  - ✓ Chalmers Drive to Huron River Drive – Streambank stabilization on the downstream end of the creek. Upstream stretch was completed in 2012 (approximately 9,000 lft).
  - ✓ Cranbrook Park – Streambank stabilization in creek from Fieldcrest Street to S. Main Street. ***The limits of this stabilization have been extended to include the portion of Mallett's Creek from Ann Arbor-Saline Road to Cranbrook Park.***
  - ✓ Oakbrook Drive to Eisenhower Parkway – Streambank stabilization from the six culverts site to Eisenhower.
- Millers Creek Streambank Stabilization – Project to take place from Geddes Road north to University properties to reduce streambank failures and address heavy sediment loading.
- ***Millers Creek Streambank Stabilization – Pepper Pike – Project to take place from Pepper Pike south to downstream of Glazier Way to reduce streambank failures and address heavy sediment loading.***
- Huron Hills Baffle Box – As identified in the Millers Creek Sediment Study prepared in 2013, a regional treatment for sediment will be constructed on the portion of Millers Creek which runs through the Huron High School Property.
- State Street (Eisenhower Parkway to south of I-94) – Complete reconstruction in order to improve the "gateway" to the City. Project will include elimination of concrete islands and replacement with green infrastructure. The NPS project includes median improvements to handle the stormwater from the roadway, including infiltrating the required Green Street Policy Volumes.

- Scio Church Road (Main Street to east of Seventh Street) – Complete reconstruction of roadway. Stormwater management options to extend time of concentration including oversized pipes with structures with sumps for sediment removal. ***This project has been revised to include the installation of a stormwater treatment facility on the Pioneer High School property on the north side of Scio Church Road as identified in the Upper Mallett's Creek Storm Water Conveyance study and infiltrate the required Green Street Policy Volumes.***
- Stadium Drive (Hutchins Avenue to Kipke Drive) – Complete reconstruction of the roadway. Swirl concentrators and extended detention to be used for stormwater management.
- ***Stone School Road (Packard to I-94) – Complete reconstruction of roadway. Stormwater management options to extend the time of concentration and to provide storm water treatment in accordance with the goals of this plan and the City's Green Streets Policy.***
- Research Park Wetlands Detention – Construct a wetland area/detention basin inside Research Park loop along Mallett's Creek. Include streambank stabilization in the area from Research Park Drive East to RR Track where failures are causing the parking lot to become undermined.
- Huron Hills Golf Course – Construction of streambank improvements through golf course and construction of a wetland/buffer area before outlet under railroad tracks. Floodplain enhancement and outlet structure to be installed.
- S. Seventh Street (Greenview Drive to Scio Church Road) – Complete reconstruction, including narrowing roadway, ***infiltrating the required Green Street Policy Volumes***, and providing stormwater management.
- 721 N. Main Street – Improvements to the site in order to provide flood protection and storm water quality improvements are proposed, including the construction of a stormwater wetland near the center of the site is proposed with planting beds and other stormwater quality improvements.
- Village Oaks – Improvements to the detention and stormwater management in the area to improve water quality and reduce volume downstream to facilitate pollutant removal.
- Maple Village Shopping Center – This shopping center, located at Dexter Road and N. Maple Road, will be redeveloped with improvements to the stormwater management system to promote reduction in runoff and infiltration.
- Lawton Park Detention Basin – A regional detention basin will be constructed on the existing park property to reduce flashiness downstream and improve water quality.
- Churchill Downs Park Stormwater Improvements – A regional detention basin will be constructed on the existing park property to reduce flashiness downstream and improve water quality.
- Lans Basin – Improvements will be made to provide additional storage and increased water quality improvements.

Section II - Project Background

This section has not been updated since the original project plan, except as specifically noted. Additional environmental clearances were secured for the six sites that have been added or changed and the letters for the 2013 projects were resent. The figures indicated herein have not been included in this plan as noted in the Table of Contents.

A. Study Area Characteristics

1. Delineation of the Study Area

The Study Area is defined as that portion of the HRGIDD contributing flow from the Mallett's, Miller, Traver, Swift Run, and Allen creeksheds, as well as direct runoff into the Huron River within the City of Ann Arbor. The creeksheds are located in eastern Washtenaw County and drain into the Huron River as shown on Figure 1. The contributing area is approximately 20.8 square miles.

The Study Area is designated as a County Drainage District; storm sewers serving most of the community are owned and operated by the City of Ann Arbor and generally drain to County Drains. The County and City as well as the University of Michigan, Ann Arbor Public School District, and the Michigan Department of Transportation are National Pollution Discharge Elimination System (NPDES) Phase I or Phase II stormwater permit holders. There are also several watercourses located in the project area that are not under the jurisdiction of the County or the City and would require easements.

The activities proposed within this Project Plan are focused on numerous locations throughout the City. See Figures 2 through 4 for a general overview of the anticipated locations for stormwater improvements.

a. Lakes, Rivers, Ponds, and Wetlands

The general locations of wetlands are shown in relation to the proposed project locations according to data from the National Wetlands Inventory (NWI) (Figure 5). A more detailed review would be performed during design of each of the proposed projects to identify any potential wetlands areas that would be regulated under Part 303 of Public Act 451.

b. Existing Treatment Facilities

Not applicable to NPS stormwater improvement projects.

c. Effluent Disposal Locations

Not applicable to NPS stormwater improvement projects.

d. Sludge Disposal Sites

Not applicable to NPS stormwater improvement projects.

e. Existing Interceptors, Collectors, Pumping Stations, and Force Mains

Not applicable to NPS stormwater improvement projects.

f. Population Distribution

Not applicable to NPS stormwater improvement projects.

g. Parks and Recreation Areas

See Figures 6 through 9 for locations of park and recreation areas owned by the City and County. There approximately 34 public properties where users have access to open surface water within the Study Area. Activities, such as canoeing, kayaking, hiking, swimming, and bird watching, are among the amenities supported by the surface water features.

2. Land Use In the Study Area

a. Land Use In the Study Area

The following table summarizes the land use/cover within the City:

Table II-1: City of Ann Arbor 2008 Land Use/Land Cover (acres/%)

Land	Cover/Use	Acres
Residential	7,479	41.6%
Single-Family Residential	6,345	35.3%
Multiple-Family Residential	1,134	6.3%
Non-Residential	10,507	58.4%
Commercial and office	1,433	8.0%
Industrial	357	2.0%
Governmental/Institutional	3,160	17.6%
Transportation, Communication & Utility	3,119	17.3%
Park, Recreation, and Open Space	2,033	11.3%
Water	405	2.3%

Source: SEMCOG website, accessed December 26, 2012

b. Summary of Land Cover within the Watershed

The land cover within the Study Area is a nearly built-out, densely-urbanized environment. The dominant land covers are residential neighborhoods, mixed-use commercial, university campus, and public school property. The only available green space that is not developed is generally associated with City owned parks and open space on the public school properties.

c. Future Land Use

The majority of the Study Area creeksheds are built-out and there currently is little room for new development. However, redevelopment of areas from one land use to another is possible.

3. Surface and Ground Waters

a. Contributing Creeksheds

Pollutants from the contributing areas are creating a significant impact upon the Huron River. The landscape is covered in significant amounts of impervious surface, allowing little opportunity for stormwater infiltration and natural pollutant removal. Currently, two impoundments and two connecting waterways to the Huron River within or upstream of the Study Area have established TMDLs requiring the community to achieve a reduction in NPS pollutants. See Appendix E for copies of the MDEQ established TMDLs. The TMDLs for the Study Area are as follows:

- Ford and Belleville Lakes – Phosphorous

- Geddes Pond (Huron River) – *E. coli*
- Mallett's Creek – Biota
- Swift Run Creek – Biota

b. Lakes, Rivers, Ponds, Wetlands, and Floodplains

There are several lakes and impoundments located within the Huron River Green Infrastructure Drainage District including Barton Lake, Argo Lake, Geddes Lake, and Sisters Lakes. In addition, there are several open channel waterways, inline detention basins, potentially regulated wetlands, and floodplains within the Study Area. The proposed stormwater improvements are located at various points along the surface waterways, as well as throughout the contributing creeksheds. See Figure 5 for the locations of the wetlands within the Study Area and Figure 10 for the locations of the floodplains and floodways. The following are the waterways within the Study Area:

- Huron River
- Mallett's Creek
- Allen Creek
- Miller Creek
- Swift Run Creek
- Traver Creek
- Fleming Creek

c. Drinking Water

The Ann Arbor water supply is drawn from both surface and ground water. About 85% of the water supply comes from the Huron River with the remaining 15% is from multiple wells located south of Ann Arbor. The water from all sources is blended at the water treatment plant. Since the water is primarily a surface supply, the United States Environmental Protection Agency (USEPA) and the MDEQ regulations require water to be treated, filtered, and disinfected to ensure that any harmful substances are removed. When treatment is complete, the water is distributed to homes, schools, and businesses in the City as well as to Ann Arbor and Scio Townships for resale to their customers.

d. NPDES Permits

Entities discharging, or proposing to discharge storm or wastewater into the surface waters of the State are required by law to obtain a National Pollutant Discharge Elimination System (NPDES) permit. The NPDES permit is intended to control discharge into the surface waters of the State by imposing effluent limits and other conditions necessary to meet the State and Federal requirements. See Appendix D for a copy of the City's current NPDES permit. The City's permit is currently under review for renewal.

B. Economic Characteristics

1. Major Employers

The major employers within the City of Ann Arbor are affiliated with the University of Michigan and the University of Michigan Health Service. The following table lists the Top Ten Employers by number of employees in Washtenaw County.

Table II-2: Top Ten Employers in Washtenaw County and Number of Staff

Organization	Number of Staff
University of Michigan	16,143
University of Michigan Medical Center	12,000
Trinity Health	5,304
Ann Arbor Public Schools	3,578
Eastern Michigan University	1,976
Toyota Technical Center	1,500
Washtenaw Community College	1,559
Washtenaw County	1,339
Veterans Administration Medical Center	1,230
Thomson Reuters	1,100

Source: 2013 Ann Arbor SPARK (dated January 2013)

2. Household Income

The median annual household income in 2010 (per SEMCOG) in the City of Ann Arbor was $52,625.

3. Economic Climate

The City of Ann Arbor is most affected by the presence of the University of Michigan, which influences the composition of the City's economy and population. The University is a long-standing institution, which is expected to remain stable in the years to come. This is reflected in SEMCOG's projected population for Ann Arbor into the year 2030.

Recent layoffs associated with economic trends have the potential to affect population growth for the area. The purchase of the former Pfizer facility by the University of Michigan may have a positive economic impact with the expansion of the life sciences research facilities.

C. Existing Facilities

Discussion of the existing municipal sewage conveyance, treatment, and disposal facilities are not applicable to the proposed NPS stormwater improvement projects.

D. Need for the Project

Extensive review of the Huron River and its many contributing waterways by the MDEQ has led to the establishment of several TMDLs within the Ann Arbor area. The measures were taken to put limits on pollutant discharge to the watershed thereby improving water, habitat, and biotic quality. The following locations and established TMDLs are directly impacted by stormwater improvements within the Study Area:

- Ford and Belleville Lakes – Phosphorous
- Geddes Pond – *E. coli*
- Mallett's Creek – Biota
- Swift Run Creek – Biota

The City of Ann Arbor, Washtenaw County, and other local parties have engaged in a multi-year effort to achieve the requirements of the established TMDLs via the Watershed Management Plan of the Huron River in the Ann Arbor – Ypsilanti Area (WMP), (Huron River Watershed Council, 2008), Millers Creek Watershed Improvement Plan (MIP), (Ayers, Lewis, Norris, & May and others, 2004), the Mallett's Creek Restoration Project (MRP), (2000), and the Allen Creek Greenway Task Force Plan (2007). Associated volume reductions will improve hydrologic conditions throughout the basin and limit downstream hydraulic impacts. These initiatives rely on a variety of NPS reduction goals outlined as part of the 319 approved WMP:

- Reduce non-point sources of pollution,
- Reduce flow variability,
- Increase the public's understanding of their role in protecting and enhancing the Huron watershed and its contributing waterways,
- Protecting and mitigating loss of natural features and open spaces in the watershed,
- Reduce flooding attributed to stormwater runoff, and
- Improve hydrologic conditions within the basin and stabilize hydraulic conditions instream.

All creeksheds included in this Project Plan are upstream of Ford and Belleville Lakes. Therefore, all nonpoint source projects proposed with the intention of reducing phosphorus loads will work towards achieving the TMDL goal associated with Ford and Belleville Lake.

Similarly, Allen Creek, Mallett's Creek, Swift Run, Traver, Fleming and Millers Creek are all tributaries to Geddes Pond and contribute to the *E. Coli* loads of the water body. Projects that focus on total suspended solids (TSS) reduction and infiltration will be beneficial to working toward the existing *E. Coli* TMDL.

The MDEQ does not issue TMDLs for TSS. However, TSS is a surrogate for the biota TMDL. Mallett's Creek has a biota TMDL. Projects within this creekshed that reduces TSS will help achieve compliance with this TMDL.

Since 1994, over $20 million has been spent within the City on various projects and initiatives to help achieve TMDL compliance from non-point sources. Recent projects include the 255,000 cubic foot underground detention basin at Pioneer High School, the stormwater improvements along Stadium Boulevard and Sylvan Avenue, as well as at West Park within the Allen Creek watershed. Additionally, the improvements within Mary Beth Doyle Park and Wetland Preserve have an anticipated 25% reduction in phosphorous to Mallett's Creek. In addition, over 2,000 tree plantings have been completed in the last 2 years.

The need for these locations has come from several sources. Most of the improvement locations have been identified within the WMP, MIP, or MRP or as part of the City's Capital Improvement Process (CIP). These documents have received public input and support for their respective proposed improvements. The remainder of the sites are planned capital improvements locations where system evaluation such as paving needs, other utility needs, or flooding concerns is ongoing. In addition, the County's new storm water regulations dictates improvements. All of the alternative locations holistically would be working toward the common goal of NPS pollutant removal while attempting to meet the requirements of the local TMDLs.

1. Compliance Status

a. Point Source

Discussion of the status of the compliance with an existing point source or groundwater discharge permit is not considered applicable for NPS stormwater improvement projects.

b. NPDES Permit

Most stormwater outfalls into the Huron River and contributing waterways within the City are permitted Municipal Separate Storm Sewer Systems (MS4) under the jurisdiction of Washtenaw County, the City of Ann Arbor, Ann Arbor Public Schools, or the University of Michigan. The County's and City's permits are watershed based, while the others are jurisdictional. Regardless of the type, the permits have six minimum requirements that must be maintained for compliance. The projects presented in this Project Plan are an additional effort over and above that of the six minimum control measures.

Therefore, these activities go beyond what is required as part of the MS4 permit. A copy of the current NPDES stormwater permit for the City is included in Appendix D along with the application for the City's next Phase I permit.

c. Discharge Data

The discharge data form is not applicable for NPS stormwater improvement projects.

2. Orders

The City of Ann Arbor has recently completed projects under an Administrative Consent Order (ACO) toward the elimination of sanitary sewer overflows. The ACO required that the City to perform the following tasks:

- Footing Drain Disconnection Project
- Offset Mitigation Project
- Swift Run Trunk Project

These projects are not applicable to the work proposed in this Project Plan and the City is no longer under the Consent Order.

3. Water Quality Problems

a. Point and Non Point Sources of Pollution

The priorities of the HRGIDD, with the support of the City and the WCWRC, are to improve stormwater quality, increase onsite infiltration, and strive to meet the goals set forth in the WMP, MIP, and MRP which include the following:

- Reduce non-point sources of pollution,
- Reduce flow variability,
- Increase the public's understanding of their role in protecting and enhancing the Huron watershed and its contributing waterways,
- Protecting and mitigating loss of natural features and open spaces in the watershed,
- Reduce flooding attributed to stormwater runoff, and
- Improve hydrologic conditions within the basin and stabilize hydraulic conditions instream.

Implementation of the stormwater management practices proposed in this Plan will help achieve those goals identified for the Huron River. The proposed projects incorporate natural feature enhancements, including the use of vegetation to increase infiltration and stabilization, provide buffers, and reduce the amount of untreated impervious runoff. The reduction of direct stormwater runoff will decrease the amount of pollution and flow variability to the Huron River and connected waterways, thereby helping to restore the natural flow regime by reducing peak wet weather flows. The proposed flow attenuation practices via BMPs will help mitigate streambank erosion while helping to ensure the success of the future/proposed stabilization projects.

Public involvement will be an integral part of the project implementation. Involving the public in the Project Plan development process, and increasing the public awareness of the improvements that result from the project will elevate public understanding of their role in protecting and enhancing watershed resources.

The target pollutants associated with material suspended within stormwater runoff to be reduced as a result of the proposed projects identified in this Plan are total phosphorous (TP) and total suspended solids (TSS), and *E. Coli*.

Phosphorous is a nutrient commonly found in water affected by eroded soils, and attributed to lawn fertilizers, animal waste, and plant debris. Sediments and nutrients are introduced from landscape runoff and are transported to waterways by heavy rains. This condition is especially problematic in highly impervious urban landscapes such as the City. All of these pollutants can be washed over land into storm drains, ultimately contributing to the Huron River and the connected waterways.

Total Suspended Solids are caused by sedimentation into streams from development and streambank erosion. An overabundance of TSS often leads to Biota TMDLs as the habitat becomes impaired. This is apparent by the established TMDL for Mallett's Creek and Swift Run Creek. The primary culprit in impairing aquatic life is TSS. Reduction of TSS will allow for the native plant and animal species in the associated watersheds to flourish. For additional information, see Appendix E for the Mallett's Creek and Swift Run Creek biota TMDLs.

E. coli, a bacterium that can enter the watershed from animal waste, is also a significant pollutant in the Huron River. This is evident by the established TMDL (2000) for Geddes Pond. The sources have been attributed to stormwater runoff caused by urban development. For additional details, see Appendix E regarding the Geddes Pond E. coli TMDL.

The proposed improvement projects within this Plan are intended to promote treatment, detention, and onsite stormwater infiltration or increase stabilization. These practices will filter many of the pollutants and mitigate the potential for erosion. Increasing onsite infiltration will also reduce and delay the volume of direct runoff entering streams, which will help reduce any impacts on the natural flow regime of the Huron River and improve base flows.

b. Unsewered Areas

The entire City of Ann Arbor is serviced by a municipal sanitary sewer system. Therefore, actions taken upon private systems are not applicable to this Plan.

c. Septage Disposal

There are no identified septage disposal problems near the proposed improvement project locations.

4. Future Project Needs for the Next 20 Years

a. Nonpoint Source Needs

The HRGIDD has identified possible NPS stormwater treatment projects that will be needed within the 20-yr planning period in addition to those described in this plan. They are the following:

- 415 W. Washington
- Bach School
- Slauson School
- U of M Properties
- Fingerle Lumber
- Miller Road – Newport to Chapin

b. Future Sanitary Flows

Documentation and projection future sanitary flows are not considered applicable for NPS stormwater improvement projects.

5. Future Environment without the Proposed Project

If the proposed work within this Plan is not undertaken, there is the likelihood that the environmental conditions will not improve and only worsen in the Huron River and along the connecting waterways. The reductions in sediment, nutrient, and bacteria inputs are a must to achieve the established TMDLs or risk the consequences they will continue to have on the environment.

Failure to substantially reduce *E. coli* colonies will likely result in continued Beneficial Use Impairments (BUI) for recreational activities downstream of the area. Without the proposed improvements, the existing problems associated with the lack of adequate stormwater management practices will continue to worsen. High frequency and large volume peak flows will increase, continually leading to more problems from nutrient loading, flooding, downstream thermal changes, and loss of aquatic habitat associated with sedimentation. As a result, recreational opportunities provided by the Huron River will continue to diminish and property owners will experience increased flooding conditions. The City and the WCWRC are being proactive in implementing highly visible BMPs on their properties. The City and WCWRC are setting an example and encouraging developers and property owners to incorporate BMPs into their plans for development and redevelopment.

E. Population Data

1. Existing and Projected Study Area Population

The following table provides the actual population from the 2010 Census, along with future projects provided by SEMCOG:

Table II-3: Existing and Projected Population in the City of Ann Arbor

Year	Population
2010 (actual Census)	113,934

2015	*115,382*
2020	*116,827*
2025	*117,929*
2030	*119,030*
2035	*121,408*
2040	*123,786*

Source: Source: 2010 Census Data for Southeast Michigan, SEMCOG website, accessed December 26, 2012. 2035 Forecast for Ann Arbor, SEMCOG website, accessed December 26, 2012

2. Current population served by existing facilities

Discussion of this item is not applicable for a NPS Project Plan.

3. Current and future population served by the proposed improvements

Discussion of this item is not applicable for a NPS Project Plan.

F. Status of Previously Noted NPS Projects

WCWRC and the City of Ann Arbor have been working to complete previously proposed projects. Since, 2005, the City has prepared five (5) Project Plans and Project Plan amendments, which included many projects. These projects are outlined on the following table.

With the passage of the Green Streets Policy, the design of the stormwater treatment for roadway projects may be altered from the alternatives identified in the original project plans. It is the intent of all stormwater treatment projects, funded through the SRF program, will designed in such a way to maximize infiltration and pollutant removal. Specific strategies to meet this goal are discussed in Section III. For all road projects included in the original 2013 Project Plan, or any of the Project Plans listed herein, the City and County will work together to determine the most effective stormwater BMPs for meeting these goals based on the specific site and soil conditions.

Table II-4: Status of NPS Projects

Project	**Status**
2005 Project Plan:	
Doyle Park	Completed
2008 Project Plan:	
Pioneer High School	Completed
Miller Road	Expired
Farmer's Market	Included in 2013 Plan
Dexter Avenue – Maple to Fairview	Constructed (No SRF)
Dexter Avenue – Fairview to Huron	Constructed (No SRF)
Stadium Blvd – Pauline to Seventh	Completed
Stadium Blvd – Seventh to Main	Included in 2013 Plan
Stadium Blvd – Main to White	Kipke to White – Completed
	Main to Kipke – Included in 2013 Plan
2009 Project Plan:	
Stadium – Suffolk to Seventh	Completed
Stadium – Seventh to Kipke	Included in 2013 Plan

West Park	Completed
Madison – Seventh to Main	Under Contruction
Miller – Chapin to Main	Constructed (Mill and Fill, no SRF)
Veteran's Memorial Park	Not completed and no longer in planning stages
Sylvan Avenue	Completed
2010 Project Plan:	
Esch Avenue	On hold
Platt Road	On hold
Mallett's/Ellsworth Basin	On hold (unlikely to proceed)
Stone School Road Retrofits	2014 2nd Quarter Closing
South State Street	On hold (MDOT)
Swift Run MDOT Improvements	On hold (MDOT)
Burns Park Alley	Completed
Millers Creek Projects	On hold – Easements
Mallett's Creek – Chalmers to Huron Parkway	Completed
Mallett's Creek – S. Huron Parkway	Completed
Mallett's Creek – Platt/Manchester	Completed
Mallett's Creek – Packard to Outfall	Removed from List
Mallett's Creek – E/W Research Drive	Included in 2013 Plan
Mallett's Creek – Boardwalk/South State	Removed from List
Mallett's Creek – Eisenhower to Oakbrook	Included in 2013 Plan
Traver Creek – Barton Drive	Completed
Millers Creek Drainage District Establishment	Future (with project)
Tree Plantings	On-going
Cistern Installations and Downspout Disconnections	On-going
Lans Basin	Included in 2013 Plan
2011 Project Plan:	
Miller Road – Maple to Newport	Under construction
Willard Street	Completed
Stadium Road Bridges	Completed
Fourth Avenue – Huron to Liberty	Completed
Stone School Road – Packard to I-94	Updated herein
Seventh – Pauline to Madison	Completed (Mill and Fill, No SRF)
South Forest – Hill Street to University	Completed
Springwater Subdivision	2014 4th Quarter Closing
Detention Basin Retrofits	Briarwood – 2013 Plan
Compost Center	Not Needed
Dexter Ann Arbor Road – N. Maple to Revena	Completed (No SRF)
Madison – Seventh to Main	2013 4th Quarter Closing

Stadium – Hutchins to Kipke	Included in 2013 Plan
Leslie Park	Completed
Leslie Science Nature Center	Future Project

G. Environmental Setting

1. Cultural Resources

The City is committed to preserving and protecting historical sites. The historic preservation coordinator is qualified to assess historic properties and any adverse impacts relative to historic properties. This is especially important along Detroit Street which is located in a Historic District. WCWRC and the City will work closely with the City's Historic Society to preserve the nature of this area.

2. The Natural Environment

a. Climate

The climate will not be affected by the improvements recommended in this Plan

b. Air Quality

There are no major factors affecting air quality by the improvements recommended in this Plan.

c. Wetlands

There are wetlands within the Study Area and at several of the project locations according to the National Wetland Inventory and observations during field visits. Impacts may be necessary as part of the stormwater improvements. However, any proposed impacts will be compensated and/or reestablished. A MDEQ Joint Permit and City of Ann Arbor wetland permit will be submitted for all improvement projects fulfilling the requirements as identified in the regulations.

d. Coastal Zone

There are no coastal zones within the Study Area.

e. Floodplains

There are designated FEMA floodplains and floodways at several of the proposed improvement project locations. Any work within the 100-year floodplains and floodways will be performed in accordance with applicable regulations and per any specific conditions of the MDEQ Joint Permit. Compensatory site modifications will be components of all the improvement projects where a mapped floodplain/floodway is present.

f. Natural or Scenic Rivers

There are no natural or wild scenic rivers in the Study Area.

g. Major Surface Waters

There are several named watercourses, including Mallett's and Millers Creek, and the Huron River and numerous connecting drains where proposed improvements will be on or within close proximity. The proposed streambank stabilization improvements will all be within the existing channel. All the proposed improvements have the intention of improving water quality, and will be performed in accordance with applicable regulations and per any specific conditions of the

MDEQ Joint Permit. No modifications will have an adverse effect on water quality or impede flow.

h. Recreational Facilities

There are numerous parks and open spaces located throughout the Study Area. One of the project locations is within Huron Hills Golf Course, which is owned by the City.

i. Topography

The topography varies throughout the Study Area from gentle and flat to fairly steep along some of the river courses. None of the proposed improvements will be affected by the topography. However, access to some of the streambank stabilization sites will require additional review during the design phase in order to protect the surrounding property due to the steep slopes.

j. Geology

The geology of the Study Area will not affect the choice of alternatives. The surficial geology of Washtenaw County is associated with deglaciation and deposition within the proglacial lake environment during the Wisconsinan Stage of the Pleistocene Series glacial episode. Subsurface glacial drift materials are expected to consist primarily of sands, gravels, and silts underlain by unsorted clayey till. Groundwater within the glacial drift reportedly occurs under unconfined conditions at shallow depths and under confined conditions at greater depths.

k. Soils

The soils within the Study Area vary significantly but can generally be classified as well-drained loamy texture glacial till, which exhibits moderate to moderately slow permeability. Prior to any formal design and construction, there must be soil samples taken at each site were infiltration BMPs are proposed.

l. Agricultural Resources

No agricultural resources are currently situated within the Study Area.

m. Fauna and Flora

Work within the Study Area will be limited to publicly owned land or easements, land within the public right-of-way or utility easements. There are no known impacts that will be occurring to any biotic species. In areas where improvements will be located within wetland or stream habitat, the project will incorporate reestablishment of the native species. Prior to any formal design and construction, there will be a field investigation at each site to ensure there is no impact on the existing biota.

n. Unique Features

There are no unique features identified within the Study Area that will be impacted by the proposed improvement project activities.

o. Existing Plant and Animal Communities:

The existing plant and animal species are typical to urbanized areas. No habitat for animals of economic or sport value is within the area. A review of protected species was also made in April 2013, using the U.S. Fish and Wildlife Service's website for Endangered Species Section 7(a)(2) Consultation Process (www.fws.gov/midwest/endangered/section7sppranges//index.html.) Endangered species listed as having a presence in Washtenaw County include the Indiana bat, Snuffbox mussel, Mitchell's satyr butterfly. Candidate species include the Eastern massasauga

snake and Poweshiek skipperling butterfly. Threatened species includes the Eastern prairie fringed orchid plant.

The office of the Michigan Natural Features Inventory (MNFI), operated by the Michigan State University Extension, was also contacted and provided a list of Michigan's endangered, threatened, or otherwise significant plant and animal species, natural plant communities, and other natural features that may exist within 1.5 miles of any of the proposed project sites.

HRC reviewed this information and found that the proposed projects would have no long-term, negative impacts to any species. Since the proposed projects are designed to improve water quality and reduce impervious surfaces, the long-term impacts should result in improved habitat for any species present. Refer to the correspondence included in Appendix F for additional information.

Section III - Analysis of Alternatives

The BMP alternatives presented in this Plan were reviewed on a qualitative and quantitative basis. When applicable, the projects were compared against water quality benefits, infiltration capacity, land availability, compatibility with surrounding land uses, capital and OM&R costs, ease of implementation, and public educational opportunities. BMP load and removal efficiencies were calculated as the cost associated with removal of each pound or cubic foot of runoff of volume reduction over the lifespan of the BMP. Projects were based on opportunities previously outlined in local management plans or originally planned as City capital improvements, such as pending street reconstruction. Removal efficiencies were quantified for TSS, TP, *E. coli*, and stormwater volume.

During the site evaluation analysis, each location was considered for stormwater infiltration where feasible. This type of mitigation, when conditions are suitable, is extremely successful at removing TSS, TP, and *E. coli*. Each BMP location was evaluated against the NRCS soil data. The NRCS has categorized each soil class based on its capacity to infiltrate water as a function of the hydrologic and physical properties of the material. The classes are noted as Type A, B, C, or D, where the properties range from loose unconsolidated sands and gravels to heavy dense clay. Sites with Type A and B soils are most favorable for infiltration BMPs, where locations with Type C and D soils may be less favorable for infiltration. Additional design and engineering must be considered for proper BMP functionality and success when Type C and D soils are present. In addition, soil borings were taken at most project locations where infiltration could be considered. It was found that many locations in the Project Plan do not have soils which are conducive for infiltration.

A. General Alternatives Considered

Each of the sites, depending on the opportunities, was analyzed for water quality improvement alternatives, optimization of existing facilities, or no action. No regional alternatives were identified for the sites. This Plan evaluates possible alternatives to improve runoff and stormwater quality for specific locations within the Study Area. Therefore, all alternatives are site-specific and regional solutions are not applicable. Conceptual figures of the proposed BMPs are included in this section. Refer to Appendix G for the existing conditions site photos. Currently, there are four established TMDLs within the Study Area, all with the goal of improving water quality by reducing volume, sediment, nutrient, and bacteria inputs. The water quality issues have been explained to the public and they have spoken through the planning process with the WMP, MIP, and MRP. Within each document are action items to address the water quality concerns. This Plan is intended to serve as a conduit to help achieve those goals via the use of low interest funding, ultimately working to improve the health of the Huron River and its connecting waterways. This section has been broken down based on individual projects, with a project description, alternatives considered per project, pollutant removal, and a cost analysis. The basis of the cost analysis is included following the project descriptions.

1. Alternative 1 – No Action

If the City is to take no action and does not implement innovative stormwater improvements, then the existing water quality problems will not improve. Therefore, this is not a Principal Alternative.

2. Alternative 2a – Water Quality BMPs

As an alternative to "No action", water quality improvements as described below can be made on the various projects sites. This includes Water Quality BMPs, Optimization of Existing Facilities, and Streambank Stabilization. Water quality BMPs are being proposed at 12 locations within the Study Area. All of these sites provide an opportunity for retrofits to improve stormwater quality. Each site is listed with specific details on each of the BMPs. The BMPs considered in this Plan are listed below.

The City of Ann Arbor recently adopted their Green Streets Policy for all new road construction or reconstruction. As such, the design of the stormwater treatment for roadway projects may be altered from the alternatives identified in the original project plans (Table II-4). It is the intent of all stormwater treatment projects that will be funded through the SRF program to be designed in such a way to maximize infiltration and pollutant removal. During the design process, the City will perform additional investigations into soil conditions, infiltration rates, and other site conditions in order to pick the most appropriate BMPs to meet this goal. The table in Section II indicates the road projects included in previous plans that will incorporate this policy. For this project plan, the policy will be reviewed for Geddes, Detroit Street, State Street, Scio Church Road, Stone School Road, and Seventh Street.

The factors used to determine the most appropriate BMPs for each project and to meet the goals of the Green Streets Policy include the following:

- ***Soil Conditions, including infiltration rates***
- ***Site Slopes***
- ***Location in Floodplain***
- ***Other utility considerations***
- ***Right-of-way constraints***
- ***Project Cost***
- ***Public Input***

The following is a list of the potential BMPs for all projects:

a. Porous Pavement

Porous pavement is an infiltration technique that combines stormwater infiltration, storage, and structural pavement consisting of a permeable surface underlain by a storage reservoir. Porous pavement helps reduce the amount of impervious land area within the watershed, which is critical to infiltrating storm water runoff, therefore improving water quality, and reducing stream flow variability. Porous pavement has been considered in areas with existing impervious surfaces where soil conditions are conducive to infiltration.

b. Bioinfiltration/Infiltration Swales

Bioinfiltration areas are shallow surface depressions planted with specially selected native vegetation to capture and treat stormwater runoff. These areas allow the runoff to be infiltrated and filtered through the vegetation. Native vegetation is commonly used in these areas because it requires less maintenance and generally has deeper roots, which is more effective in facilitating infiltration and filtering pollutants. Bioinfiltration typically manages small drainage areas and are generally used in conjunction with other BMPs. Grassed infiltration swales are depressions in which stormwater runoff is collected following a rain or snow event. In this Plan, swales are proposed in the road right-of-way to collect and dispose of stormwater runoff, and to remove pollutants from stormwater through infiltration. Stormwater enters swales through cuts in the curb and infiltrates through the grass and soil.

c. Underground Pollutant Separation Structures

Pollutant separation structures are storm water management devices used to reduce NPS pollution. They are designed as flow-through structures with a settling or separation unit to remove sediment and other pollutants from the storm flow before moving downstream to the outfall. Periodic maintenance is needed to remove accumulated sediment.

d. HMA Pavement with Subsurface Stone Reservoir

For road projects, a typical HMA section will be used for the pavement surface. However, a stone reservoir will be used that will connect to a sand seam in order to store and filter runoff for treatment and possible infiltration. Open bottom catch basins will be used to convey the flows to the stone reservoir.

e. Infiltration Sewers

Infiltration sewers are perforated storm sewers that allow for infiltration. Manholes located on the infiltration sewers are fitted with a weir plate to allow time for the stormwater to infiltrate into the surrounding soils. All catch basins and manholes along the infiltration storm sewer will have sumps to capture accumulated sediment.

f. Oversized Storm Sewer/First Flush Storm Sewers

Oversized storm sewers are identical to infiltration sewers except that they are not perforated. These sewers are utilized in areas with soils not conducive to infiltration.

g. Tree Planting

Strategically placed, healthy trees can effectively reduce the amount of runoff and pollutant loading in receiving waters. Trees protect water quality by substantially reducing runoff during small rainfall events, which are responsible for the first flush runoff. According to the International Society of Arboriculture, a typical tree will intercept approximately 3,000 gallons of stormwater per year.

h. Constructed Filters

Constructed filters are structures or excavated areas containing a layer of sand, compost, organic material, peat, or other media that reduce pollutant levels in stormwater runoff by filtering sediments, metals, hydrocarbons, and other pollutants. Constructed filters are suitable for sites without sufficient surface area available for bioretention.

i. Buffer Strips

For road or pavement projects, vegetated buffer strips can be installed prior to other types of treatment to remove sediment.

Water Quality BMP Installation Proposed for the Following Sites. ***Figures are included only for the new or updated sites.***

- Geddes Avenue (Arlington to Huron Parkway – Figures 11a and 11b) – This section of Geddes Avenue is in poor condition and is slated for complete reconstruction in 2015 in the City's CIP. This section of the roadway drains directly into the Huron River and has limited stormwater conveyance or treatment at this time. As part of the project, improvements will be made to allow for storm water ***infiltration and*** treatment.

  A "first-flush storm sewer" could be sized to capture and detain the stormwater runoff (***approximately 5,000 – 6,000 cf depending on the final road section***) from the first 0.5-in of rainfall (Figure 11a). All catch basins and manholes along this storm sewer will be designed to have sumps to capture accumulated sediment. Due to the limited ROW, the "first-flush storm sewer" will ***likely*** be placed underneath the roadway and it is likely that the roadway associated with this storm sewer will need to be replaced.

  As an alternative to the first flush storm sewer, the City could install a subsurface stone reservoir ***underneath the proposed road cross section at several locations throughout the project*** for stormwater storage, filtering, and treatment (Figure 11b). The stone reservoir would be sized appropriately for the ***Green Streets Policy with a minimum of the "first-flush" volume as described above*** and storage would be in the voids prior going to the storm sewer system. ***In an effort to minimize the disruption of the right-of-way, it is likely that other utilities will need to be installed within the roadway zone of influence. Granular sand backfill is required in this application. This material is suitable for infiltration to lower sand seams present and thus provides infiltration and treatment.***

  In conjunction with the options above, a portion of the treatment and infiltration could be accomplished using Bioinfiltration/Infiltration Swales along the side of the road in areas where suitable slopes exist. In addition, some limited tree planting can be completed. These options are likely not sufficient to meet the treatment and infiltration requirements on their own, but could be used as part of a larger water quality strategy.

  Due to the steep grades along the road way, a stepped ***water quality*** system will be required, regardless of the method used, with weirs provided to surcharge the system and provide storage in oversized pipes ***or the infiltration beds***. There is a high point in the roadway located at approximately 300 lft west of Heatherway Street. The slopes to the west are 2.6% and there is approximately 1000' from this high point to Arlington Drive. Due to the existing grades, limited space, and lack of a viable outlet, it is unlikely that any storm sewer outlet treatment can be completed at this end. To the east, the slopes are in excess of 7% in some areas. Two alternatives were reviewed, one to connect to the existing storm sewer system and one to construct a new outlet to the river. ***This will be further evaluated based on grades, capacity and condition of the existing outlet. If a piped system is used, rather than infiltration beds, a water treatment structure may be required on the system to address pollutant loading.*** While the connection to the existing storm sewer would be preferred, this may not be feasible due to grades. ***This will be determined during detailed design. If the final sewer design needs to be deeper than the existing outlet,*** the selected alternative may require a new outfall to the river. Easements and permits may be necessary to construct this outlet.

  Detention***/infiltration*** of the first flush and ***Green Streets Policy volume*** will help improve watershed hydrology and downstream conditions by reducing peak flows, particularly those that result in streambank erosion. The proposed improvement would

Figure 11a

Proposed Stormwater Improvements

Geddes Road - First Flush
Storm Sewer

HRGIDD 2013 Project Plan

Restoration Activities

- Pollutant Seperator
- Storm Manhole
- Storm Sewer
- First Flush Storm Sewer
- Parcels

N
W E
S

1 inch = 150 feet

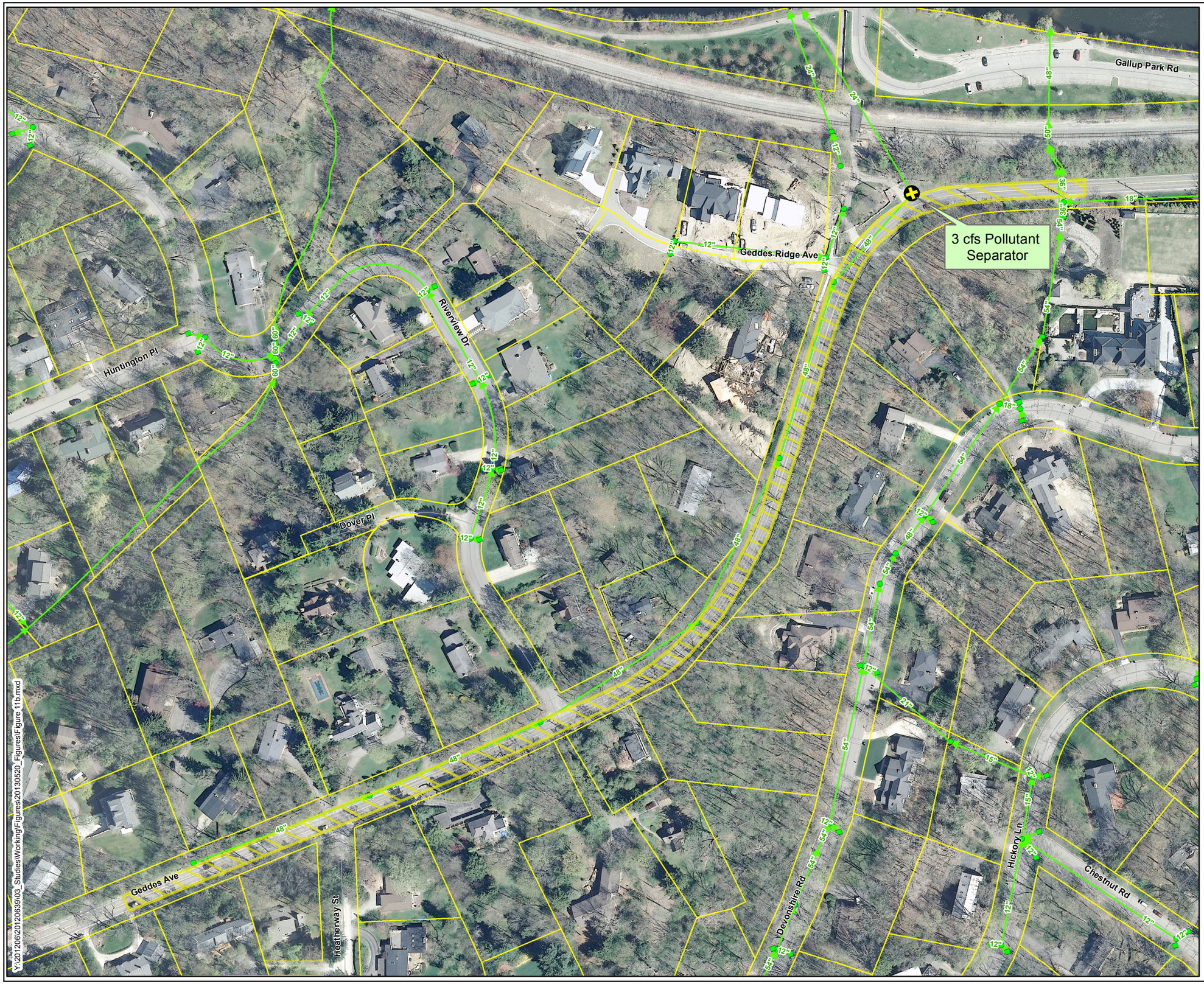
HRC

Figure 11b

Proposed Stormwater Improvements

Geddes Road - Subsurface Stone Reservoir

HRGIDD 2013 Project Plan



Restoration Activities

- Pollutant Seperator
- HMA Section with Subsurface Stone Reservoir
- Storm Manhole
- Storm Sewer
- Parcels

N E S W

1 inch = 150 feet

HRC

mitigate stormwater runoff from approximately 1.8-ac of contributing area. This is a Principal Alternative.

Other alternatives, such porous pavement, have been considered. However, due to the narrow right-of-way, private property issues, traffic volumes, and steep slopes along the road corridor, they are not viable alternatives for NPS pollution management.

Total Preliminary Costs	***$2,720,000***
Present Worth of Analysis	***$2,050,000***

Direct, Indirect, and Irreversible Impacts

This proposed project will provide stormwater management retrofits as part of a road reconstruction project. Adverse environmental impacts are expected to be minimal. All construction activities will take place within the Geddes Road right-of-way. This project site is no located in or near known floodways, floodplains, or wetlands. The project is located within a wooded area. However, all improvements are proposed within the current footprint of the roadway.

There is limited anticipated tree removal and no anticipated adverse effects on endangered species or historical, cultural resources.

Based on the final design, an outlet to the river may need to be constructed for this area. If this is the case, all necessary easements and permits will be secured.

Due to the limited right-of-way, there will be traffic disruptions and inconveniences for people living in the area during construction. These disruptions will be temporary during construction and will be communicated through project signage.

- Detroit Street (Catherine to Division, Figures 12a and 12b) – Detroit Street is an older, brick street that is in deteriorating condition located within the Allen Creek subwatershed with a portion that outlets directly to the Huron River. The road needs to be replaced at this time. However, due to its location in a Historic District, replacement of the roads is a sensitive subject and must keep with the historic feel of the area. The roadway will be replaced with bricks that keep with the historic nature of the street. This project is located within the Old Fourth Ward Historic District in the City. The City will work with members of the Historical Society to assure that the final project design is acceptable.

  Based on the soil boring information in the area, the soils are not ideal for infiltration. While the boring at the north end of the street showed some sandy gravel, the boring was not able to be completed and the sandy gravel was at a shallow depth. The boring at the south end of the street indicated that the soil is primarily clay which is not a viable option for infiltration. Based on the soils, traffic loads, and need to maintain the historic feel of the area, porous pavement was not considered at this location. Furthermore, due to the limited right-of-way, other stormwater BMPs such as rain gardens or bioswales could not be considered.

  The existing storm sewer for this roadway outlets to the existing storm pipe at the intersection of Detroit and High Street. A two (2') diameter first flush storm sewer, with a pollutant separator at the downstream end, can be constructed to capture the stormwater runoff (2,715 cf) from the first 0.5-in of rainfall (See Figure 12a). This is the largest storm sewer that can be designed in this area, and while it can handle slightly more than the first flush volume, bank full volume cannot be accommodated. HRC evaluated this alternative and determined that to handle the bankfull volume, larger storm sewer would be required. Based on the depth of this outletting storm sewer and the cross section for the roadway, in order to provide appropriate cover, this alternative is not feasible. The proposed storm sewer will only pick up stormwater from the project site and will not handle any upstream flow.

  As an alternative, the City may consider a brick paver section with a stone reservoir for stormwater storage, filtering, and treatment (see Figure 12b). The stone reservoir would be sized appropriately for the first flush volume and storage would be in the voids prior to discharging to the storm sewer system. If site conditions find sand below the depth discussed above, infiltration will be used.

  Detention of the first flush will help improve watershed hydrology and downstream conditions by reducing peak flows, particularly those that result in streambank erosion. The proposed improvement would mitigate stormwater runoff from approximately 1.27-ac of contributing area. This is a Principal Alternative.

  Other alternatives, such as bioinfiltration or porous pavement, have been reviewed. However, due to the soil conditions, infiltration is not an ideal alternative. In addition, the porous brick paver options may not meet the historic criteria necessary in the area. Therefore, these are not viable alternatives for NPS pollution management.

Total Preliminary Costs	$1,090,000
Present Worth of Analysis	$824,000

Direct, Indirect, and Irreversible Impacts

The proposed retrofits along Detroit Street to improve the road surface and incorporate stormwater managements BMPs will be incorporated into the overall road reconstruction project. Adverse environmental impacts are expected to be minimal. All construction activities will take place in the Detroit Road right-of-way. This project site is not located in or near known floodways, floodplains, or wetlands.

There is no anticipated tree removal or adverse effects on endangered species. The street is located within the Old Fourth Ward Historic District of the City of Ann Arbor. The brick roadway will be replaced with an appropriate brick to match the historic characteristics of the area. The City will work with the historic district in order to assure that this is acceptable.

There will be traffic disruptions, detours, and limits to the on-street parking during construction and may be impacts to pedestrian facilities. These disruptions will be temporary and will be communicated through project signage, website updates and stakeholder e-mails.

- Farmers Market Parking Lot (Figures 13a and 13b) – The Farmers Market Parking Lot is in poor condition and needs replacement. This project is located within the Allen Creek subwatershed in downtown Ann Arbor. The area is currently asphalt with no stormwater storage or treatment. Based on the current site conditions, there is limited space for water quality improvements.

  The existing storm sewer for this site outlets to the existing storm pipe along N. Fourth Avenue. A "first-flush storm sewer" (Figure 13a) would be sized to capture and detain the stormwater runoff (3,000 cf) from the first 0.5-in of rainfall. All catch basins and manholes associated with this storm sewer would have sumps to capture accumulated sediment. A pollutant separator will be installed at the outlet. While the proposed storm sewer is sized slightly greater than the first flush volume, this is the largest size that is feasible while still matching the downstream invert and providing appropriate cover. As an alternative, the City may consider a standard HMA section with a stone reservoir for stormwater storage, filtering and treatment (See Figure 13b). The stone reservoir would be sized appropriately for the first flush volume and storage would be in the voids prior going to the storm sewer system. Preliminary soil borings showed a small sand seam that may be able to be tied into for infiltration opportunities. The other utilities in the area would need to be reviewed prior selecting one of these alternatives.

  Detention of the first flush through either a first flush storm sewer or underground stone storage reservoir will help improve watershed hydrology and downstream conditions by reducing peak flows, particularly those that result in streambank erosion. The proposed improvement would mitigate stormwater runoff from approximately 1.72-ac of contributing area. Storage of the first flush in either a storm sewer or stone reservoir is a Principal Alternative.

  Other alternatives, such as porous pavement, could have been considered. However, due to the heavy truck traffic and less than ideal soil conditions, this is not a viable alternative for NPS pollution management.

Total Preliminary Costs	$700,000
Present Worth of Analysis	$530,000

  Direct, Indirect, and Irreversible Impacts

  The proposed retrofits to the Farmers Market Parking lot are to improve the parking lot surface, increase the parking area, and incorporate stormwater managements BMPs. Adverse environmental impacts are expected to be minimal. All construction activities will take place within the current Farmers Market area. This project site is not located in or near known floodways, floodplains, or wetlands.

  There is no anticipated tree removal or adverse effects on endangered species. The street is located within the Old Fourth Ward Historic District of the City of Ann Arbor. WCWRC will work with the Ann Arbor Historic District Commission to maintain the historic nature of this project. During construction, the Farmer's Market (which operates year round) will be impacted and will likely have to be temporarily moved to another site.

  There will be traffic disruptions and limits to the parking during construction and there may also be impacts to pedestrian facilities. These disruptions will be temporary and will be communicated through project signage. There will also be disruptions to the Farmers Market operations during the construction project. WCWRC and the City of Ann Arbor will work with the Public Market Advisory Commission to develop a construction schedule, likely including night work, to minimize disruptions.

- Street Tree Planting (Throughout the City) – As stated above, tree planting can be used to reduce runoff and pollutant loading. As part of the City's extensive tree replacement and enhancement program, the HRGIDD seeks to supplement that program with the installation of approximately 750 trees annually for 5 years. The trees will be planted along road corridors and on public property to enhance stormwater interception, infiltration, and transpiration. Structural soil will be incorporated as needed for healthy tree growth. These tree plantings will take place in all subwatersheds located within the City. Some areas where trees are dead or diseased will be replanted with new trees. The costs below include the costs for removal of stumps and/or trees. This is a Principal Alternative.

  Healthy trees can reduce the amount of runoff and pollutant loading in receiving waters. Trees protect water quality by substantially reducing run off during small rainfall events, which are responsible for the first flush runoff. The amount of rainfall that trees intercept depend on the species, age of tree, rainfall patterns, and the climate. According to the International Society of Aboriculture, a typical tree will remove approximately 3,000 gallons of storm water per year.

Total Preliminary Costs	$2,070,000
Present Worth of Analysis	$1,725,000

  Direct, Indirect, and Irreversible Impacts

  This project involves planting new trees along road corridors and on public property. There is no anticipated construction work. Therefore, no environmental impacts are expected.

- State Street (Eisenhower to south of I-94 – Figure 14) – The location is directly off of I-94 in an area where many visitors first enter Ann Arbor. The City wishes to make this area a more attractive and inviting "gateway" into the City. In addition, the road surface is past its useful lifespan and is in need of repair. The project is located within the Mallett's Creek subwatershed and is currently scheduled for construction in 2015.

  The existing concrete islands which separate northbound and southbound traffic will be replaced with infiltration swales. The construction will include excavation to the existing sand seam (approximately 4.5-6.5' below the surface) and connecting the swales to this seam in order to encourage infiltration. Depending on the soils encountered, a subsurface stone reservoir may be constructed to facilitate storage of stormwater. The swales will be connected to the sand seam via a system of infiltration catch basins. This system will be designed to handle the "first-flush" storm volume from the roadway. In addition, any catch basins and manholes necessary will have sumps to capture accumulated sediment. These infiltration beds will be designed to handle approximately 21,200 cf from the first 0.5-in of runoff. By placing these basins, approximately 157,900 sf of impervious areas will be removed as the concrete islands will be replaced with pervious improvements. In additional, tree plantings with structural soil will be used in these areas. No pavement replacement will be required as part of this work due to the work taking place within island areas.

  Detention of the first flush will help improve watershed hydrology and downstream conditions by reducing peak flows, particularly those that result in streambank erosion. The proposed improvement would mitigate stormwater runoff from approximately 12.2-ac of contributing area roadway. In addition, 3.6-ac of currently impervious area would removed and restored to a greenbelt area. This project is considered a Principal Alternative.

  Other alternates such as porous pavement were not considered due to the heavy traffic and maintenance concerns. A full width subsurface stone reservoir was not considered due to the likelihood of utilities in the area.

Total Preliminary Costs	$1,060,000
Present Worth of Analysis	$801,000

  Direct, Indirect, and Irreversible Impacts

  The proposed retrofits along State Street to improve the road surface and incorporate stormwater managements BMPs will be incorporated into the overall road reconstruction project. Adverse environmental impacts are expected to be minimal. All construction activities will take place in the State Street right-of-way. There are several areas where the Mallett's Creek crosses State Street in the project area. Appropriate permits for the floodplains associated with these crossings will be procured during the design process.

  There is no anticipated tree removal or adverse effects on endangered species. There will be traffic disruptions and limits to the pedestrian facilities during construction. These disruptions will be temporary and will be communicated through project signage, website updates, and stakeholder e-mails.

- Scio Church (Main Street to east of Seventh Street – Figure 15) – This location is bordered by Ann Arbor public schools property and residential areas. It is located within the Mallett's Creek subwatershed. The road surface is past its useful lifespan and is need of repair. Currently, this project is scheduled for 2015 construction. The area has poor soils which will limit the ability for infiltration projects.

  A "first-flush storm sewer" and would be sized to handle the first 0.5 inches of rain from the site. In addition the storm sewer will be designed to detain a portion of the bankfull volume. However, due to poor soil conditions and the lack of ability to infiltrate, the storm sewer would need to be quite large to detain the entire bankfull volume. The size of the storm sewer that can be installed is dictated by the existing inverts of the downstream storm sewers. Pollutant separators will be used at the outlets to the treat the stormwater prior to outletting into the existing storm sewer.

  In addition to the treatment of the stormwater in the roadway, the project will consist of the construction of a stormwater treatment and detention basin as outlined in the Upper Mallett's Creek study completed on March 21, 2014. Excerpts from this report are included in Appendix K and provide additional information. This basin is 2.8 acres in area and has a storage volume of 9.2 acre-ft. The basin will be sized to handle flow from the roadway and surrounding areas. The stormwater treatment basin will help to filter out pollutants, provide natural infiltration, and reduce the flashiness of Mallett's Creek, thus protection the stream downstream from additional sedimentation. All design will be completed in accordance with Green Streets Policy.

  Detention of the first flush ***and the stormwater treatment basin*** will help improve watershed hydrology and downstream conditions by reducing peak flows, particularly those that result in streambank erosion. The proposed improvement would mitigate stormwater runoff from approximately 7.25-ac of contributing area roadway. Due to the location of the storm sewer down the center of the roadway, the entire road will likely need to be replaced. This project is considered a Principal Alternative.

  Other alternates such as porous pavement were not considered due to the heavy traffic and maintenance concerns. Infiltration type projects were not considered due to the soil conditions. The City also considered a standard HMA section with a subsurface stone reservoir as called out in other projects herein. However, due to the groundwater conditions, this was not considered a viable alternative.

Total Preliminary Costs	***$5,000,000***
Present Worth of Analysis	***$3,801,000***

  Direct, Indirect, and Irreversible Impacts

  This proposed project will provide stormwater management retrofits as part of a road reconstruction project. Adverse environmental impacts are expected to be minimal. All construction activities will take place within the Scio Church Road right-of-way. This project site is no located in or near known floodways or floodplains.

  There are no anticipated adverse effects on endangered species or historical, cultural resources.

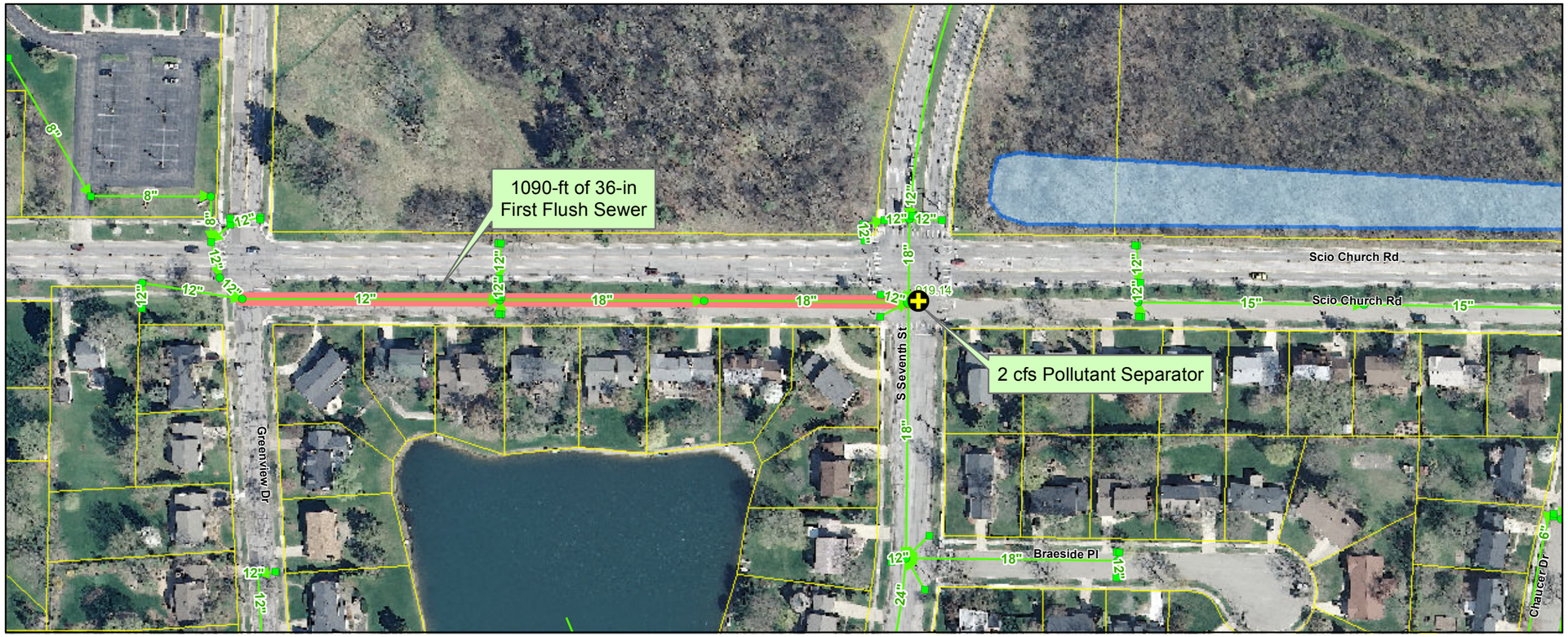
  The east end of the proposed stormwater treatment facility may impact some existing wetlands. During design, the exact limits of the wetlands will be identified and the design team will work with MDEQ to protect/enhance these features.

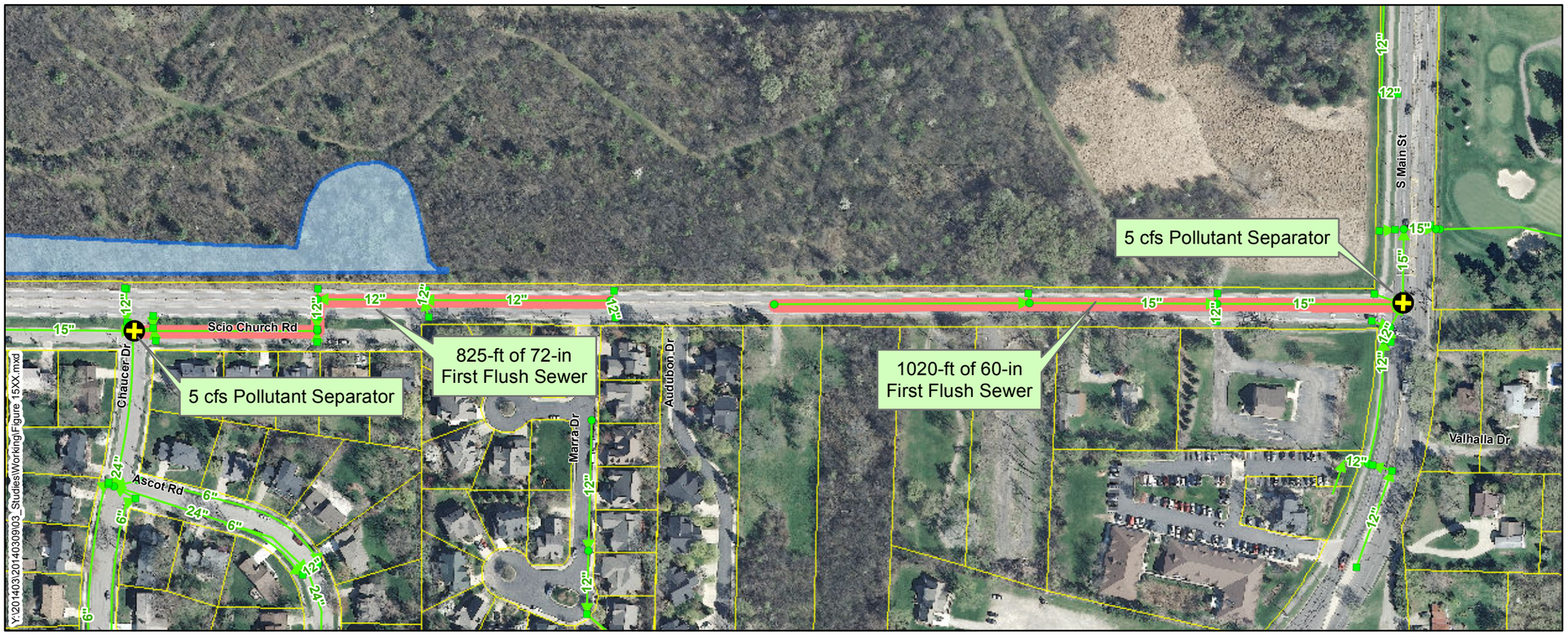
Figure XX

Proposed Stormwater Improvements

Scio Church Road - Amended Project

HRGIDD 2014 Project Plan Amendment





Restoration Activities

- Pollutant Separator
- Storm Catch Basin
- Storm Manhole
- Storm Sewer
- First Flush Sewer
- Stormwater Treatment
- Parcels

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1 inch = 200 feet

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Some tree removal may be necessary for the construction of the stormwater treatment basin. The majority of the area is small trees and shrubbery, but there are likely several larger trees that would need to be removed. However, the environmental benefits of this treatment area would compensate for the limited removal.

The area is currently a heavily trafficked pedestrian trail system. Access to the trail system would be limited during construction of the stormwater treatment area. However, the final design will include plans for continued pedestrian access, such as boardwalks or raised trail bed so that access will be maintained in the long term. In addition, the Pioneer High School disc golf course is located in this area. There is one hole that would be impacted by the proposed construction. During design, the City would work with the school to relocate this hole.

There will be traffic disruptions and inconveniences for people living in the area during construction. It is likely that pedestrian traffic will be impacted during construction. This will be routed around the site for safety. These disruptions will be temporary during construction and will be communicated through project signage.

- Stadium (Hutchins to Kipke – Figures 16a and 16b) – This project was included in the 2011 Project Plan amendment. The project is similar to the previously proposed project. The location is bordered by U-M campus, residential property, and Ann Arbor public schools property. It is located within the Allen Creek and Mallett's Creek subwatersheds. The road surface is past its useful lifespan and is in need of repair. Currently, this project is scheduled for 2015 construction.

  Porous pavement was considered for this site. Soil conditions in the area are less conducive to infiltration. However, by filtering the stormwater through the porous pavement section, additional storm water quality benefits can be realized prior to connecting to the storm sewer system. Furthermore, storage time in the storage reservoir can help to decrease peak flows from the area. A three (3') deep stone reservoir will be used for storage and will provide approximately 27,000 cft of storage. As an alternative, the City may consider a standard HMA section with a stone reservoir for stormwater storage, filtering and treatment. The stone reservoir would be sized appropriately for the first flush and bankfull volume storage in the voids before going to the storm sewer system. Figure 16a shows the options of porous pavement and/or a subsurface stone reservoir for storage.

  As an alternative to this, a "first-flush storm sewer" could be sized and constructed to capture and detain the stormwater runoff (3,300 cf) from the first 0.5-in of rainfall. All catch basins and manholes along this storm sewer would have sumps to capture accumulated sediment. This is shown on Figure 16b.

  Detention of the first flush through either a first flush storm sewer or a porous pavement/subsurface stone reservoir will help improve watershed hydrology and downstream conditions by reducing peak flows, particularly those that result in streambank erosion. It is likely that due to the utilities in the road right-of-way, the first flush storm sewer will be the preferred solution. However, this will be verified during final design. The proposed improvement would mitigate stormwater runoff from approximately 2-ac of contributing area. In addition, trees with structural soil would be planted along the Pioneer High School property, which would also reduce the amount of runoff. This is a Principal Alternative.

  Other alternatives, such as bioinfiltration, could have been considered. However, due to the narrow right-of-way, private property issues, traffic volumes, and steep slopes along the road corridor, they are not viable alternatives for NPS pollution management.

  Alternate B – First Flush Storm Sewer

Total Preliminary Costs	$1,640,000
Present Worth of Analysis	$1,242,000

  Direct, Indirect, and Irreversible Impacts

  The proposed retrofits along Stadium Boulevard are to incorporate BMPs (first flush storm sewer and tree planting or porous/HMA pavement with stone reservoir) into a road reconstruction project. Adverse environmental impacts are expected to be minimal. All construction activities will take place within the Stadium Boulevard right-of-way. The site is not located in or near known floodways, floodplains, wetlands or other sensitive features.

  There is no anticipated tree removal or adverse effects on the endangered species or historical cultural resources.

There may be disruptions to road traffic or limits on parking usage during construction. Additionally, this project is near the University of Michigan campus and Pioneer High School. Pedestrian traffic may be temporarily routed around the site for safety. These disruptions will be temporary and will be communicated through project signage.

- ***Stone School Road (Packard to I-94 – Figure XX) – This project was included in the 2011 Project Plan amendment. The project is similar to the previously proposed project. As part of the City's ongoing Capital Improvement Program, there are opportunities to incorporate innovated stormwater BMPs as appropriate projects arise. Stone School Road, located in the Mallett's Creek watershed, is an ideal site in which to incorporate infiltration practices due to the high visibility near residential and school properties as well as the Type B soil conditions. Opportunities along the roadway within the right-of-way are bioinfiltration basins, first flush storm sewer, tentatively sized at 60", and pollutant separation (three units at 4, 11 and 25 cfs) proposed to be located on the 15-in, 24-in, and 36-in storm sewer. During detailed design, the City will review the alternatives in accordance with the Green Streets Policy.***

  The "first-flush storm sewer" would be sized and constructed to capture and detain the stormwater runoff from the first 0.5-in of rainfall or as identified in the Green Streets Policy. All catch basins and manholes along this storm sewer would have sumps to capture accumulated sediment. Detention of the first flush would help improve watershed hydrology and downstream conditions by reducing peak flows, particularly those that result in streambank erosion. The proposed improvements would mitigate stormwater runoff from approximately 62-ac of contributing area. This is a <u>Principal Alternative</u>.

  Other alternatives, such as porous roadway, have been considered. However, due to steep slopes along a portion of the road corridor near I-94, it was not a viable alternative for NPS pollution management.

  Alternate B – First Flush Storm Sewer

Total Preliminary Costs	***$1,300,000***
Present Worth of Analysis	***$988,000***

  <u>Direct, Indirect, and Irreversible Impacts</u>

  The proposed retrofits along Stone School Road are to incorporate BMPs (first flush storm sewer and bioinfiltration basins) into a road reconstruction project. Adverse environmental impacts are expected to be minimal. All construction activities will take place within the Stone School Road right-of-way. The site is not located in or near known floodways, floodplains, wetlands or other sensitive features.

  There are no anticipated tree removal or adverse effects on the endangered species or historical cultural resources.

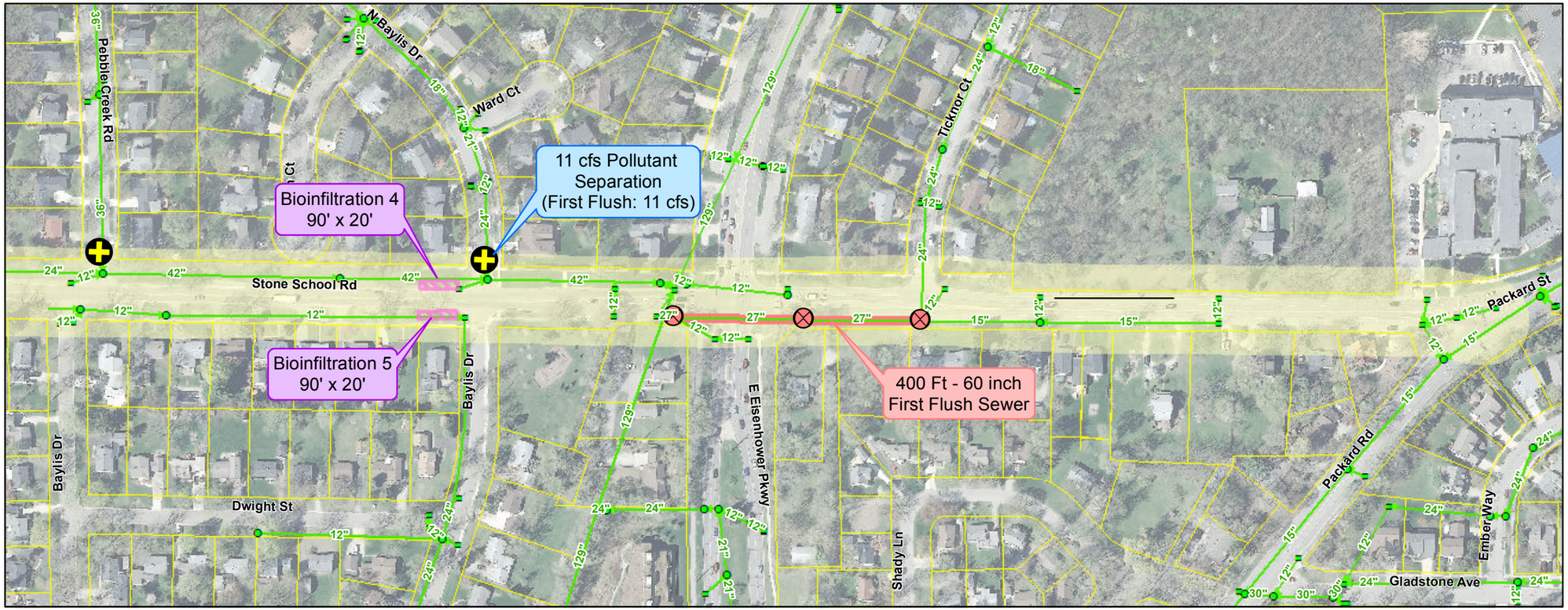
  There may be disruptions to road traffic or limits on parking usage during construction. Pedestrian traffic may be temporarily routed around the site for safety. These disruptions will be temporary and will be communicated through project signage.

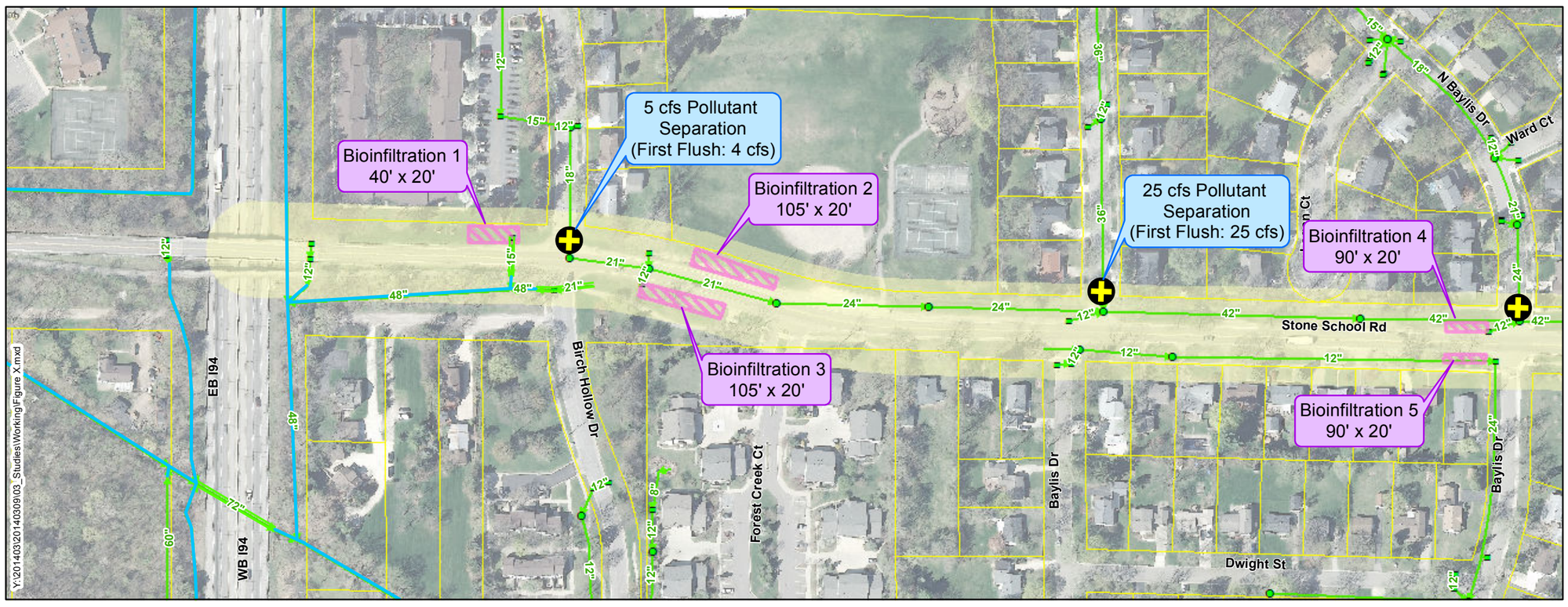
Figure X

Proposed Stormwater Improvements

Stone School Road Reconstruction
Packard to I-94 - Amended Project

HRGIDD 2014 Project
Plan Amendment





Restoration Activities

- Pollutant Seperation with First Flush Flow
- Storm Culvert
- Open Drain
- Bioinfiltration
- First Flush Manhole
- First Flush Sewer
- Storm Catch Basin
- Storm Manhole
- Storm Sewer
- Project Location
- Parcels

1 inch = 200 feet

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- 721 N. Main (Figure 17) – 721 N. Main Street is the former site of the City's DPW site. The site is still owned by the City and the building on site is still used for storage. The site is located within the Allen Creek subwatershed, and an enclosed portion of Allen Creek runs underneath the site. The entire site is located in the floodplain, with a large portion located within the floodway. The City previously received a Hazard Mitigation Grant from the Federal Emergency Management Agency (FEMA) to remove several of the ancillary buildings that were located in the floodway. The current site is completely paved. Improvements to the site in order to provide flood protection and storm water quality improvements are proposed, including the construction of a stormwater wetland near the center of the site with planting beds and other stormwater quality improvements.

  The proposed project will remove approximately 2.5 acres of impervious area and create a wetland area for the treatment of stormwater. This wetland will remove sediment and provide treatment for the removal of other nutrients from upstream areas.

  Furthermore, this property is located within the floodplain and a portion of this is located within the floodway. This project will remove structures and parking from the floodway and floodplain, and create a park area with walking trails and native plantings

Total Preliminary Costs	$1,760,000
Present Worth of Analysis	$1,228,000

  Direct, Indirect, and Irreversible Impacts

  This proposed project will provide stormwater management retrofits on a site located within the within the floodplain. This will include reduction the amount of pavement. Adverse environmental impacts are expected to be minimal. All construction activities will take place within the City owned property and no easements are necessary.

  As discussed above, the entire site is located within the regulated floodplain, with a large portion located within the floodway. All required MDEQ permits will be procured prior to the start of work on the site.

  There is no anticipated tree removal or adverse effects on endangered species or historical, cultural resources.

  There may be traffic disruptions on Main Street and inconveniences for people living in the area during construction. However, because this work is anticipated to take place primarily on the site, these disruptions will be minimal. These disruptions will be temporary during construction and will be communicated through project signage. City operations at the site may be limited during construction.

- S. Seventh Street (Scio Church to Greenview – Figures 18a and 18b) – This project includes reworking the right-of-way of S. Seventh Street in the area described. This project is located within the Mallett's Creek subwatershed and is a residential street. Currently the street is overly wide for a residential right-of-way as it was originally meant to be an arterial street. By narrowing the roadway (road diet) approximately 10' over the 875' length, 8,750 square feet of pavement can be removed and turned back into a greenbelt area. The soil borings in this area identify primarily clay soils which do not lend themselves well to infiltration type projects.

  As this is a residential street, porous pavement was considered. Soil conditions in the area are less conducive to infiltration. However, by filtering the stormwater through the porous pavement section, additional storm water quality benefits can be realized prior to connecting to the storm sewer system. Furthermore, storage time in the storage reservoir can help to decrease peak flows from the area. A three (3') deep stone reservoir will be used for storage and will provide approximately 15,750 cft of storage. As an alternative, the City may consider a standard HMA section with a stone reservoir for stormwater storage, filtering and treatment. The stone reservoir would be sized appropriately for the first flush and bankfull volume storage in the voids before going to the storm sewer system. Figure 18a shows the options of porous pavement and/or a subsurface stone reservoir for storage.

  As a second alternative, as shown on Figure 18b, a "first-flush storm sewer" could be sized to capture and detain the stormwater runoff (~3,300 cf) from the first 0.5-in of rainfall. All catch basins and manholes along this storm sewer would have sumps to capture accumulated sediment. In addition hydronomic separation would be used at the outlet to the existing storm sewer system. Due to the constraints of the elevation of the existing outlet, the storm sewer cannot be upsized to include additional storage.

  Detention of the first flush and additional flow through the installation of porous pavement will help improve watershed hydrology and downstream conditions by reducing peak flows, particularly those that result in streambank erosion. The proposed improvement would mitigate stormwater runoff from approximately 1.9-ac of contributing area roadway. In addition, 0.2-ac of currently impervious area would removed and restored to a greenbelt area. Porous pavement and/or a subsurface stone reservoir on this project is considered a Principal Alternative.

  Other alternatives, such as bioinfiltration, could have been considered. However, due to the maintenance concerns along of the City, and the aesthetics of the residential street, they are not viable alternatives for NPS pollution management. In addition, consideration was given to converting the road into a boulevard section. However, the capital costs long term maintenance costs associated with this option made it more expensive that the road diet proposed herein.

  Alternate A – Porous Pavement and/or Subsurface Stone Reservoir

Total Preliminary Costs	$840,000
Present Worth of Analysis	$645,000

  Direct, Indirect, and Irreversible Impacts

  This proposed project will provide stormwater management retrofits as part of a road reconstruction project. This will also include reducing the amount of pavement as the street is overly wide. Adverse environmental impacts are expected to be minimal. All

construction activities will take place within the Seventh Street right-of-way. This project site is not located in or near known floodways, floodplains, or wetlands.

There is no anticipated tree removal or adverse effects on endangered species or historical, cultural resources.

There will be traffic disruptions and inconveniences for people living in the area during construction. These disruptions will be temporary during construction and will be communicated through project signage. By narrowing the roadway, some on street parking may be lost.

- Maple Village (Figure 19) – Maple Village is an existing shopping center that is located at the southeast corner of Dexter and Maple Roads. It is located within the Allen Creek watershed. This parcel is currently in the process of being redeveloped and receives runoff from the adjacent shopping center, the freeway, and a small portion of the adjacent neighborhood. In accordance with WCWRC's new design standards, storage is being required for the full 100 year storm. Soil borings in the area show the site is primarily sand, which will provide options for infiltration.

  Three options were investigated for the redevelopment of this property. The project site is approximately 28-acres. Based on WCWRC detention calculations, the amount of storage required for a 100 year storm even for a site of this size is approximately 235,000 cubic feet.

  Alternative A - Below ground detention/infiltration for the site (100 yr. event) with standard HMA pavement.

  Alternative B - Below ground detention/infiltration for the site (100 yr. event) with porous asphalt. Due to the sandy soil conditions, underdrain would not be required for the porous pavement section.

  Alternative C - Below ground detention/infiltration for the basin (100 yr. or bankfull event) with standard HMA pavement.

  Based on the amount of storage needed for the site based on a design commercial use and a large amount of impervious area, Alternative B is the more cost effective project. The used of porous pavement will reduce the amount of storage necessary as a portion of the storage can be addressed in the stone reservoir. Therefore, the footprint of the basin and associated easement can be shrunk. Furthermore, the site is primarily sand, which will allow for infiltration.

Total Preliminary Costs	$2,420,000
Present Worth of Analysis	$1,836,000

  Direct, Indirect, and Irreversible Impacts

  This proposed project will provide stormwater management retrofits as part of a site redevelopment project. Adverse environmental impacts are expected to be minimal. All construction activities will take place on a currently built out commercial site. This project site is not located in or near known floodways, floodplains, or wetlands.

  There is no anticipated tree removal or adverse effects on endangered species or historical, cultural resources.

  There will be traffic disruptions and inconveniences for people living in the area during construction. These disruptions will be temporary during construction and will be communicated through project signage.

- Lawton Park (Figure 20) – The City has recently undertaken a significant review of the stormwater management in the Upper Mallett's Creek section of the City (located south of Scio Church Road, northeast of I-94 and west of Ann Arbor-Saline Road. Based on the results of this study, it was found that there are several areas where stormwater detention would be beneficial for the hydraulics and hydrology of the area.

  The first of these areas is a large, underground storage basin to be located at Lawton Park. Other alternatives, such as open storage, were considered at this site. However, due to the grades, limited space, and activities at the park which need to be maintained, it was determined that the underground basin would be the least disruptive alternative.

  The project will consist of the construction of an 825,000 cu ft underground storage tank which will slowly outlet into Mallett's Creek. Depending on the final soil, the basin may be able to be connected to a sand seam, which may allow for some infiltration.

  By improving the storage in the area, the Drainage District will be improved. Additional storage to the volumes originally identified will increase the storage time and infiltration and decrease the excess flow to Mallett's Creek. The increase in storage time will thus increase sedimentation in areas where it is easier to remove and therefore reduce the amount of TSS into Mallett's Creek.

Total Preliminary Costs	$13,520,000
Present Worth of Analysis	$10,513,000

  Direct, Indirect, and Irreversible Impacts

  This proposed project will provide stormwater management retrofits and additional storage in a portion of the Mallett's Creek subwatershed. Adverse environmental impacts are expected to be minimal. All construction activities will take place on City-owned Park property. This project site is not located in or near known floodways or floodplains, or wetlands.

  There may be limited tree removal associated with the project. There are no known adverse effects on endangered species or historical, cultural resources.

  There will be traffic disruptions and inconveniences for people living in the area during construction. These disruptions will be temporary during construction and will be communicated through project signage.

  As the project site is an active City-owned Park, there will be interruptions in the services offered at the Park (such as soccer and baseball) during the construction of the project. However, because the project will consist of an underground storage basin, once the construction is complete, activities on the Park will be able to resume. During scheduled maintenance, City crews will need to access the Park to perform the necessary cleanout.

- Churchill Downs Park (Figure 21) – A second area that was identified in the review of the Upper Mallett's Creek area was Churchill Downs Park. This area is located at the convergence of two branches of the Mallett's Creek and offers and ideal location for storage and stormwater quality improvements.

  A 425,000 cu ft above ground storage basin will be constructed on this site. Other alternatives such as underground storage was not considered for this site, as the grades on the site are not conducive to a gravity release and pumping the stormwater would add significant capital,operations, and maintenance costs.

  By improving the storage in the area, the Drainage District will be improved. Additional storage to the volumes originally identified will increase the storage time and infiltration and decrease the excess flow to Mallett's Creek. The increase in storage time will thus increase sedimentation in areas where it is easier to remove and therefore reduce the amount of TSS into Mallett's Creek.

Total Preliminary Costs	$3,810,000
Present Worth of Analysis	$2,990,000

  Direct, Indirect, and Irreversible Impacts

  This proposed project will provide stormwater management retrofits and additional storage in a portion of the Mallett's Creek subwatershed. Adverse environmental impacts are expected to be minimal. All construction activities will take place on City-owned Park property. This project site is not located in or near known floodways or floodplains, or wetlands.

  There may be limited tree removal associated with the project. There are no known adverse effects on endangered species or historical, cultural resources.

  There will be traffic disruptions and inconveniences for people living in the area during construction. These disruptions will be temporary during construction and will be communicated through project signage.

  As the project site is an active City-owned Park, there will be interruptions in the services offered at the Park (such as soccer and baseball) during the construction of the project. There are many areas of the Park that are currently unable to be accessed. The basin will be constructed primarily in these areas. The existing playscape and sports courts will not be impacted. During scheduled maintenance, City crews will need to access the Park to perform the necessary cleanout.

3. Alternative 2b – Optimization of Existing Facilities

Optimization of existing facilities is being proposed for four projects (6 locations total). These projects focus on improving existing controls using the latest design methods to achieve additional pollutant removal and meet stormwater quality goals.

- Lans Basin (See Figure 22) – As discussed in previous sections, the Upper Mallett's Creek section has been extensively reviewed. One of the proposed projects is the modification of the existing Lans Basin which is located in rear yards south of Delaware Street between Seventh Street and Ann Arbor-Saline Road. This project consists of the modification of the basin to provide an additional 200,000 cubic feet of storage by dredging out existing pond and removing or altering the existing weirs. This will help to offset some of the flashiness of the stream in the area which leads to downstream water quality issues such as erosion. Furthermore, additional storage will help to allow for increased infiltration and evaporation rather than moving the water downstream as quickly as possible. The increase in storage time will also allow for additional sedimentation to take place in the ponds, where there will be easier access for maintenance, which will reduce the amount of TSS downstream in Mallett's Creek.

Total Preliminary Costs	$1,410,000
Present Worth of Analysis	$1,136,000

Direct, Indirect, and Irreversible Impacts

This proposed project will provide stormwater management retrofits and additional storage in a portion of the Mallett's Creek subwatershed. Adverse environmental impacts are expected to be minimal. All construction activities will take place within easements. This project site is located near the regulated floodplain associated with Mallett's Creek. Any impacts to the floodplain will be properly modeled and permitted. The existing ponds to be modified may include regulated wetlands. However, the proposed projects will be permitted and all improvements will increase the quality of the wetlands.

The existing weirs and ponds are owned (and exclusively reserved for access to) by a small Homeowners Association (HOA). The ability to execute this project is subject to the ability to reach agreement with the HOA on their current financial responsibility for weir and sediment removal, along with construction access/easement, long term maintenance responsibility and access. While a number has been included in the project costs for easement acquisition, this is an estimate which may vary upon negotiations with the HOA.

This project is also subject to a final evaluation of the physical feasibility of performing construction in a challenging location while maintaining an acceptable cost-benefit ratio, with similar final evaluation needed to determine the feasibility of allowing for cost-effective long-term maintenance.

This project has been included on the assumption that there could be benefit to upstream property owners by virtue of providing nonpoint source treatment and additional storage to the neighborhood if upstream system constraints are alleviated improving conveyance to this vicinity.

There may be limited tree removal associated with the project. There are no known adverse effects on endangered species or historical, cultural resources.

There will be traffic disruptions and inconveniences for people living in the area during construction. These disruptions will be temporary during construction and will be communicated through project signage. As this project is located in rear yards, access to the site would likely impact the residents.

- Village Oaks (See Figure 23) – The area near Village Oaks and Chaucer Court has experienced storm water issues for the past several years. This area is in the Mallett's Creek subwatershed. In 2012, the City of Ann Arbor completed a review of the storm water management in this area. Several different alternatives were studied by the City as outlined in the Village Oaks report provided in Appendix I. Based on the findings of this report, the existing detention basin is undersized and the hydraulics in the area cause the basin to fill more quickly then designed and then flow downstream into Mallett's Creek prematurely. This flooding of Mallett's Creek downstream leads to water quality issues due to the flashiness of the stream during rain events. This then leads to the streambank washing out, and issues with downstream capacity. The results of the study indicated that in order to restore the hydraulics and hydrology in the area, improvements are necessary. These improvements include implementing infiltration and extended storage techniques.

  By improving the storage in the area, the Drainage District will be improved. Additional storage to the volumes originally identified will increase the storage time and infiltration and decrease the excess flow to Mallett's Creek. The increase in storage time will thus increase sedimentation in areas where it is easier to remove and therefore reduce the amount of TSS into Mallett's Creek.

  The cost analysis includes the review of two separate scenarios. Alternate A (Figure 23) is to provide additional storage in several basins throughout the project area. Alternate B is to provide a larger regional basin. Based on the cost analysis, Alternate A is the more cost effective option.

Total Preliminary Costs	$1,291,000
Present Worth of Analysis	$860,000

  Direct, Indirect, and Irreversible Impacts

  This proposed project will provide stormwater management retrofits and additional storage in a portion of the Mallett's Creek subwatershed. Adverse environmental impacts are expected to be minimal. All construction activities will take place within easements. This project site is not located in or near known floodways or floodplains. The existing ponds to be modified may include regulated wetlands. However, the proposed projects will be permitted and all improvements will increase the quality of the wetlands.

  There may be limited tree removal associated with the project. There are no known adverse effects on endangered species or historical, cultural resources.

  There will be traffic disruptions and inconveniences for people living in the area during construction. These disruptions will be temporary during construction and will be communicated through project signage.

  Additional easement acquisition will be required to complete this project, which is a large portion of the project cost.

- Research Park Wetland Detention (See Figure 24) – Mallett's Creek passes through a vacant parcel of land inside the Research Park Drive loop at the south end of the City. This area is ideal for the construction of a wetland detention area to provide storm water treatment. In addition, the area between Research Park Drive and the RR Tracks has been identified as having severely eroded conditions which leads to high volumes of sediment being deposited downstream. This has led to habitat degradation and the establishment of a biota TMDL on Mallett's Creek.

  The existing drain is channelized, laterally-confined, and moderately incised due to clear water discharge (lack of bedload) from storm sewers. The downstream crossing of Research Park Drive is perched.

  The proposed project includes floodplain excavation along the north side to reduce bank heights, increase flood capacity, encourage floodplain deposition, and dissipate energy. The invasive vegetation along the south bank will be cut and treated, and the mature trees and shrubs will be protected to provide shading.

  An alternative for this project was examined in the 2010 Project Plan. However, this plan only called for streambank stabilization of Mallett's Creek between E. Research Park Drive and W. Research Park Drive. This project did not address the severe erosion issue between E. Research Park Drive and the RR tracks. Furthermore, upon additional review of the overall Mallett's Creek system, it was determined that this is a good location to provide a treatment wetland and storage area in order to buffer high flows.

Total Preliminary Costs	$920,000
Present Worth of Analysis	$695,000

  Direct, Indirect, and Irreversible Impacts

  This project includes creation of wetland area as well as streambank stabilization along Mallett's Creek. While there are floodplains associated with these sites, the improvements are not expected to impact floodways, floodplains, wetlands, or any other sensitive features. Limited tree removal may be necessary in order to install the stabilization measures. Adverse impacts on endangered species or historical resources are not anticipated. During design, all necessary permits will be secured prior to beginning construction. There are several areas where easements will be required. These will be secured prior to construction.

- Briarwood Mall Ponds Retrofit Project (see Figure 25) – There are three existing basins on the Briarwood Mall project along branches of Mallett's Creek. These three ponds will be retrofitted to provide for stormwater quality in this area as follows:

    - Plaza Drive Pond – This pond is an inline pond located on the north side of the mall property. The pond currently is full of sediment. The project will consist of removal of the sediment from the pond and the installation of an access point for future maintenance of the pond, along with the installation of a sediment forebay. ***In addition to the pond improvements, upstream improvements will be made to improve storm water quality. Currently, the upstream inlet to the pond is inefficient, and the inefficiencies lead to additional sedimentation in the pond. This includes repairs to the pipe, in several areas where sinkholes have formed which add additional sedimentation in the pond.***
    - Von Maur Pond – This is also an inline pond, located on the south side of the mall property. The project will consist of improvements to the outlet structure in order to provide for a dry pond for sediment storage.
    - Holiday Inn Express Pond – This is an inline pond, located downstream of the Von Maur Pond on the south side of the mall property. The project will consist of improvements to the outlet structure in order to provide for a dry pond for sediment storage.

  These projects are considered a Principal Alternative. No other alternatives were considered for these projects.

  Total Preliminary Costs ***$1,420,000***
  Present Worth of Analysis ***$1,081,000***

  Direct, Indirect, and Irreversible Impacts

  This project includes retrofits to several inline ponds along Mallett's Creek. Proposed improvements include creation of a sediment forebay, dredging existing structures, outlet improvements, and other water quality measures. This project occurs within the floodway, and a hydraulic analysis will be performed to verify that the improvements will not impact the 100-year flood elevation and base flood elevation. During design, all necessary permits will be secured prior to beginning construction. There is a potential for limited tree removal. Easements will be required. These will be secured prior to construction. Adverse impacts on any historic resources are not anticipated.

  There is a potential for tree removal during construction on all basins. There may also be disruptions to traffic or parking on the mall property during construction. These disruptions will be temporary and will be communicated through proper signage.

Figure XX

Proposed Stormwater Improvements

Briarwood Mall Ponds - Amended Project

HRGIDD 2014 Project Plan Amendment

Inlet Improvements

Construct Sediment Forebay

Dredge Pond 10,000 cyd

Forebay (Manageable)

Weir Improvements

Weir Improvements

Briarwood Cir

S Main St

Plaza Rd

Mall Dr

Hilton Blvd

WB I94 ONRP from SB State

WB I94

EB I94

EB I94 OFRP W of State

Lariat Loop

Restoration Activities

- Storm_Catchbasin
- Storm Manhole
- Storm Sewer
- Rock Weir
- Parcels

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1 inch = 350 feet

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HRC

4. Alternative 2c – Streambank Stabilization

Several sites within the Study Area have been identified as having opportunities for streambank stabilization. All of these locations are exhibiting signs of moderately to severely eroded conditions. Significant amounts of erosion leads to high volumes of sediment being removed and deposited downstream. Evidence of significant habitat degradation due to sedimentation has led to the establishment of biota TMDLs on the Mallett's Creek. Furthermore, sedimentation on the Millers Creek has led to severe sedimentation issues at the mouth of the creek that are undermining Geddes Road.

The MIP, MRP, and WMP reports identify administrative and physical improvements necessary to protect from further stream degradation. Administrative and policy improvements, including development standards and permitting requirements, are underway. However, physical improvements are still needed. As part of the final design, site specific hydrology will be studied in further detail in order to finalize the appropriate measures. A preliminary review of the sites has been completed.

Streambank stabilization is being proposed in 3 subwatersheds (6 locations total). These projects achieve stormwater goals by preventing sediment removal and deposition downstream of eroded streambanks. All of the streambank stabilization sites are considered Principal Alternatives.

No additional alternatives were considered for the streambank stabilization projects as streambank stabilization is the preferred alternative for addressing these projects as far as environmental, habitat, and cost considerations are concerned.

- Mallett's Creek Streambank Stabilization
    - Chalmers to Huron River (See Figure 26)

The proposed project includes 600 feet of Priority 3 restoration of a log step-pool channel with excavation of a narrow floodprone area along the right bank. The channel is incised with excessive bank erosion along the right bank (facing downstream). Pool filling and embeddedness have been caused by channel over-widening and excessive sedimentation from upstream sources. A backwater wetland has formed upstream of the E Huron River Drive crossing. The work involved clearing the right side of the stream through this section. The step-pool channel reach will transition into 255 feet of Priority 2 restoration upstream of E Huron Drive.

- Oakbrook to Eisenhower (See Figure 27)

The project includes 1,800 feet of stream restoration in order to address streambank erosion and sedimentation for upstream sources. The project will also include the replacement of the 6 culverts that currently cross under Oakbrook Drive with an appropriately sized single span culvert which meets current MDEQ design criteria. The work will involve clearing one side of the bank. This project will also include replacement of the six (6) parallel cross culverts currently located at Oakbrook Drive.

- Cranbrook Park (See Figure 28)

The project includes 2,970 feet of stream restoration in order to address streambank erosion and sedimentation from upstream sources. The work will involve clearing one side of the bank.

Total Preliminary Costs	$2,770,000
Present Worth of Analysis	$2,317,000

It was determined that the City would also investigate the section of Mallett's Creek from Ann Arbor-Saline Road to the limits of Cranbook Park

- ***Cranbrook Park to Ann Arbor Saline Road (See Figure X)***

The project includes 1,000 feet of stream restoration in order to address streambank erosion and sedimentation from upstream sources. The work will involve clearing one side of the bank.

Total Preliminary Costs	***$520,000***
Present Worth of Analysis	***$444,000***

Direct, Indirect, and Irreversible Impacts

These projects include streambank stabilization at three sites along Mallet's Creek and its tributaries. While there are floodplains associated with these sites, the improvements are not expected to impact floodways, floodplains, wetlands, or any other sensitive features and will improve stream and habitat quality. Limited tree removal may be necessary in order to install the stabilization measures. Adverse impacts on endangered species or historical resources are not anticipated. During design, all necessary permits will be secured prior to beginning construction. There are several areas where easements will be required. These will be secured prior to construction.

Figure 28

Proposed Stormwater Improvements

Ann Arbor - Saline Road
through Cranbrook Park

HRGIDD 2014 Project Plan
- Amendment

Restoration Activities

- Channel Re-Meandering or Restoration
- Storm_Catchbasin
- Storm Manhole
- Storm Sewer
- Step-Pool Conveyance Channel
- Vegetation Management

N
W E
S

0 100 200 400

Feet

HRC

- Millers Creek Streambank Stabilization (See Figure 29)

This portion of Millers Creek from Geddes Road to the University properties north of Lakehaven Drive is in poor condition and in need of sediment removal. This area is located downstream of the area previously identified in the 2010 Project Plan. Channel widening is occurring on the existing channel due to excessive sediment deposition from upstream sources. Channel straightening and a lack of floodplain connectivity have increased stream power. Channel restoration (re-meandering and reduction of width-to-depth ratio) is recommended once upstream sediment sources have been controlled. The proposed project calls for 1,250 feet of floodplain restoration, slope stabilization along the west bank, and riparian vegetation management. Management of riparian vegetation includes selective tree thinning using arborist practices, invasive species control, seed of herbaceous groundcover, and supplemental plantings.

Total Preliminary Costs	$650,000
Present Worth of Analysis	$492,000

Direct, Indirect, and Irreversible Impacts

This project includes streambank stabilization along one area of Millers Creek. While there are floodplains associated with these sites, the improvements are not expected to impact floodways, floodplains, wetlands, or any other sensitive features. Limited tree removal may be necessary in order to install the stabilization measures. Adverse impacts on endangered species or historical resources are not anticipated. During design, all necessary permits will be secured prior to beginning construction. Currently, this area is not within an established Drainage District and the watercourse is a water of the State. Appropriate easements will be secured prior to construction.

As this area is not within an established Drainage District, any project that is completed along this stretch of the stream will include establishment of a Drainage District in order to assess for the proposed project.

- ***Pepper Pike Streambank Stabilization***

This portion of Millers Creek from Pepper Pike to downstream of Glazier Way is poor condition and in need of sediment removal. This area is located upstream of the area previously identified in the 2010 Project Plan and was identified in the Millers Creek Sedimentation Study. Channel widening is occurring on the existing channel due to excessive sediment deposition from upstream sources. The proposed project calls for 1,100 feet of floodplain restoration, slope stabilization along one bank, and riparian vegetation management. Management of riparian vegetation includes selective tree thinning using arborist practices, invasive species control, seed of herbaceous groundcover, and supplemental plantings.

Total Preliminary Costs	***$700,000***
Present Worth of Analysis	***$534,000***

<u>Direct, Indirect, and Irreversible Impacts</u>

This project includes streambank stabilization along one area of Millers Creek. While there are floodplains associated with these sites, the improvements are not expected to impact floodways, floodplains, wetlands, or any other sensitive features. Limited tree removal may be necessary in order to install the stabilization measures. Adverse impacts on endangered species or historical resources are not anticipated. During design, all necessary permits will be secured prior to beginning construction. Currently, this area is not within an established Drainage District and the watercourse is a water of the State. Appropriate easements will be secured prior to construction.

As this area is not within an established Drainage District, any project that is completed along this stretch of the stream will include establishment of a Drainage District in order to assess for the proposed project.

Figure XX

Proposed Stormwater Improvements

Pepper Pike

HRGIDD 2014 Project
Plan Amendment

Restoration Activities

- Storm Culvert
- Open Drain
- Vegetation Management & Stream Stabilization
- Storm Catch Basin
- Storm Manhole
- Storm Sewer
- Contours 2ft
- Parcels

N
W E
S

1 inch = 200 feet

HRC

- Huron High School Baffle Box (See Figure 30)

Based on the preliminary results of the Millers Creek Sediment Study, there were several alternatives evaluated to reduce the sediment loading in Millers Creek along with providing opportunities for better maintenance. These alternatives include maintenance activities such as periodic sediment removal along specific reaches, multiple Trap-and-Removal facilities, culvert cleanouts, and a regional Trap-and-Removal facility. Due to the private ownership along the drain route and lack of a Drainage District, it was determined that a regional facility located at Huron High School would be the most cost effective method for managing the sediment in this creek. Although an easement would also be required from the High School for access and maintenance, dealing with one property owner is generally simpler than dealing with many.

The proposed project includes the construction of a precast baffle box along the reach of Millers Creek that passes through the Huron High School property. This facility could have the potential to trap and remove 230 tons of sediment annually (63% of the upstream bank load). This project would address the majority of the 2.4 square mile watershed.

Total Preliminary Costs	$200,000
Present Worth of Analysis	$158,000

Direct, Indirect, and Irreversible Impacts

This project will include construction of a baffle box along a stretch of Millers Creek. While there are floodplains associated with this site, the improvements are not expected to impact floodways, floodplains, wetlands, or any other sensitive features. Limited tree removal may be necessary in order to install the stabilization measures. Adverse impacts on endangered species or historical resources are not anticipated. During design, all necessary permits will be secured prior to beginning construction. Currently, this area is not within an established Drainage District and the watercourse is a water of the State. Appropriate easements will be secured prior to construction. This project will need to be maintained by the City in order to assure proper functionality and will be incorporated into the City's maintenance program.

- Huron Hills Golf Course (See Figure 31)

The existing watershed consists of an in-line pond upstream of E Huron Drive which discharges to a small unnamed tributary which flows through the Huron Hills golf course to Gallup Youth Fishing Pond north of the railroad tracks and then to the Huron River. The channel is moderately incised due to a lack of bedload due to the clear-water discharge from the in-line pond. Storm outfalls and under-sized cart crossings have had localized impacts. The channel lacks shading and riparian vegetation. Turf grass is mowed to the top of bank and goose droppings are excessive. Backwater wetlands have formed upstream of the railroad due to a lack of gradient above the fishing pond. This spring-fed headwater creek has the greatest habitat restoration potential of all of the sites, but the pollutant reductions are lower due to the small drainage area and low bank heights.

The proposed project includes a Priority 2 restoration of 1,030 feet of meandering wet meadow stream, including establishment of riparian vegetation with herbaceous understory and low growing shrubs to hold the banks together and deter waterfowl. Floodplain wetlands with off-line vernal pools will be established to provide stormwater treatment prior to outletting. The golf cart crossings will be replaced with floodplain bridges and stormwater treatment will be provided for roadway outfalls.

Total Preliminary Costs	$1,220,000
Present Worth of Analysis	$952,000

Direct, Indirect, and Irreversible Impacts

This project will include construction of streambank improvements through the golf course and construction of a wetland/buffer area upstream of an outlet which flows under railroad tracks. Floodplain enhancement and outlet structure are to be installed. This project occurs within the floodway, and a hydraulic analysis will be performed to verify that the improvements will not impact the 100-year flood elevation and base flood elevation. During design, all necessary permits will be secured prior to beginning construction. There is a potential for limited tree removal. Adverse impacts on any historic resources are not anticipated

B. Analysis of Principal Alternatives

For each of the project alternatives discussed previously, the Principal Alternatives were selected based on the site analysis, feasibility of conceptual design, and stakeholder input. Technical feasibility, maintenance, and pollutant removal efficiency were the defining factors when selecting the alternatives. The "no action" alternative was not considered a feasible option to improve the conditions of the watershed. It is imperative that the community continue to address the need for improved water quality. Taking a "no action" approach would not address that need. The selected potential alternatives identified for the sites are considered Principal alternatives and will be subject to the following evaluations:

1. The Monetary Evaluation

a. Sunk Costs

Sunk costs area any investment or financial commitments made before or during Planning. There are no sunk costs associated with the projects proposed in this Plan.

b. Present Worth

Present worth calculations for the alternatives have been included in the sections above for each site. Each alternative includes capital costs for construction, engineering, financial, legal, administration, contingency, and annual operations and maintenance performed by the City or County. See Appendix A for the complete present worth analysis for all the alternatives.

Appendix A includes detailed cost estimates and present worth analyses for the new and updated projects.

c. Salvage Value

There is a salvage value associated with certain equipment and structures. Salvage value was calculated using straight-line depreciation and is included in the monetary evaluation for items that have remaining value at the end of the 20-year planning period. Salvage value considered for the following items: all underground concrete infrastructure and detention basins.

d. Escalation

Energy costs and land value may be escalated, if appropriate. This is most applicable if different alternatives use different fuel supplies or an alternative land application and others do not. For the projects proposed in this Plan, any increase will apply equally at all alternatives. Therefore, costs were not escalated.

e. Interest During Construction

If interest during construction is significant and may influence the choice of alternatives, it may be included in the monetary evaluation. The construction period for the project alternatives will be on the order of months. Any interest during construction of the projects proposed in this Plan is not anticipated to affect the choice of alternatives and therefore was not included in the financial analysis.

f. Mitigation Cost

There will be no mitigation required as a result of the proposed alternatives construction. Therefore, mitigation costs were not included as part of the monetary evaluation. The mitigation costs described herein are part of general construction costs.

g. User Costs

Another aspect of the monetary evaluation is the computation of the total cost of the project to users. Total cost in this context includes capital and financing costs, OM&R costs, and other costs. The alternative analysis includes an evaluation of projects with different capital costs, life expectancies, and annual costs using a present worth analysis, which provides the estimated annual and quarterly costs of each selected alternative to the users in the Study Area. This information is included in this Plan and will be included in the public participation of the Planning process. A summary of the capital present worth values for all projects is included herein along with the individual values in the write ups above:

Table III – 1: Present Worth Values – Updated Projects Only

Site	*Proposed Alternative*	*Present Worth*
1	*Geddes Avenue*	*$2,064,000*
2	*Briarwood Mall Pond Retrofits*	*$1,081,000*
3	*Mallett's Creek Streambank Stabilization*	*$444,000*
4	*Millers Creek Streambank Stabilization – Pepper Pike*	*$534,000*
5	*Scio Church - Main Street to east of Seventh*	*$3,801,000*
6	*Stone School Road*	*$444,000*

2. Staging Construction

The monetary evaluation was performed using a 20-year planning period. For all alternatives identified in this Plan, the design life is anticipated to be sustainable. There is no growth associated with the individual sites. Therefore, there are no effects on staging construction to consider.

3. Partitioning the Project

Under certain circumstances, partitioning of a project is allowed. A partitioned Project Plan may be prepared when construction of a discrete component of the project must occur prior to the completion of the entire Project Plan in order to remedy a severe public health, water quality, or other environmental concern. For the proposed projects, there are no components that need to be completed prior to the Project Plan. Therefore, there is no need to partition any of the proposed projects.

4. The Environmental Evaluation

Each of the proposed Principal alternatives provides a positive impact to the environment. In general, the alternatives help reduce NPS pollution by reducing erosive runoff velocities, stabilizing eroded streambanks, providing runoff infiltration, filtering pollutants, facilitating needed maintenance (such as providing access or sedimentation traps for future maintenance), and reducing peak runoff flows.

The proposed projects are intended to address the water quality impairments identified in the four TMDLs in the area (Ford and Belleville Lake – phosphorus, Mallett's and Swift Run – biota

and Geddes Pond – *E.coli*) As can be seen in this section, the proposed projects have significant beneficial impacts on water quality.

For this Project Plan, methods developed by the EPA (1983), Schueler (1987), Pitt (1998), the Millers Creek planning team (2004), SEMCOG (2008), Rosgen (1996), and the MDEQ (1999) were utilized to estimate pollutant loading and removal rates for each of the project locations.

For the sites with volumetric BMPs, as noted in the Water Quality BMPs and Optimization of Existing Facilities alternatives, general assumptions were made based on the location, land cover, and upstream contributing area. A summary of the TSS/TP pollutant concentrations, runoff, and loading can be reviewed in Tables III-2 and III-3. The SEMCOG Low Impact Development Manual for Michigan (2008) was utilized to determine BMP pollutant removal efficiencies at the sites.

Urban bacteria loading are a significant impact on the Huron River. The established TMDL at Geddes Pond for a reduction in *E. coli* is evidence that measures must be taken to address the pollutant. It is generally accepted that infiltration BMPs are very efficient mechanisms to help mitigate their impact to the watershed. However, developing baseline estimations for the pollutant contributions to the Study Area is very difficult due to the high variability with the bacteria lifecycle. Pitt (1998) developed an assumed median pollutant load for urbanized *E. coli* contributions to a typical watershed. This value along with the Simple Method was utilized to calculate an annual pollutant load to the Study Area. Refer to Table III-4 for details on the potential *E. coli* contribution to the project locations. Although *E. coli* removal is difficult to quantify, it is known that *E. coli* populations are reduced with infiltration practices. A recent study by the Indiana Geological Survey has also shown that there is also a strong statistical correlation between values of *E. coli* concentrations and the total suspended solids (TSS). Therefore, it is reasonable to assume that *E. coli* will be removed to some degree when infiltration and/or TSS removal is incorporated into BMP projects.

All of the proposed water quality BMPs have a pollutant removal efficiency that each can potentially mitigate based on the first flush event. This is considered the dirtiest runoff associated with the most frequently occurring storm events. A summary of the volume or rate, depending on the type of BMP, can be viewed in Table III-5 as well as the percent treated for the first flush.

For streambank stabilization BMPs, general assumptions were made based on the locations and stream morphology. The analysis was further supported in part by the MIP and MRP findings and documentation. The assumptions for this streambank stabilization site were compiled and sediment erosion and pollutant loads were quantified for each reach. Reach lengths, unless field verified, were estimated from the field observations. A summary of the total bank erosion and pollutant reductions per site can be reviewed in Table III-6.

All of the alternatives provide a sediment, nutrient, and bacteria reduction component either through settling, infiltration, mechanical filtration, or vegetative filtration. Total project cost and the cost per unit of removal were quantified for this site. A summary of the cost of removal can be review in Table III-7.

The following tables have been updated for the six new or updated projects only.

Table III-2
Calculated Urban Annual TSS Pollutant Load, Removal Efficiency, and Quantity Removed

Site	Location	BMP	Area (ac)	Runoff Coefficient	Annual Runoff (in)[1]	TSS Pollutant Concentration (mg/l)[2,3]	Annual TSS Load (lbs)[2]	TSS Removal Efficiency[4]	% First Flush Treated	TSS Reduction (lb/yr)
			A	R_v	R	C	L			
A	Geddes Drive	First Flush Storage with Pollutant Separation	3.00	0.95	30.22	100	2,049	60%	445%	1,230
B	Briarwood Ponds	Pond Retrofits	160.00	0.65	20.68	100	74,778	50%	67%	25,051
C	Malletts' Creek	Streambank Stabilization	See Table III-6							
D	Miller Creek	Streambank Stabilization	See Table III-6							
E	Scio Church	First Flush Storage with Pollutant Separation	7.25	0.90	28.63	100	4,692	60%	112%	2,815
F	Stone School Road	Bioinfiltration	9.24	0.55	17.37	100	3,628	70%	93%	2,352
		First Flush Storm Sewer	5.39	0.60	19.09	100	2,325	30%	100%	698
		Pollutant Separation	44.66	0.60	19.09	100	19,267	60%	100%	11,560
		Tree Planting			0.00	100	0			0

[1]Assuming 35.35-in annual rainfall for P and 0.9 for P_j where $R=P*P_j*R_v$

[2]Schueler, *Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban Best Management Practices* (Washington D.C.: MWCOG, 1987), L=0.226*R*C*A

[3]USEPA, *Results of the Nationwide Urban Runoff Program* (Washington D.C: USEPA 1983)

[4]Low Impact Development Manual for Michigan

Table III-3
Calculated Urban Annual TP Pollutant Load, Removal Efficiency, and Quantity Removed

Site	Location	BMP	Area (ac)	Runoff Coefficient	Annual Runoff (in)[1]	TP Pollutant Concentration (lb/ac/yr)[2]	Annual TP Load (lbs)	TP Removal Efficiency[3]	% First Flush Treated	TP Reduction (lb/yr)
			A	R_v	R	C	L			
A	Geddes Drive	First Flush Storage with Pollutant Separation	3.00	0.95	30.22	0.5	2	30%	445%	0.45
B	Briarwood Ponds	Pond Retrofits	160.00	0.65	20.68	0.5	80	60%	67%	32
C	Mallett's Creek	Streambank Stabilization	See Table III-6							
D	Pepper Pike	Streambank Stabilization	See Table III-6							
E	Scio Church Road	First Flush Storage with Pollutant Separation	7.25	0.90	28.63	0.5	4	30%	112%	1.09
F	Stone Schoool Road	Bioinfiltration	9.24	0.55	17.37	0.5	5	60%	93%	2.57
		First Flush Storm Sewer	5.39	0.60	19.09	0.5	3	30%	100%	0.81
		Pollutant Separation	44.66	0.60	19.09	0.5	22	30%	100%	6.70
		Tree Planting	0	0.00	0.00	0.5	0		0%	0

[1]Assuming 35.35-in annual rainfall for P and 0.9 for P_j where $R=P*P_j*R_v$

[2]*Millers Creek Watershed Improvement Plan*

[3]Low Impact Development Manual for Michigan

[4]Analysis for this site was performed outside of the Project Plan with a pollutant concentration in mg/L

Table III-4
Calculated Urban *E coli.* Pollutant Load

Site		BMP	Area (ac)	Runoff Coefficient	Annual Runoff (in)[1]	*E coli.* Pollutant Concentration (#/100 ml)[2]	Annual *E coli.* Load (billion colonies)[3]
			A	R_v	R	C	L
A	Geddes Drive	First Flush Storage with Pollutant Separation	3.00	0.95	30.22	20,000	1,868
B	Briarwood Ponds	Pond Retrofits	160.00	0.45	14.32	20,000	47,188
C	Mallett's Creek	Streambank Stabilization	NA	NA	NA	NA	NA
D	Pepper Pike	Streambank Stabilization	NA	NA	NA	NA	NA
E	Scio Church	First Flush Storage with Pollutant Separation	7.25	0.95	30.22	20,000	4,513
F	Stone Schoool Road	Bioinfiltration	9.24	0.55	17.37	20,000	3,307
		First Flush Storm Sewer	5.39	0.60	19.09	20,000	2,120
		Pollutant Separation	44.66	0.60	19.09	20,000	17,562

[1]Assuming 35.35-in annual rainfall for P and 0.9 for P_j where $R=P*P_j*R_v$

[2]USEPA, *Results of the Nationwide Urban Runoff Program* (Washington D.C: USEPA 1983)

[3]Schueler, *Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban Best Management Practices* (Washington D.C.: MWCOG, 1987), L=1.03*10^-3*R*C*A

[4]*MPN/100 mL, which represents the most probable number (MPN) of bacteria that would be found in 100 mL of water*

Table III-5
First Flush Volume Summary

Site	Site	BMP	First Flush Volume (cf)[1]	Treatment Volume (cf)	First Flush Flow Rate (cfs)	Treatment First Flush Flow Rate (cfs)	% First Flush Treated
1	Geddes Drive	First Flush Storage with Pollutant Separation	3,104	13,823	3	4	445%
4	Briarwood Ponds	Pond Retrofits	188,760	126,000	NA	NA	67%
6	Malletts Creek	Streambank Stabilization	NA	NA	NA	NA	NA
7	Pepper Pike	Streambank Stabilization	NA	NA	NA	NA	NA
10	Scio Church	First Flush Storage with Pollutant Separation	12,501	14,019	10	10	112%
14	Stone School Road	Bioinfiltration	9,158	8,480	NA	NA	93%
		First Flush Storm Sewer	5,870	5,870	NA	NA	100%
		Pollutant Separation	48,635	NA	40	40	100%

1 The first flush is 0.5-in of rainfall over the contributing area, determined by with the Rational Method

Table III-6
Streambank Erosion Quantities and Annual Pollutant Reductions

Site	Project Name	Length of Bank (ft)	Existing Bank Erosion Rate (tons/yr)[1]	Post Rehab Bank Erorsion Rate (tons/yr)[2]	Post Rehab TSS Reduction (tons/yr)	Annual P Removal (lb)[3]	Annual N Removal (lb)[2]
	Malletts Creek	**7200**	**1770**	**70**	**1700**	**1445**	**2890**
	Pepper Pike	**1250**	**310**	**10**	**300**	**255**	**510**

[1]Rosgen, *Applied River Morphology*. Wildlife Hydrology (Pagosa Springs, CO: 1996), Existing Bank Erosion Rate = Length of Bank*0.246

[2]Rosgen, *Applied River Morphology*. Wildlife Hydrology (Pagosa Springs, CO: 1996), Post Rehab Bank Erosion Rate = Length of Bank*0.0099

[3]MDEQ, *Pollutants Controlled Calculations and Documentation for Section 319 Watersheds Training Manual* (Lansing: MDEQ, 1999), Annual P Removal = Post Rehab Reduction*lb P Removed*Soil Texture Correction, assuimg lb P rRemoved equals 0.0005 lb p/lb soil, lb N removed equals 0.001 lb/lb soil, and Soil Texture Correction equals 0.85

Table III-7
Alternative Cost and Cost per Unit of Storage or Removal

Site	Alternative Type	Site	BMP	Cost	$/cf Storage	$/lb TSS Removed	$/lb P Removed
A	Geddes Avenue		First Flush Storage with Pollutant Separation	$2,720,000	$197	$2,212	$6,044,000
B	Briarwood Mall Pond Retrofits		Pond Retrofits	$1,420,000	$11	$56.69	$44,154
C	Mallett's Creek Streambank Stabilization		Streambank Stabilization	$3,290,000	NA	$1.16	$2,277
D	Pepper Pike		Streambank Stabilization	$700,000	NA	$1.17	$2,745
E	Scio Church - Main Street to east of Seventh		First Flush Storage with Pollutant Separation	$5,000,000	$126	$1,776	$4,587,156
F	Stone School Road		Bioinfiltration	$1,300,000	$205	$1,690	$2,733,333

5. Implementability and Public Participation

Most of the proposed project locations presented in this Plan are also identified in the City's Capital Improvements Plan, and are supported by the WMP. During the planning process for those plans, the public was involved and had the opportunity to comment and help prioritize the improvements.

The locations of the majority of the projects proposed in this Plan are on City or County-owned and maintained properties. There are several areas where the County is working on easements to perform these improvements as noted herein. These will be procured prior to implementation of these projects. The WCWRC and the City have a strong relationship and are able to coordinate and implement multiple design and construction projects. The overall scale of these proposed projects is well within their abilities to manage.

6. Technical and Other Considerations

The following considerations are outlined in the SRF Project Plan development guidance. The majority of the considerations are related to sanitary analyses and are not applicable to NPS Project Plan development, and are included only to ensure completeness of the Project Plan development process.

a. Infiltration and Inflow (I/I) Removal

I/I removal is an issue related to sanitary sewers and is therefore not applicable to this NPS Project Plan.

b. Sludge and Residuals

Sludge and residuals are related to wastewater treatment processes and are therefore not applicable to this NPS Project Plan.

c. Industrial Pretreatment

This section is not applicable to this NPS Project Plan.

d. Growth Capacity

The land cover of the drainage areas is nearly built-out. Future stormwater increases are not anticipated for the Study Area.

e. Areas Currently without Sewers

There are no onsite sewage disposal systems (OSDS) near the proposed alternatives. Therefore, the proposed BMPs are not considered to adversely affect any OSDS.

f. Reliability

It is anticipated that all the sites will need soil erosion and sedimentation permits. Areas where there is work proposed within or near an inland waterway, wetland, or 100-year floodplain, will require an MDEQ Joint Permit. It is anticipated in order to maintain BMP reliability that all sites will be inspected on a regular frequency. Any of the improvement sites with water quality BMPs, such as pollutant separation or offline first flush storm sewer, will need to be regularly maintained by the City.

g. Alternative Sites and Routings

All BMPs will be constructed onsite. Therefore, no routing considerations are needed.

h. Combined Sewer Overflows

This section is not applicable to this NPS Project Plan.

i. Contamination at the Project Site

There are no known sites of contamination that will affect or be affected by the proposed BMPs.

Section IV - Selected Alternative

A. Description of the Selected Alternative

For each of the proposed project locations, the Principal Alternatives were evaluated as previously described, with emphasis on removal of NPS pollutants from the Study Area. The proposed BMPs were categorized as water quality BMPs, optimizations of existing facilities, or streambank stabilization. When considering the opportunities, each BMP was maximized to mitigate NPS pollutants most-closely associated with first flush components. For the facility optimization and streambank stabilization projects, the options for correction were limited; however, the impact of these projects in reducing NPS pollutants will be significant.

The water quality BMP locations were evaluated as suites, where several options could be implemented on each site to maximize NPS pollutant removal. If for some reason, a specific BMP has to be eliminated from the formal design, there are other options available. In addition, sites that are suitable for utilizing several options allow the greatest TSS, TP, and *E. coli* reduction yield possible. A summary of all the sites and the associated selected alternatives are in Table IV-1. ***This table has been updated to include only the new or amended projects. All other projects can be found in the original project plan.***

Table IV-1 – Proposed Projects

Site	*Site*	*Alternative Type*
A	*Geddes Road -City of Ann Arbor Green Street Policy inflitration volume with pollutant separation*	*Water Quality BMP*
B	*Briarwood Mall Pond Retrofits*	*Optimization of Existing Facilities*
C	*Mallett's Creek Streambank Stabilization - Updated Project*	*Streambank Stabilization/ Water Quality BMP*
D	*Millers Creek Streambank Stabilization - Pepper Pike*	*Streambank Stabilization/ Water Quality BMP*
E	*Scio Church - Main Street to east of Seventh - First Flush Storm Sewer and Stormwater Treatment Basin*	*Water Quality BMP*
F	*Stone School Road - First Flush Storm Sewer, Bioinfiltration and Pollutant Separation*	*Water Quality BMP*

1. Relevant Design Parameters

a. Ann Arbor Green Streets Policy

All projects identified herein in public road rights-of-way shall comply with the City's Green Streets Policy to the extent possible.

b. The major process features are outlined in Table IV-1. Each sites pollutant loads and BMP reductions are outlined in the previous tables.

c. The unit processes and sizes as related to service area needs.

The BMP sizing was performed at a conceptual for each site. Greater emphasis will be placed on the calculation during the design phase of the projects. The graphical elements are shown on the Figures in Section 3.

d. A schematic flow diagram of the treatment process

This is not applicable for stormwater treatment projects.

e. The design criteria (detention times, overflow rates, process loadings, and design flows).

In all cases where BMPs were considered, the site improvements were maximized in an attempt to mitigate the first flush rainfall. The first flush is the portion of a storm that washes the majority of the pollutants from a site and is considered to be the first 0.5-in of rain. Events of this size account for the majority of the total rain events total rain events in a year, approximately 85%. All water quality BMPs, in accordance with the WCWRC design standard, will be constructed to dewater within 24-48 hours. Soil amendments and underdraining will be considered for the bioinfiltration, bioswale, and porous surface BMPs.

The porous surfaces will be designed at a depth necessary to mitigate the entire first flush runoff volume. This area accounts for the porous surface material with a layer of open graded aggregate subbase. Underdrain, if needed, will be placed below the aggregate subbase to capture any additional water that is beyond the capacity of the soil and the BMP. Any necessary underdrains will discharge to a nearby storm sewer. The porous surface is anticipated to maintain a 40% void space for stormwater infiltration and detention. However, a 30% design void space has been used for the stormwater calculations as a safety factor based on the WCWRC design standards.

Several pollutant separators are being proposed throughout the Study Area. Each unit is sized for the first flush flow based on the upstream land cover, time of concentration and contributing area.

The bioinfiltration/infiltration swales will be designed to drain within 24 to 48 hours. While some preliminary soil borings have been taken, additional testing will be taken during the design phase. An overflow system will be considered for all proposed BMPs as a means for emergency conveyance during large storm events.

Streambank stabilization will be designed on a site by site basis. However, a combination of regrading, toe protection, flow dissipation, and naturalization with native species will be incorporated. The improvements will be subject to high velocities and will need to reflect the final design.

The tree installation and enhancement program will be focused on placing new hardwood vegetation along City corridors. The specific species and locations will be guided by the City's forester to enhance water quality through interception, infiltration, and transpiration.

f. Residuals Management

It is anticipated that frequent vactoring and/or dredging of sediment and debris from the hydrodynamic separators and first flush storm sewers will be necessary for proper BMP function. It is recommended that the City initially perform maintenance twice annually. All sediment and debris that is removed will be transported and disposed of at a licensed disposal facility.

g. Sewer Length and Sizes

The sewers that are proposed for this Project Plan are associated with the first flush or larger storm sewer upgrades, unless otherwise noted. All improvement will be performed as an enhancement and upsize to the existing infrastructure to mitigate the

flow and volume associated with the first flush. Final sizing and length of the storm sewer will be determined as part of the project design.

For the bioinfiltration basins, infiltration swales, and porous road surfaces, it may be necessary for an underdrain below the BMPs if the in-situ soils are poorly drained. This will be determined as part of the design phase.

h. Pump stations types and sizes, including provisions for standby power and odor control

There are no pump stations to be constructed as part of this Project Plan.

i. The proposed schedule for design and construction.

From submittal of the Project Plan to project closeout, it is anticipated that the entire timeline will occur from July 2013 – July 2019. There are six major tasks identified for the selected alternatives completion. These tasks include:

- Submittal of the Project Plan to MDEQ – July 1, 2013
- Project Plan review and approval – The MDEQ will have the opportunity to review the plan. Approval will be needed prior to the design and construction of the selected alternatives.
- Plan development and design – Design of the selected alternatives will be performed and plan for construction will be developed.
- Permits and easements – All required permits will be obtained. All easement acquisition will be handled prior to the project.
- Project construction – The selected alternatives will be constructed per each project milestone schedule.
- Administration and closeout – Administration of the improvements will be necessary throughout the length of the project. Closeout will be performed at the end of the project.

2. Controlling Factors

The typical controlling factors listed in SRF Project Plan development guideline are not applicable to this NPS Project Plan. These include items such as service area population; characteristics of influent wastewater and treatment residuals; discharge permit requirements; stipulations in court orders, federal or state enforcement orders, or administrative consent orders; proposed effluent limits; local health department findings and directives; and mitigation of environmental impacts with regard to collection and transport via sewers or force mains.

However, additional controlling factors applicable to this NPS Project Plan include:

a. <u>Pedestrian or Traffic Impact</u>

Placing BMPs in highly visible or accessible locations can be great for exposure; however, detrimental to foot and vehicular traffic. Bioinfiltration areas adjacent to high foot traffic zones will be marked with signs to educate the public on their purpose and need for protection. All underground BMPs within the right-of-way may pose a traffic hazard during maintenance procedures. City staff will utilize proper traffic signage and signaling during maintenance activities. The sites potentially affected by this control are primarily Detroit Street, the Farmers Market Parking Lot, Stadium Street***, and Stone School Road.***

b. Maintenance

Proper BMP maintenance is crucial for long term success. Street sweeping on the porous surfaces, vactoring pollutant separation units, and first flush storm sewers, as well as biannual freshening of the bioinfiltration and bioswale planted beds will help sustain their storm runoff mitigation capacity. Furthermore, cleaning out oversized pipes and sumps on an annual basis will help maintain stormwater treatment capacity. The sites potentially affected by this control are Detroit Street, the Farmers Market Parking Lot, Geddes Road, Scio Church Road, Stadium Drive, S. Seventh Street, State Street, Research Park, 721 N. Main, ***and Stone School Road***.

c. Topographic Constraints

Steep topography can limit the accessibility for construction and maintenance of the proposed BMPs. The slopes along Geddes Road (Site 1) are very steep and will require additional analysis during design and construction. ***There are also some areas along Stone School Road with a steep slope.***

d. Accessibility

Several BMP locations are located along highway corridors or at remote locations on drain reaches. These areas are all within designated public right-of-ways and/or drainage easements. However, temporary signage and markers will be necessary along the highways as well as possibly temporary construction easements for equipment to access the sites. The sites potentially affected by this control are Mallett's Creek and Millers Creek Improvements***, including the Pepper Pike streambank stabilization.***.

3. Project Maps

The categories identified in the guidance document were not applicable to this Project Plan. However, maps have been created to illustrate the proposed projects and convey the proposed improvements. These figures illustrate aerial views of the sites, existing storm sewer, and the locations or footprints of the proposed BMPs. These are all shown on Figures included in the previous section. ***Only figures for the new or updated plan are included in the amendment.***

4. Sensitive Features

Sensitive features, such as agricultural lands, archeological sites, or threatened and endangered species habitat, will not be impacted by the proposed projects. Figure 5 provides the location of the existing wetlands that are near several of proposed projects. ***This figure can be found in the original project plan.***

Established FEMA floodplain/floodways are present at numerous locations and mitigation may be necessary due to the nature of the proposed improvements. All work within regulatory floodplains will be permitted through MDEQ Joint Permit Application process. See Figure 10 for locations of the Floodways and Floodplains in the City of Ann Arbor. ***This figure can be found in the original project plan.***

5. Mitigation of Environmental Impacts

All proposed improvements that may impact existing wetlands and/or floodplains will be performed in accordance with all regulations and any specific conditions of the MDEQ Joint Permits. The improvements are intended to improve habitat quality while enhancing its functionality as a stormwater quality feature. At no point is it the intention of this Project Plan to destroy, remove, or impact a sensitive habitat/feature without proper mitigation. Such measures would be counterintuitive to enhancing water quality within the Study Area.

6. Schedule for Design and Construction

The Schedule is tentative pending the approval of the SRF Project Plan Amendment. Below is a tentative proposed schedule.

Advertise Public Hearing ..... May 23, 2014

Draft Project Plan on Display ..... May 23, 2014

Public Hearing ..... June 25, 2014

Adoption of Project Plan by the Statutory Drain Board .. June 26, 2014

Final Project Plan Submittal to the MDEQ .....July 1, 2014

Table IV-2 below outlines the proposed requested loan closing date (year and quarter) of the proposed improvement projects for each site. For projects beyond 2015, no quarters are provided. ***The table only provides the schedule for the new and updated projects. For all other projects, please see original plan.***

Table IV-2 – Proposed Project Schedule

Site	*Project*	*Year*	*Quarter*
A	*Geddes Avenue*	*2015*	*3*
B	*Briarwood Mall Pond Retrofits*	*2018*	
C	*Mallett's Creek Streambank Stabilization*	*2016*	
D	*Millers Creek Streambank Stabilization*	*2016*	
E	*Scio Church - Main Street to east of Seventh*	*2016*	
F	*Stone School Road*	*2016*	

7. Cost Summary

The cost summary provided in Table IV-3 is the total cost for all of the selected alternatives, including engineering, construction, and contingency fees. As the summary indicates, the total cost for all of the ***updated or new projects*** is approximately ***$8,368,000.*** See Appendix A for a detailed cost breakdown of each ***updated*** site.

Table IV-3 – Total Project Costs

Site	*Proposed Alternative*	*Cost*
A	*Geddes Avenue*	*$2,720,000*
B	*Briarwood Mall Pond Retrofits*	*$1,420,000*
C	*Mallett's Creek Streambank Stabilization*	*$520,000*
D	*Millers Creek Streambank Stabilization*	*$700,000*
E	*Scio Church - Main Street to east of Seventh*	*$5,000,000*
F	*Stone School Road*	*$1,300,000*

B. Authority to Implement the Selected Alternative

The Huron River Green Infrastructure Drainage District (HRGIDD) is a legally established Chapter 20 Drainage District under PA 40 of 1956. The Washtenaw County Water Resources Commissioner is chair of the Statutory Drain Board which oversees all activities within the District. The HRGIDD includes all land located within individual districts where activity is proposed: Allen, Traver, Mallett's, Swift Run, and the prospective Miller Creek Drainage District. Planning will take place under the authority of the HRGIDD; project implementation will take place under the authority of the individual districts. Financing will be backed with the Full Faith and Credit of Washtenaw County. All site locations are within the City of Ann Arbor and are either publically owned, or within a public ROW or easement. The tree planting project, which takes place throughout the City, will be implemented and under the authority of the HRGIDD.

C. Users Costs

The HRGIDD Study Area is made up of several entities based on jurisdictional authority. Each entity will be assessed the cost of the loan repayment based on the selected project and the following apportionments.

Malletts Creek	
City of Ann Arbor	74.54%
County	0.99%
State	5.62%
Pittsfield Twp	18.85%

Swift Run Creek	
City of Ann Arbor	59.61%
County	1.43%
State	7.65%
Pittsfield Twp	31.31%

Traver Creek	
City of Ann Arbor	93.48%
County	2.24%
State	4.28%

Allen Creek	
City of Ann Arbor	96.10%
County	0.00%
State	3.90%

The proposed projects be initiated by a petition and reviewed by the Statutory Drain Board with comments taken from the County.

The City resident apportionment will be paid through the existing stormwater utility fee. There are currently 25,171 users connected to the system. The 20 project sites have a combined estimated construction cost of $45,180,000. This equates to $27.90 per residential equivalent unit on a quarterly basis. These projects will be programmed into the City's Capital Improvement plan, therefore will not require any fee increase. ***The costs for the updated or new projects are $8,368,000. This equates to $5.05 per residential equivalent unit on a quarterly basis.***

Section V - Evaluation of Environmental Impacts

A. General

The anticipated environmental impacts resulting from the construction of the selected plan include beneficial and adverse, short term and long term, and irreversible and irretrievable impacts. The following is a discussion of the environmental impacts of the selected plan.

1. Beneficial and Adverse Impacts

Construction activities associated with this Project Plan will take place primarily in existing road rights-of-way or existing easements. Construction and equipment manufacturing related jobs would be generated, and local contractors would have an equal opportunity to bid on the construction contracts.

Implementation of the Project Plan would create temporary disruption due to required construction. This includes noise and dust generated by the work, and possible erosion of spoils from open excavation. The assessment of alternate solutions and sites for the proposed project included identification of any important resources of either historic or environmental value which are protected by law and should be avoided.

2. Short and Long-Term Impacts

The short-term adverse impacts associated with construction activities would be minimal, and mitigated, in comparison to the resulting long-term beneficial impacts. Short-term impacts include traffic disruption, dust, noise, and inconveniences for the adjacent properties. No long-term negative impacts are anticipated. The long-term positive impacts include improved water quality within the watershed.

3. Irreversible Impacts

The investment in non-recoverable resources committed to the Project Plan would be traded off for the improved performance of the facilities during the life of the system. The commitment of resources includes public capital, energy, labor, and unsalvageable materials. These non-recoverable resources would be foregone for the provision of the proposed improvements.

Construction accidents associated with this project may cause irreversible bodily injuries or death. Accidents may also cause damage to or destruction of equipment and other resources.

B. Analysis of Impacts

1. Direct Impacts

Direct impacts for each of the individual projects are included in Section 3 under the project descriptions and costs. Overall, the direct impacts are in regards to inconveniences due to traffic and pedestrian disruptions, and temporary closures or blockages for people living in the area of construction. However, these direct impacts are expected to be minimal compared to the benefit received from completing these projects.

2. Indirect Impacts

No indirect impacts such as increased development, changes in land use, impacts on air quality, etc. are expected as a result of the proposed projects.

3. Cumulative Impacts

By reducing the volume of runoff and providing water quality benefits, the cumulative impacts to the environment as a result of these projects are expected to be positive.

Section VI - Mitigation

A. Short-Term, Construction-Related Mitigation

Traffic control will be necessary for the work proposed along or near cross roads of project sites. Proper signage, barricades, and lighting will be placed for the duration of the construction projects in accordance with Federal, State, and Local requirements. Soil erosion and sedimentation control measures as well as local permits will be required and followed during all construction activities. An MDEQ /Army Corps Joint Permit will be required for all work within, adjacent to, or nearby an inland lake or stream, wetland, or floodplain/floodway.

B. Mitigation of Long Term and Indirect Impacts

No adverse or long-term impacts are expected with this Project Plan. Where work may be within a regulated sensitive habitat, such as a wetland, stream, or floodplain, there will be mitigation as part of the design and permit process per the requirements of Act 451 of 1994, as amended.

C. Mitigation of Indirect Impacts

No adverse indirect impacts are expected with this Project Plan.

Section VII - Public Participation

A. Public Meetings on Project Alternatives

The project alternatives were developed from recommendations presented in the WMP, MIP, MRP, and CIP. All three plans involved the public and went through traditional means to receive input at public meeting and workshops. The findings, directives, and recommendations outlined within each plan were utilized to develop this SRF Project Plan.

Additional project locations, not specifically identified within another plan, were added by the City and WCWRC for NPS stormwater improvements. They are in areas significantly affected by stormwater runoff or are a source of NPS pollutants. The proposed improvements take into consideration the objectives of the WMP and will be helping the community achieve a reduction in pollutants as directed in the local TMDLs.

B. The Formal Public Hearing

A formal public hearing was held on June 24, 2013. It was advertised for at least 30 days prior to the meeting. A formal copy of the affidavit of notification is included in Appendix B. The Project Plan was made available for review by interested parties at Ann Arbor City Hall and the WCWRC office for the full 30 days. A verbatim transcript from the meeting as well as the power point presentation is also provided in Appendix B. The questions and public comment were received and responded to during the meeting. One resident asked questions regarding the City's CIP process. While the City and WCWRC tried to answer the question during the meeting, after the meeting, the resident was verbally provided a contact person at the City to contact about the specific process. Several emails were received and have been added to Appendix B, along with the responses.

A formal public hearing for the amendment was held on June 25, 2014. The plan was advertised and on public display for 30 days prior to the meeting. The Project Plan was made available for review by interested parties and Ann Arbor City Hall and the WCWRC office for the full 30 days.

C. Adoption of the Project Plan

The final Project Plan, including the selected alternative for improvement, was adopted by the Statutory Drain Board at a meeting on June 26, 2013. A copy of the resolution is included in Appendix C.

The final Project Plan Amendment, including the selected alternative for improvement, was adopted by the Statutory Drain Board at a meeting on June 26, 2014. A copy of the resolution will be included in the final Amendment.

Section VIII - References

Ayers, Lewis, Norris, & May, Inc., Huron River Watershed Council, and Tilton and Associates, Inc. 2004. *Millers Creek Watershed Improvement Plan*.

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ECT 2013. *Management of Millers Creek Sediment Accumulation Study*

Spicer 2014. *Upper Mallett's Stormwater Conveyance Study*

HURON RIVER 2013 SRF PROJECT PLAN AMENDMENT

PREPARED FOR

Huron River Green Infrastructure Drainage District

APPENDIX A
COST AND PRESENT WORTH ANALYSIS – UPDATED AND NEW PROJECTS

HURON RIVER 2013 SRF PROJECT PLAN AMENDMENT

PREPARED FOR

Huron River Green Infrastructure Drainage District

APPENDIX L
UTILITY TRENCH DETAIL

PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COSTS

Huron River 2013 SRF Project Plan Amendment

Geddes Avenue - Arlington to Huron Parkway - Alternate A - First Flush Storm Sewer
May-14

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
1	Mobilization (5%)	**LS**	1	$75,000	$75,000
2	Traffic Control	**LS**	1	$15,000	$15,000
3	Erosion Control	**LS**	1	$15,000	$15,000
4	Infiltration Beds	**LS**	1	$22,500	$22,500
5	First Flush Storm Sewer (48")	**FT**	2,000	$75	$150,000
6	Storm Structure	**EACH**	7	$2,500	$17,500
7	Storm Sewer Outlet	**LFT**	500	$100	$50,000
8	3 cfs Pollutant Separator (First Flush: 3 cfs)	**EACH**	1	$20,000	$20,000
9	Road Reconstruction	**SFT**	84,375	$15	$1,265,625
10	Pavement Removal	**SYD**	9,375	$5	$46,875
11	Restoration	**LS**	1	$30,000	$30,000
	SUBTOTAL				$1,707,500
	Construction Contingency (20%)				$341,500
	TOTAL CONSTRUCTION COST				$2,049,000
	Engineering and Construction Services (25%)				$512,300
	Geotechnical Investigation				$5,000
	Geotechnical Services During Construction				$20,000
	Financial and Legal (5%)				$102,500
	ALLOWANCES				
	Easement acquisition costs, if required				$10,000
	Major utility relocation				$7,000
	Permit fees, bonds and inspection fees from permitting agencies.				$10,000
	TOTAL COST				$2,720,000

Washtenaw County Water Resources Commissioner
Huron River 2013 SRF Project Plan Amendment
Non Point Source Projects

Geddes Avenue - Arlington to Huron Parkway - Alternate A - First Flush Storm Sewer
Present Worth Calculations

CAPITAL COST	CAPITAL COST[1]	SERVICE LIFE (YEARS)	PRESENT WORTH[2]
Geddes Road Improvements	$ 2,720,000.00	50	$ 1,993,000.00
TOTAL CAPITAL COST	**$ 2,720,000.00**		$ 1,993,000.00
INTEREST DURING CONSTRUCTION Assumes 1 years interest at 2.5%			$ 68,000.00
ANNUAL OPERATION AND MAINTENANCE COST			
ANNUAL O, M & R COST (NON-ENERGY)		$ 250.00	
PRESENT WORTH OF OM&R COST (NON ENERGY)			$ 3,000.00
ANNUAL O, M & R COST (ENERGY)		$ -	
PRESENT WORTH OF OM&R COST (ENERGY)			
PRESENT WORTH			**$ 2,064,000.00**
AVERAGE ANNUAL EQUIVALENT COST			**$ 154,000.00**

Notes:

[1] May 2014 ENR 20 Cities CCI = 9796

[2] Cost is based on a study period of 20 years and a discount rate of 4.375%.
Present Worth Costs are based on Straight Line Depreciation and no inflation.

[3] BMPs expected to last 50 years if properly maintained.

PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COSTS

Huron River 2013 SRF Project Plan Amendment

Geddes Avenue - Arlington to Huron Parkway - Alternate B - Subsurface Stone Reservoir
May-14

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
1	Mobilization (5%)	**LS**	1	$75,000	$75,000
2	Traffic Control	**LS**	1	$15,000	$15,000
3	Erosion Control	**LS**	1	$15,000	$15,000
4	Infiltration Beds	**LS**	1	$12,500	$12,500
5	Subsurface Stone Reservoir	**CYD**	2,500	$70	$175,000
6	Storm Structure	**EACH**	7	$2,500	$17,500
7	Storm Sewer Outlet	**LFT**	500	$100	$50,000
8	3 cfs Pollutant Separator (First Flush: 3 cfs)	**EACH**	1	$20,000	$20,000
9	Road Reconstruction	**SFT**	84,375	$15	$1,265,625
10	Pavement Removal	**SYD**	9,375	$5	$46,875
11	Restoration	**LS**	1	$30,000	$30,000
	SUBTOTAL				$1,722,500
	Construction Contingency (20%)				$344,500
	TOTAL CONSTRUCTION COST				$2,067,000
	Engineering and Construction Services (25%)				$516,800
	Geotechnical Investigation				$5,000
	Geotechnical Services During Construction				$20,000
	Financial and Legal (5%)				$103,400
	ALLOWANCES				
	Easement acquisition costs, if required				$10,000
	Major utility relocation				$7,000
	Permit fees, bonds and inspection fees from permitting agencies.				$10,000
	TOTAL COST				$2,740,000

Washtenaw County Water Resources Commissioner
Huron River 2013 SRF Project Plan Amendment
Non Point Source Projects

Geddes Avenue - Arlington to Huron Parkway - Alternate B - Subsurface Stone Reservoir
Present Worth Calculations

CAPITAL COST	CAPITAL COST[1]	SERVICE LIFE (YEARS)	PRESENT WORTH[2]
Detroit Street Improvements	$ 2,740,000.00	50	$ 2,008,000.00
TOTAL CAPITAL COST	**$ 2,740,000.00**		$ 2,008,000.00
INTEREST DURING CONSTRUCTION Assumes 1 years interest at 2.5%			$ 69,000.00
ANNUAL OPERATION AND MAINTENANCE COST			
ANNUAL O, M & R COST (NON-ENERGY)		$ 250.00	
PRESENT WORTH OF OM&R COST (NON ENERGY)			$ 3,000.00
ANNUAL O, M & R COST (ENERGY)		$ -	
PRESENT WORTH OF OM&R COST (ENERGY)			
PRESENT WORTH			**$ 2,080,000.00**
AVERAGE ANNUAL EQUIVALENT COST			**$ 155,000.00**

Notes:

[1] May 2014 ENR 20 Cities CCI = 9796

[2] Cost is based on a study period of 20 years and a discount rate of 4.375%.
Present Worth Costs are based on Straight Line Depreciation and no inflation.

[3] BMPs expected to last 50 years if properly maintained.

PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COSTS

Huron River 2013 SRF Project Plan Amendment

Briarwood Ponds - Retrofits
May-14

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
1	Mobilization (5%)	**LS**	1	$25,000	$25,000
2	Traffic Control	**LS**	1	$10,000	$10,000
3	Erosion Control	**LS**	1	$10,000	$10,000
4	Weir Adjustments	**EACH**	2	$15,000	$30,000
5	Basin Dredging	**CYD**	10,000	$25	$250,000
6	Disposal	**CYD**	10,000	$20	$200,000
7	Berm Construction - in water	**CYD**	1,200	$30	$36,000
8	Plaza Drive Inlet Investigation	**LFT**	500	$40	$20,000
9	Inlet Improvements	**LS**	1	$75,000	$75,000
10	Inlet Sediment Removal	**LS**	1	$25,000	$25,000
11	Naturalize Berms	**SYD**	1,200	$5	$6,000
12	Naturalize Basin Perimeter	**SYD**	2,500	$5	$12,500
13	Surface Restoration	**SYD**	15,000	$3	$45,000
14	Aggregate Surface	**SYD**	1,500	$10	$15,000
15	Easement Acquisition	**LS**	1	$75,000	$75,000
16	Restoration	**LS**	1	$40,000	$40,000
	SUBTOTAL				$874,500
	Construction Contingency (20%)				$174,900
	TOTAL CONSTRUCTION COST				$1,049,400
	Engineering and Construction Services (25%)				$262,400
	Geotechnical Investigation				$5,000
	Geotechnical Services During Construction				$20,000
	Financial and Legal (5%)				$52,500
	ALLOWANCES				
	Easement acquisition costs, if required				$10,000
	Major utility relocation				$6,000
	Permit fees, bonds and inspection fees from permitting agencies.				$10,000
	TOTAL COST				$1,420,000

Washtenaw County Water Resources Commissioner
Huron River 2013 SRF Project Plan Amendment
Non Point Source Projects

Briarwood Ponds - Retrofits
Present Worth Calculations

CAPITAL COST	CAPITAL COST[1]	SERVICE LIFE (YEARS)	PRESENT WORTH[2]
Briarwood Ponds - Retrofits	$ 1,420,000.00	50	$ 1,040,000.00
TOTAL CAPITAL COST	**$ 1,420,000.00**		$ 1,040,000.00
INTEREST DURING CONSTRUCTION Assumes 1 year interest at 2.5%			$ 28,000.00
ANNUAL OPERATION AND MAINTENANCE COST			
ANNUAL O, M & R COST (NON-ENERGY)		$ 1,000.00	
PRESENT WORTH OF OM&R COST (NON ENERGY)			$ 13,000.00
ANNUAL O, M & R COST (ENERGY)		$ -	
PRESENT WORTH OF OM&R COST (ENERGY)			
PRESENT WORTH			**$ 1,081,000.00**
AVERAGE ANNUAL EQUIVALENT COST			**$ 80,000.00**

Notes:

[1] June 2013 ENR 20 Cities CCI = 9542

[2] Cost is based on a study period of 20 years and a discount rate of 4.375%.
Present Worth Costs are based on Straight Line Depreciation and no inflation.

[3] BMPs expected to last 50 years if properly maintained.

PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COSTS

Huron River 2013 SRF Project Plan Amendment

Mallett's Creek Streambank Restoration - Ann Arbor-Saline Road to Cranbrook Park
May-14

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
1	Mobilization (5%)	**LS**	1	$2,500	$2,500
2	Traffic Control	**LS**	1	$1,000	$1,000
3	Erosion Control	**LS**	1	$2,500	$2,500
5	Streambank Stabilization	**LFT**	1,000	$250	$250,000
	SUBTOTAL				$256,000
	Construction Contingency (20%)				$51,200
	TOTAL CONSTRUCTION COST				$307,200
	Engineering and Construction Services (25%)				$76,800
	Geotechnical Investigation				$10,000
	Geotechnical Services During Construction				$40,000
	Financial and Legal (5%)				$15,400
	ALLOWANCES				
	Easement acquisition costs, if required				$25,000
	Major utility relocation				$24,000
	Permit fees, bonds and inspection fees from permitting agencies.				$15,000
	TOTAL COST				$520,000

Washtenaw County Water Resources Commissioner
Huron River 2013 SRF Project Plan Amendment
Non Point Source Projects

Mallett's Creek Streambank Stabilization - Ann Arbor-Saline Road to Cranbrook Park
Present Worth Calculations

CAPITAL COST	CAPITAL COST[1]	SERVICE LIFE (YEARS)	PRESENT WORTH[2]
Malletts Creek Streambank Stabilization	$ 520,000.00	50	$ 381,000.00
TOTAL CAPITAL COST	**$ 520,000.00**		$ 381,000.00
INTEREST DURING CONSTRUCTION Assumes 5 years interest at 2.5%			$ 50,000.00
ANNUAL OPERATION AND MAINTENANCE COST			
ANNUAL O, M & R COST (NON-ENERGY)		$ 1,000.00	
PRESENT WORTH OF OM&R COST (NON ENERGY)			$ 13,000.00
ANNUAL O, M & R COST (ENERGY)		$ -	
PRESENT WORTH OF OM&R COST (ENERGY)			
PRESENT WORTH			**$ 444,000.00**
AVERAGE ANNUAL EQUIVALENT COST			**$ 33,000.00**

Notes:

[1] May 2014 ENR 20 Cities CCI = 9796

[2] Cost is based on a study period of 20 years and a discount rate of 4.375%.
Present Worth Costs are based on Straight Line Depreciation and no inflation.

[3] BMPs expected to last 50 years if properly maintained.

PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COSTS

Huron River 2013 SRF Project Plan Amendment

Millers Creek Streambank Restoration - Pepper Pike
May-14

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
1	Mobilization (5%)	**LS**	1	$5,000	$5,000
2	Traffic Control	**LS**	1	$5,000	$5,000
3	Erosion Control	**LS**	1	$10,000	$10,000
4	Vegetation Management	**LS**	1	$10,000	$10,000
5	Streambank Stabilization	**LFT**	1,100	$300	$330,000
	SUBTOTAL				$360,000
	Construction Contingency (20%)				$72,000
	TOTAL CONSTRUCTION COST				$432,000
	Engineering and Construction Services (25%)				$108,000
	Geotechnical Investigation				$10,000
	Geotechnical Services During Construction				$40,000
	Financial and Legal (5%)				$21,600
	ALLOWANCES				
	Easement acquisition costs, if required				$25,000
	Major utility relocation				$24,000
	Permit fees, bonds and inspection fees from permitting agencies.				$15,000
	Establishment of Drainage District				$20,000
	TOTAL COST				$700,000

Washtenaw County Water Resources Commissioner
Huron River 2013 SRF Project Plan Amendment
Non Point Source Projects

Millers Creek Streambank Restoration - Pepper Pike
Present Worth Calculations

CAPITAL COST	CAPITAL COST[1]	SERVICE LIFE (YEARS)	PRESENT WORTH[2]
Millers Creek Streambank Restoration	$ 700,000.00	50	$ 513,000.00
TOTAL CAPITAL COST	**$ 700,000.00**		$ 513,000.00
INTEREST DURING CONSTRUCTION Assumes 1 years interest at 2.5%			$ 18,000.00
ANNUAL OPERATION AND MAINTENANCE COST			
ANNUAL O, M & R COST (NON-ENERGY)		$ 250.00	
PRESENT WORTH OF OM&R COST (NON ENERGY)			$ 3,000.00
ANNUAL O, M & R COST (ENERGY)		$ -	
PRESENT WORTH OF OM&R COST (ENERGY)			
PRESENT WORTH			**$ 534,000.00**
AVERAGE ANNUAL EQUIVALENT COST			**$ 40,000.00**

Notes:

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Present Worth Costs are based on Straight Line Depreciation and no inflation.

[3] BMPs expected to last 50 years if properly maintained.

PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COSTS

Huron River 2013 SRF Project Plan Amendment

Scio Church - Main Street to Greenview
May-14

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
1	Mobilization (5%)	**LS**	1	$40,000	$40,000
2	Traffic Control	**LS**	1	$50,000	$50,000
3	Erosion Control	**LS**	1	$8,000	$8,000
5	72" First Flush Storm Sewer	**LFT**	1,100	$150	$165,000
6	60" First Flush Storm Sewer	**LFT**	1,300	$100	$130,000
7	36" First Flush Storm Sewer	**LFT**	1,100	$50	$55,000
8	5 cfs Pollutant Separator (First Flush: 4 cfs)	**EACH**	1	$50,000	$50,000
9	5 cfs Pollutant Separator (First Flush: 4 cfs)	**EACH**	1	$50,000	$50,000
10	2 cfs Pollutant Separator (First Flush: 2 cfs)	**EACH**	1	$10,000	$10,000
11	Site Clearing and Tree Removal	**LS**	1	$39,000	$39,000
12	Earth Excavation and Spoils Handling	**CYD**	25,000	$21	$525,000
13	Reconstruct Disc Golf Hole	**LS**	1	$5,000	$5,000
14	Lanscaping, Final Grading, Sodding, and Mulching	**LS**	1	$25,000	$25,000
15	Pond Storm Sewer Improvements	**LS**	1	$58,000	$58,000
16	Pedestrian Access Improvements	**LS**	1	$75,000	$75,000
17	Pavement Remove and Replace	**SYD**	43,000	$40	$1,720,000
17	Restoration	**LS**	1	$70,000	$70,000
	SUBTOTAL				$3,075,000
	Construction Contingency (20%)				$615,000
	TOTAL CONSTRUCTION COST				$3,690,000
	Engineering and Construction Services (25%)				$922,500
	Geotechnical Investigation				$15,000
	Geotechnical Services During Construction				$60,000
	Financial and Legal (5%)				$184,500
	ALLOWANCES				
	Easement acquisition costs, if required				$60,000
	Major utility relocation				$42,000
	Permit fees, bonds and inspection fees from permitting agencies.				$20,000
	TOTAL COST				$5,000,000

Washtenaw County Water Resources Commissioner
Huron River 2013 SRF Project Plan Amendment
Non Point Source Projects

Scio Church - Main Street to Greenview
Present Worth Calculations

CAPITAL COST	CAPITAL COST[1]	SERVICE LIFE (YEARS)	PRESENT WORTH[2]
Scio Church Improvements	$ 5,000,000.00	50	$ 3,663,000.00
TOTAL CAPITAL COST	**$ 5,000,000.00**		$ 3,663,000.00
INTEREST DURING CONSTRUCTION Assumes 1 years interest at 2.5%			$ 125,000.00
ANNUAL OPERATION AND MAINTENANCE COST			
ANNUAL O, M & R COST (NON-ENERGY)		$ 1,000.00	
PRESENT WORTH OF OM&R COST (NON ENERGY)			$ 13,000.00
ANNUAL O, M & R COST (ENERGY)		$ -	
PRESENT WORTH OF OM&R COST (ENERGY)			
PRESENT WORTH			**$ 3,801,000.00**
AVERAGE ANNUAL EQUIVALENT COST			**$ 283,000.00**

Notes:

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Present Worth Costs are based on Straight Line Depreciation and no inflation.

[3] BMPs expected to last 50 years if properly maintained.

PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COSTS

Huron River 2013 SRF Project Plan Amendment

Stone School Road - I-94 to Packard
May-14

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
1	Mobilization	**LS**	1	$25,000	$25,000
2	Traffic Control	**LS**	1	$20,000	$20,000
3	Erosion Control	**LS**	1	$10,000	$10,000
4	6" Underdrain	**FT**	600	$10	$6,000
5	First Flush Sewer or Stone Reservoir	**LS**	1	$275,000	$275,000
6	First Flush Manhole, 96" Diameter	**EACH**	3	$10,000	$30,000
7	11 cfs Pollutant Separator	**EACH**	1	$60,000	$60,000
8	25 cfs Pollutant Separator	**EACH**	1	$125,000	$125,000
9	Pavement Removal and Replace	**SYD**	1,400	$50	$70,000
11	Restoration	**LS**	1	$50,000	$50,000
12	Bio-Infiltration	**SFT**	8,500	$10	$85,000
	SUBTOTAL				$756,000
	Construction Contingency (20%)				$151,200
	TOTAL CONSTRUCTION COST				$907,200
	Engineering and Construction Services (25%)				$226,800
	Geotechnical Investigation				$10,000
	Geotechnical Services During Construction				$40,000
	Financial and Legal (5%)				$45,400
	ALLOWANCES				
	Easement acquisition costs, if required				$20,000
	Major utility relocation				$35,000
	Permit fees, bonds and inspection fees from permitting agencies.				$15,000
	TOTAL COST				$1,300,000

Washtenaw County Water Resources Commissioner
Huron River 2013 SRF Project Plan Amendment
Non Point Source Projects

Stone School Road - I-94 to Packard
Present Worth Calculations

CAPITAL COST	CAPITAL COST[(1)]	SERVICE LIFE (YEARS)	PRESENT WORTH[(2)]
Tree Planting	$ 1,300,000.00	50	$ 952,000.00
TOTAL CAPITAL COST	**$ 1,300,000.00**		$ 952,000.00
INTEREST DURING CONSTRUCTION Assumes 1 years interest at 2.5%			$ 33,000.00
ANNUAL OPERATION AND MAINTENANCE COST			
ANNUAL O, M & R COST (NON-ENERGY)		$ 250.00	
PRESENT WORTH OF OM&R COST (NON ENERGY)			$ 3,000.00
ANNUAL O, M & R COST (ENERGY)		$ -	
PRESENT WORTH OF OM&R COST (ENERGY)			
PRESENT WORTH			**$ 988,000.00**
AVERAGE ANNUAL EQUIVALENT COST			**$ 74,000.00**

Notes:

(1) May 2014 ENR 20 Cities CCI = 9796

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Present Worth Costs are based on Straight Line Depreciation and no inflation.

(3) BMPs expected to last 50 years if properly maintained.

HURON RIVER 2013 SRF PROJECT PLAN AMENDEMENT

PREPARED FOR

Huron River Green Infrastructure Drainage District

APPENDIX B
PUBLIC HEARING – UPDATED INFORMATION

Public Hearing Notice

Notice is hereby given that the Washtenaw County Water Resources Commissioner (WCWRC) will hold a public hearing on an amendment to the 2013 State Revolving Fund Project Plan for the Huron River watershed within the City of Ann Arbor for the purpose of receiving comments from interested persons. The hearing will be held from 7-8:00 pm on Wednesday, June 25, 2014 at the NEW Center, located at 1100 N Main St. Ann Arbor, MI.

The purpose of the proposed project plan amendment is to secure low interest funding for non-point source water quality treatment improvements in the Huron River watershed. The purpose of the projects described in the project plan is to help reduce storm water pollutants, flooding and flow to the River and low-lying neighborhoods by retaining, delaying, and infiltrating the storm water runoff. Six sites are being proposed based on the potential storm water management opportunities they provide to the watershed. These projects include new sites, and amendments to projects included in previous plans based on updated information.

This project will be funded through loans from Michigan's State Revolving Fund. The six project sites have a combined estimated construction cost of $11,000,000. This equates to $6.75 per residential equivalent unit on a quarterly basis.

Copies of the project plan detailing the proposed projects will be available for public review on May 23, 2014 on the fourth floor of the Ann Arbor City Hall, 301 E Huron St., Ann Arbor, MI; or on the first floor of the Washtenaw County Water Resources Office (WCWRC), 705 N. Zeeb Road. For an electronic copy, please email drains@ewashtenaw.org.

Written comments received through June 25, 2014 will be entered into the public hearing record and should be sent to the Washtenaw County Water Resources Office, Attention: Harry Sheehan, Washtenaw County Water Resources, PO Box 8645, Ann Arbor, MI, 48107-8645

HURON RIVER 2013 SRF PROJECT PLAN AMENDMENT

PREPARED FOR

Huron River Green Infrastructure Drainage District

APPENDIX C
RESOLUTION

HURON RIVER 2013 SRF PROJECT PLAN AMENDMENT

PREPARED FOR

Huron River Green Infrastructure Drainage District

APPENDIX D
MS4 STORMWATER PERMIT – NOT INCLUDED

HURON RIVER 2013 SRF PROJECT PLAN AMENDMENT

PREPARED FOR

Huron River Green Infrastructure Drainage District

APPENDIX E
TMDLs – NOT INCLUDED

HURON RIVER 2013 SRF PROJECT PLAN AMENDMENT

PREPARED FOR

Huron River Green Infrastructure Drainage District

APPENDIX F
AGENCY CONTACT LETTERS - UPDATED

HRC 100 YEARS
CONSULTING ENGINEERS SINCE 1915

PRINCIPALS
George E. Hubbell
Thomas E. Biehl
Walter H. Alix
Peter T. Roth
Keith D. McCormack
Nancy M. D. Faught
Daniel W. Mitchell
Jesse B. VanDeCreek
Roland N. Alix

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OFFICE: 555 Hulet Drive
Bloomfield Hills, MI 48302-0360
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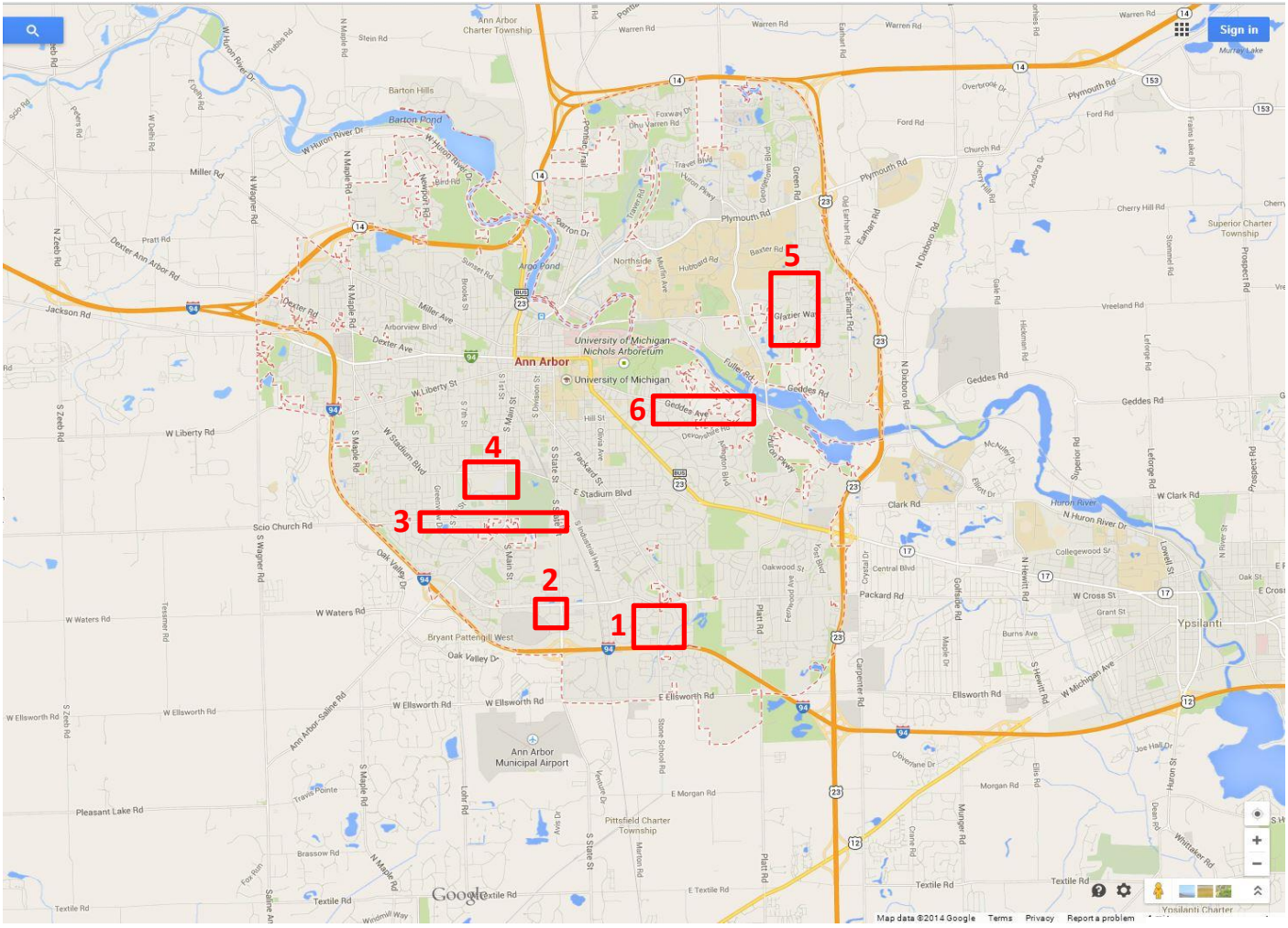
Bloomfield Hills, MI 48303-0824
PHONE: 248.454.6300
FAX: 248.454.6312
WEBSITE: www.hrc-engr.com
EMAIL: info@hrc-engr.com

Updated Project Sites to be included in the Huron River 2013 SRF Project Plan, numbered shown on USGS Maps:

1. Stone School Road Reconstruction (Packard to I-94)
2. Plaza Drive Pond Improvements
3. Scio Church Road Stormwater Improvements
4. Ann Arbor – Saline Road to Cranbrook Park Streambank Stabilization
5. Pepper Pike Streambank Stabilization
6. Geddes Road Stormwater Improvements

Location Map



Project Location

N

HRC 100 YEARS
CONSULTING ENGINEERS SINCE 1915

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May 19, 2014

Bay Mills Indian Community
12214 West Lakeshore Drive
Brimley, MI 49715-9320

Attn: Paula Carrick

Re: Huron River 2013 SRF Project Plan HRC Job No. 20140309

Dear Ms. Carrick:

Hubbell, Roth & Clark Inc. (HRC) is presently working with the Washtenaw County Water Resource Commissioner to update the Project Plan for improvements in mitigating non-point source pollution. This will include several projects at various locations throughout the City of Ann Arbor. These projects may include the replacement of existing pavement with porous concrete, stream bank stabilization along various creeks, construction of rain gardens and/or planting trees or other vegetation. These projects are being undertaken as part of the City's and the County's ongoing mission to improving surface water quality in the area. Appropriate permitting measures will be taken for all work included in this project.

Washtenaw County has decided to pursue financial assistance for these improvements from the State of Michigan through the State Revolving Fund (SRF). A Project Plan is the required first step in applying for a SRF loan. The SRF Project Plan requirements state that your office is to be notified so that a determination can be made of whether the proposed project could impact religious or culturally significant tribal lands in the vicinity of the project. Maps of the project areas are attached.

Please inform us of your findings at your earliest convenience. If you have any questions or require any additional information, please contact the undersigned.

Very truly yours,

HUBBELL, ROTH & CLARK, INC.

Karyn Stickel

Karyn M. Stickel, P.E.
Senior Project Engineer

KS
Attachment
Enclosure
pc: HRC; File

HRC 100 YEARS
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May 19, 2014

Burt Lake Band of Ottawa and Chippewa Indians
6461 Brutus Road
PO Box 206
Brutus, MI 49716

Attn: Bruce R. Hamlin

Re: Huron River 2013 SRF Project Plan HRC Job No. 20140309

Dear Mr. Hamlin:

Hubbell, Roth & Clark Inc. (HRC) is presently working with the Washtenaw County Water Resource Commissioner to update the Project Plan for improvements in mitigating non-point source pollution. This will include several projects at various locations throughout the City of Ann Arbor. These projects may include the replacement of existing pavement with porous concrete, stream bank stabilization along various creeks, construction of rain gardens and/or planting trees or other vegetation. These projects are being undertaken as part of the City's and the County's ongoing mission to improving surface water quality in the area. Appropriate permitting measures will be taken for all work included in this project.

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Very truly yours,

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May 19, 2014

Grand River Band of Ottawa Indians
1251 Plainfield NE Ste B
PO Box 2937
Grand Rapids, MI 49501

Attn: Ron Yob

Re: Huron River 2013 SRF Project Plan HRC Job No. 20140309

Dear Mr. Yob:

Hubbell, Roth & Clark Inc. (HRC) is presently working with the Washtenaw County Water Resource Commissioner to update the Project Plan for improvements in mitigating non-point source pollution. This will include several projects at various locations throughout the City of Ann Arbor. These projects may include the replacement of existing pavement with porous concrete, stream bank stabilization along various creeks, construction of rain gardens and/or planting trees or other vegetation. These projects are being undertaken as part of the City's and the County's ongoing mission to improving surface water quality in the area. Appropriate permitting measures will be taken for all work included in this project.

Washtenaw County has decided to pursue financial assistance for these improvements from the State of Michigan through the State Revolving Fund (SRF). A Project Plan is the required first step in applying for a SRF loan. The SRF Project Plan requirements state that your office is to be notified so that a determination can be made of whether the proposed project could impact religious or culturally significant tribal lands in the vicinity of the project. Maps of the project areas are attached.

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Very truly yours,

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Karyn Stickel

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May 19, 2014

Grand Traverse Band of Ottawa and Chippewa Indians
2605 N. West Bay Shore Dr.
Peshawbestown, MI 49682

Attn: Mark E. Russell

Re: Huron River 2013 SRF Project Plan HRC Job No. 20140309

Dear Mr. Russell:

Hubbell, Roth & Clark Inc. (HRC) is presently working with the Washtenaw County Water Resource Commissioner to update the Project Plan for improvements in mitigating non-point source pollution. This will include several projects at various locations throughout the City of Ann Arbor. These projects may include the replacement of existing pavement with porous concrete, stream bank stabilization along various creeks, construction of rain gardens and/or planting trees or other vegetation. These projects are being undertaken as part of the City's and the County's ongoing mission to improving surface water quality in the area. Appropriate permitting measures will be taken for all work included in this project.

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EMAIL: info@hrc-engr.com

May 19, 2014

Hannahville Potawatomi Indian Community
14911 Hannahville B-1 Road
Wildon, MI 49896

Attn: Earl Meshigaud

Re: Huron River 2013 SRF Project Plan HRC Job No. 20140309

Dear Mr. Meshigaud:

Hubbell, Roth & Clark Inc. (HRC) is presently working with the Washtenaw County Water Resource Commissioner to update the Project Plan for improvements in mitigating non-point source pollution. This will include several projects at various locations throughout the City of Ann Arbor. These projects may include the replacement of existing pavement with porous concrete, stream bank stabilization along various creeks, construction of rain gardens and/or planting trees or other vegetation. These projects are being undertaken as part of the City's and the County's ongoing mission to improving surface water quality in the area. Appropriate permitting measures will be taken for all work included in this project.

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HUBBELL, ROTH & CLARK, INC.

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Senior Project Engineer

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HRC 100 YEARS
CONSULTING ENGINEERS SINCE 1915

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WEBSITE: www.hrc-engr.com
EMAIL: info@hrc-engr.com

May 19, 2014

Keweenaw Bay Indian Community
16429 Beartown Road
Baraga, MI 49908

Attn: Summer Sky Cohen

Re: Huron River 2013 SRF Project Plan HRC Job No. 20140309

Dear Summer Sky Cohen:

Hubbell, Roth & Clark Inc. (HRC) is presently working with the Washtenaw County Water Resource Commissioner to update the Project Plan for improvements in mitigating non-point source pollution. This will include several projects at various locations throughout the City of Ann Arbor. These projects may include the replacement of existing pavement with porous concrete, stream bank stabilization along various creeks, construction of rain gardens and/or planting trees or other vegetation. These projects are being undertaken as part of the City's and the County's ongoing mission to improving surface water quality in the area. Appropriate permitting measures will be taken for all work included in this project.

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Please inform us of your findings at your earliest convenience. If you have any questions or require any additional information, please contact the undersigned.

Very truly yours,

HUBBELL, ROTH & CLARK, INC.

Karyn M. Stickel, P.E.
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May 19, 2014

Lac Vieux Desert Band of Lake Superior Chippewa Indians
PO Box 249
Watersmeet, MI 49969

Attn: Giiwegiizhigookway Martin

Re: Huron River 2013 SRF Project Plan HRC Job No. 20140309

Dear Giiwegiizhigookway Martin:

Hubbell, Roth & Clark Inc. (HRC) is presently working with the Washtenaw County Water Resource Commissioner to update the Project Plan for improvements in mitigating non-point source pollution. This will include several projects at various locations throughout the City of Ann Arbor. These projects may include the replacement of existing pavement with porous concrete, stream bank stabilization along various creeks, construction of rain gardens and/or planting trees or other vegetation. These projects are being undertaken as part of the City's and the County's ongoing mission to improving surface water quality in the area. Appropriate permitting measures will be taken for all work included in this project.

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May 19, 2014

Little River Band of Ottawa Indians
375 River Street
Manistee, MI 49660

Attn: Jay Sam

Re: Huron River 2013 SRF Project Plan HRC Job No. 20140309

Dear Jay Sam:

Hubbell, Roth & Clark Inc. (HRC) is presently working with the Washtenaw County Water Resource Commissioner to update the Project Plan for improvements in mitigating non-point source pollution. This will include several projects at various locations throughout the City of Ann Arbor. These projects may include the replacement of existing pavement with porous concrete, stream bank stabilization along various creeks, construction of rain gardens and/or planting trees or other vegetation. These projects are being undertaken as part of the City's and the County's ongoing mission to improving surface water quality in the area. Appropriate permitting measures will be taken for all work included in this project.

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May 19, 2014

Little Traverse Bay Band of Odawa Indians
7500 Odawa Circle
Harbor Springs, MI 49740

Attn: Eric Hemenway and Gijigowi Bipskaabiimii

Re: Huron River 2013 SRF Project Plan HRC Job No. 20140309

Dear Eric Hemenway and Gijigowi Bipskaabiimii:

Hubbell, Roth & Clark Inc. (HRC) is presently working with the Washtenaw County Water Resource Commissioner to update the Project Plan for improvements in mitigating non-point source pollution. This will include several projects at various locations throughout the City of Ann Arbor. These projects may include the replacement of existing pavement with porous concrete, stream bank stabilization along various creeks, construction of rain gardens and/or planting trees or other vegetation. These projects are being undertaken as part of the City's and the County's ongoing mission to improving surface water quality in the area. Appropriate permitting measures will be taken for all work included in this project.

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May 19, 2014

Match-e-be-nash-shee-wish Gun Lake Band of Potawatomi Indians
PO Box 218
Dorr, MI 49323

Attn: Lorraine Shananaquat

Re: Huron River 2013 SRF Project Plan HRC Job No. 20140309

Dear Ms. Shananaquat:

Hubbell, Roth & Clark Inc. (HRC) is presently working with the Washtenaw County Water Resource Commissioner to update the Project Plan for improvements in mitigating non-point source pollution. This will include several projects at various locations throughout the City of Ann Arbor. These projects may include the replacement of existing pavement with porous concrete, stream bank stabilization along various creeks, construction of rain gardens and/or planting trees or other vegetation. These projects are being undertaken as part of the City's and the County's ongoing mission to improving surface water quality in the area. Appropriate permitting measures will be taken for all work included in this project.

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May 19, 2014

Nottawaseppi Band of Huron Potawatomi
1474 Mno-Bmadzwen-Way
Fulton, MI 49052

Attn: Jeff Chivis

Re: Huron River 2013 SRF Project Plan HRC Job No. 20140309

Dear Mr. Chivis:

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May 19, 2014

Pokagon Band of Potawatomi
PO Box 180
Dowagiac, MI 49047

Attn: Michael Zimmerman

Re: Huron River 2013 SRF Project Plan HRC Job No. 20140309

Dear Mr. Zimmerman:

Hubbell, Roth & Clark Inc. (HRC) is presently working with the Washtenaw County Water Resource Commissioner to update the Project Plan for improvements in mitigating non-point source pollution. This will include several projects at various locations throughout the City of Ann Arbor. These projects may include the replacement of existing pavement with porous concrete, stream bank stabilization along various creeks, construction of rain gardens and/or planting trees or other vegetation. These projects are being undertaken as part of the City's and the County's ongoing mission to improving surface water quality in the area. Appropriate permitting measures will be taken for all work included in this project.

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May 19, 2014

Saginaw Chippewa Indian Tribe of Michigan
6650 East Broadway
Mount Pleasant, MI 48858

Attn: William Johnson

Re: Huron River 2013 SRF Project Plan HRC Job No. 20140309

Dear Mr. Johnson:

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May 19, 2014

Sault Ste. Mariw Tribe of Chippewa Indians
523 Ashmun
Sault Ste. Marie, MI 49783

Attn: Cecil E. Pavlat Sr.

Re: Huron River 2013 SRF Project Plan HRC Job No. 20140309

Dear Mr. Pavlat:

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May 19, 2014

MDEQ Jackson District Office
301 E. Louis Glick Hwy.
Jackson, MI 49201

Attn: James Sallee

Re: Huron River 2013 SRF Project Plan HRC Job No. 20140309

Dear Mr. Sallee:

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The project locations can be found at Township 02 S Range: 06 E, Sections 23, 26, 27, 31 and 32; and Township: 03 S Range: 06 E Sections 8, 9, and 10 on the Ann Arbor West, Ann Arbor East, Saline, Ypsilanti West USGS quadrangle maps. Maps of the project areas are attached. Please inform us of your findings at your earliest convenience. Should you have any questions or require additional information regarding this matter, please contact the undersigned at 248-454-6566.

If you have any questions or require any additional information, please contact the undersigned.

Very truly yours,

HUBBELL, ROTH & CLARK, INC.

Karyn M. Stickel, P.E.
Senior Project Engineer

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May 20, 2014

Brian Grennell, Environmental Review Specialist
State Historic Preservation Office
Environmental Review Office
Michigan Historical Center
P.O. Box 30740
Lansing, MI 48909-8240

Re: Washtenaw County Water Resources Commission HRC Job No. 20140309
SRF Project Plan Amendment

Dear Mr. Grennell:

The Washtenaw County Water Resources Commissioner is in the process of submitting an SRF project plan amendment for project areas within the Huron River Green Infrastructure Drainage District. The proposed work consists of streambank stabilization, stormwater improvements, and pond improvements to enhance water quality in the Drainage District. The enclosed map and description of project area summarizes the improvements and their respective locations. Photo logs of the project sites within the area of potential effects (APE) have also been included.

The locations of potential impacts are limited to the areas of proposed work, as shown on the attached figures.

There are several known historic properties within the APE as indicated on Attachment A. However, these historic sites are located in areas where road improvements are proposed, and all work will take place within the road right-of-way with no changes to the historic properties. There will be no changes to the historic properties for the construction of these projects. The Michigan Historic Sites Online (http://www.mcgi.state.mi.us/hso/findlocation.asp) was used to confirm the location of historic sites within the project areas.

Based on our research of the APE for the proposed projects, we anticipate no historic properties will be impacted by the proposed construction activities. The project sites will be restored to their original condition following all construction activities. Any noise impacts from construction traffic will be temporary and discontinued at the end of the project.

Please review and verify the enclosed information regarding the WCWRC SRF Project Plan Amendment. Please return comments to the undersigned.

If you have any questions or require any additional information, please contact the undersigned.

Very truly yours,

HUBBELL, ROTH & CLARK, INC.

Karyn Stickel

Karyn M. Stickel, P.E.
Senior Project Engineer

KS
Attachment
Enclosure
pc: HRC; File

STATE HISTORIC PRESERVATION OFFICE
Application for Section 106 Review

SHPO Use Only
☐ IN Received Date ____ / ____ / ____ Log In Date ____ / ____ / ____
☐ OUT Response Date ____ / ____ / ____ Log Out Date ____ / ____ / ____
Sent Date ____ / ____ / ____

Submit one copy for each project for which review is requested. This application is required. Please type. Applications must be complete for review to begin. Incomplete applications will be sent back to the applicant without comment. Send only the information and attachments requested on this application. Materials submitted for review cannot be returned. Due to limited resources we are unable to accept this application electronically.

I. GENERAL INFORMATION

☒ THIS IS A NEW SUBMITTAL ☐ THIS IS MORE INFORMATION RELATING TO ER#

a. Project Name: Huron River 2013 SRF Project Plan
b. Project Address (if available): Various Locations throughout the City of Ann Arbor
c. Municipal Unit: Washtenaw County Water Resource Commissioner County: Washtenaw
d. Federal Agency, Contact Name and Mailing Address (*If you do not know the federal agency involved in your project please contact the party requiring you to apply for Section 106 review, not the SHPO, for this information*.): Mr. Andrew Lausted, US EPA Region 5 77 W. Jackson Blvd. Chicago, IL 60604 312-886-0189
e. State Agency (if applicable), Contact Name and Mailing Address: Karol Patton, MDEQ SRF Program, (517) 241-0724
f. Consultant or Applicant Contact Information (if applicable) *including mailing address*: Hubbell, Roth & Clark Attn: Karyn Stickel 555 Hulet Dr Bloomfield Hills, MI 48303; kstickel@hrc-engr.com

---

II. GROUND DISTURBING ACTIVITY (INCLUDING EXCAVATION, GRADING, TREE REMOVALS, UTILITY INSTALLATION, ETC.)

DOES THIS PROJECT INVOLVE GROUND-DISTURBING ACTIVITY? ☒ YES ☐ NO (If no, proceed to section III.)

Exact project location must be submitted on a USGS Quad map (portions, photocopies of portions, and electronic USGS maps are acceptable as long as the location is clearly marked).

a. USGS Quad Map Name: Ann Arbor West, Ann Arbor East, Saline, Ypsilanti West
b. Township: Range: Section: T02S, R 06E, S23, 26, 27, 31 and 32; T03S, R06E, S8, 9, and 10
c. Description of width, length and depth of proposed ground disturbing activity: Varies depending on project.
d. Previous land use and disturbances: Sites are currently public right-of-ways, parking lots and other previously developed land uses, streams and stormwater controls.
e. Current land use and conditions: Storm eastements, public right-of-way, river banks
f. Does the landowner know of any archaeological resources found on the property? ☐ YES ☒ NO
Please describe: N/A

III. PROJECT WORK DESCRIPTION AND AREA OF POTENTIAL EFFECTS (APE)
Note: Every project has an APE.

a. Provide a detailed written description of the project (plans, specifications, Environmental Impact Statements (EIS), Environmental Assessments (EA), etc. **cannot** be substituted for the written description): See attached letter See Attached Letter.
b. Provide a localized map indicating the location of the project; road names must be included and legible. Figures Attached.
c. On the above-mentioned map, identify the APE. See Attached.
d. Provide a written description of the APE (physical, visual, auditory, and sociocultural), the steps taken to identify the APE, and the justification for the boundaries chosen. See attached

IV. IDENTIFICATION OF HISTORIC PROPERTIES

a. List and date **all** properties 50 years of age or older located in the APE. If the property is located within a National Register eligible, listed or local district it is only necessary to identify the district: None
b. Describe the steps taken to identify whether or not any **historic** properties exist in the APE and include the level of effort made to carry out such steps: The proposed project site locations were cross referenced with documents from the Ann Arbor historic district as well as state and national databases of historic properties and landmarks.
c. Based on the information contained in "b", please choose one:
   - ☐ Historic Properties Present in the APE
   - ☒ No Historic Properties Present in the APE See Attached.
d. Describe the condition, previous disturbance to, and history of any historic properties located in the APE: None present None Present.

V. PHOTOGRAPHS

Note: All photographs must be keyed to a localized map.

a. Provide photographs of the site itself. See Attachement.
b. Provide photographs of all properties 50 years of age or older located in the APE (faxed or photocopied photographs are not acceptable). N/A

VI. DETERMINATION OF EFFECT

☒ No historic properties affected based on [36 CFR § 800.4(d)(1)], please provide the basis for this determination.

☐ No Adverse Effect [36 CFR § 800.5(b)] on historic properties, explain why the criteria of adverse effect, 36 CFR Part 800.5(a)(1), were found not applicable.

☐ Adverse Effect [36 CFR § 800.5(d)(2)] on historic properties, explain why the criteria of adverse effect, [36 CFR Part 800.5(a)(1)], were found applicable.

Please print and mail completed form and required information to:

State Historic Preservation Office, Environmental Review Office, Michigan Historical Center, 702 W. Kalamazoo Street, P.O. Box 30740, Lansing, MI 48909-8240

HRC 100 YEARS
CONSULTING ENGINEERS SINCE 1915

PRINCIPALS
George E. Hubbell
Thomas E. Biehl
Walter H. Alix
Peter T. Roth
Keith D. McCormack
Nancy M. D. Faught
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Attachment A

Re: Huron River 2013 SRF Project Plan, Application 106 Review

Ladies and Gentlemen:

Hubbell, Roth & Clark Inc. (HRC) is presently working with the Washtenaw County Water Resource Commissioner to update the Project Plan for improvements in mitigating non-point source pollution. This will include several projects at various locations throughout the City of Ann Arbor. These projects may include the replacement of existing pavement with porous materials; stream bank stabilization along various creeks; improvements to or construction of wetlands, detention basins, rain gardens and infiltration basins; planting trees or other vegetation; and other stormwater best management practices. These projects are being undertaken as part of the City's and the County's ongoing mission to improving surface water quality in the area. Appropriate permitting measures will be taken for all work included in this project.

The proposed projects are intended to improve the integrity of any property's location, design, setting, materials, workmanship, feeling, and association, by improving water quality and utilizing best management practices.

The Project Plan will be submitted to the Michigan Department of Environmental Quality's Environmental Services and Science Division (MDEQ-ESSD) for prioritization of a State Revolving Fund loan. The following additional information is provided as an attachment to the Application for Section 106 Review, in accordance with the National Historic Preservation Act of 1996:

I. GENERAL INFORMATION:

Federal Agency Contact:
Mr. Andrew Lausted, 312-886-0189
US EPA Region 5
77 W. Jackson Blvd.
Chicago, IL 60604

State Agency Contact:
Ms. Karol Patton, (517) 241-0724
MDEQ, Revolving Loan Section
P.O. Box 30457
Lansing, Michigan 48909-7957

This Project Plan is being prepared as part of the State Revolving Fund loan program.

II. GROUND DISTURBING ACTIVITY:

Any ground disturbing activities associated with this project will be associated with stormwater improvements. All areas will either be restored to their existing uses or restored from an urban use to a natural feature.

III. PROJECT WORK DESCRIPTION AND AREA OF POTENTIAL EFFECTS (APE)

Project Work Description:

The locations and projects proposed in this Project Plan were each individually evaluated to determine the quantity of first flush stormwater runoff and/or pollutants that could be captured and mitigated. The Best Management Practices (BMPs) were then selected based on watershed storage needs or stream bank protection needs, together with individual site conditions and constraints. The data was then used to design each BMP to maximize the pollutant removal, with emphasis on total suspended solids (TSS), total phosphorous (TP), and *E. coli* removal, as well as onsite infiltration. Projects were selected based on those included in the City's Capital Improvement Plan (CIP). The CIP is developed based on inventory, assessment, and coordinated asset maintenance and improvements. The 6 projects that will be updated in this year's Project Plan are listed herein.

All projects involving road reconstruction will include components in order to treat and detain the first flush and bankfull volumes per City and County standards. Infiltration will be used to the extent necessary based on soil conditions. While some soil conditions are known, additional infiltration may be able to be proposed during design based on more comprehensive soil information. Where infiltration is not used, oversized pipes for extended detention, including sumps for maintenance, or stone reservoirs with underdrains, will be used to promote storm water quality.

1. Stone School Road Reconstruction (Packard to I-94)
2. Plaza Drive Pond Improvements
3. Scio Church Road Stormwater Improvements
4. Ann Arbor – Saline Road to Cranbrook Park Streambank Stabilization
5. Pepper Pike Streambank Stabilization
6. Geddes Road Stormwater Improvements

Description of the APE:

The Area of Potential Effects (APE) is limited to the specific areas identified above, and shown on the attached map. All projects are intended to improve the downstream water quality and to reduce stormwater flows as required. Visually, the projects are within the right-of-way of City roads or are on City property, and properties adjacent to the work areas are typically zoned residential or commercial. Where work will take place near parks or within surface waters, the proposed work will enhance the natural settings. There will be no additional traffic, noise, or other impacts resulting from

implementation of the projects, other than short-term, temporary impacts related to the construction work. Proper signage and traffic controls will be installed prior to any work.

IV. IDENTIFICATION OF HISTORIC PROPERTIES:

Research was performed to determine the location of historical features. This included using the State's website to map all State and Federally-registered sites. The Michigan Historic Sites Online website (http://www.mcgi.state.mi.us/hso/findlocation.asp) was verified to determine the absence of historic properties within the Project Area on May 19, 2014.

While there are no historic properties located within the APE, the following are listed sites that are nearby proposed work areas for reference.

Proposed Project Site No. 1 (Stone School Road Reconstruction) involves several of stormwater BMPs and stormwater reconstruction. This project is near the following historic property:

- Stone School, National Register listed, Site ID# P3576
- Ticknor, Dr. Benajah House, , State and National Register listed, Site ID# P3774

Proposed Project Site No. 6 (Geddes Road Stormwater Improvements) involves incorporation of stormwater BMPs to reduce surface runoff and improve stormwater quality. This project is near the following historic properties:

- Orrin White House, State and National Register listed, Site ID#P24965
- Earhart Manor, State Register listed, Site ID# P21285
- Palmer, Williams B. and Mary Shuford House, National Register listed, Site ID# 35727

There will be no change to the streetscape view of or from, or any other impacts to any of these nearby historic properties.

V. PHOTOGRAPHS:

See the attached photo sheets.

VI. DETERMINATION OF EFFECT:

This project will not have any adverse effect on the nearby historic properties.

The project **will not** diminish the integrity of any property's location, design, setting, materials, workmanship, feeling, or association. There are **no** foreseeable effects caused by the undertaking that may occur later in time. The proposed project is in keeping with all of the sites' existing uses and context. All sites will be restored to

their existing uses and there will be no discernable change to the physical, visual, auditory, and sociocultural climates of the project sites.

There will be minimal ground disturbance and the streetscape view of the site will be improved by the additional natural features and improved stormwater quality. All areas will either be restored to their existing conditions, or include additional natural features. The pre and post-construction climate of the APE therefore will not be negatively impacted.

A temporary impact to the area will be experienced due to the increased noise, traffic, and work activity associated with construction. However, this will be mitigated by limiting construction activity on nights and weekends, requiring periodic cleaning and maintenance of the sites to protect the public and prevent excessive dust or debris, and having all activity comply within the City Codes.

Site #1, South on Stone School Road

Site #1, North on Stone School Road towards Packard

Site #1, South on Stone School Road

Site #2, East on Plaza Road

Site #2, Northeast on Mall Drive

Site #3, East on Scio Church Road

Site #3, East on Scio Church Road

Site #3, East on Scio Church Road

Site #3, West on Scio Church Road

Site #4, Southeast on Ann Arbor – Saline Road

Site #4, West on S. Main Street

Site #5, North on Pepper Pike Road

Site #5, South on Pepper Pike Road

Site #6, East on Geddes Avenue

Site #6, East on Geddes Avenue

Site #6, Northeast on Geddes Avenue

Project Sites			
Figure #	**Name of Site**	**Area of Disturbance**	**Disturbance Previously of Intact Soils***
1	Stone School Road Reconstruction	L = 1950' W= 140' D= 5'	No
2	Plaza Drive Pond Improvements	TBD	No, previously disturbed for construction of ponds
3	Scio Church Road Stormwater Improvements	L = 2800' W= 40' D= 5'	No
4	Ann Arbor - Saline Road to Cranbrook Park Streambank	L = 2100' W= Varies D= Varies	Yes, along existing stream to provide stabilization
5	Pepper Pike Streambank Stabilization	TBD	Yes, along existing stream to provide stabilization
6	Geddes Road Stormwater Improvements	L = 1575' W= 45' D= 5'	No

*The projects involving road reconstruction and improvements will not be disturbing any undisturbed areas as theyare generally redevelopment of existing properties in order to provide better storm water management. The pond and streambank projects take place along existing water courses in order to provide stabilization, or involves retrofits to existing ponds or basins in order to provide better storm water quality treatment.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ANN ARBOR EAST QUADRANGLE
MICHIGAN—WASHTENAW CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
SW/4 SOUTH LYON 15' QUADRANGLE

4268 IV NE (HAMBURG)
4268 I NW (SOUTH LYON)
4268 I NE (SALEM)
4268 IV SE (ANN ARBOR WEST)
4268 I SE (DENTON)
(SALINE I 62 500) 4268 III
(YPSILANTI 1:62 500) 4268 II
(YPSILANTI EAST) 4268 II NE

NORTHFIELD
SALEM
ANN ARBOR
SUPERIOR
PITTSFIELD
YPSILANTI TWP

Gravel Pit
PIPELINE
O'Connor Drain
NORTH TERRITORIAL ROAD
Leland Cem
Radio Tower
Emery
St Patricks Cem
BM 932
NORTHFIELD CHURCH ROAD
St Johns Ch
Gravel Pit
Northfield
Superior Townline Sch
Gravel Pits
TRAIL
PONTIAC
JOY ROAD
WARREN ROAD
BM 935
BM 574
Washtenong Memorial Park
Thurston Sch
Observation Tower
Gravel Pit BM 859
Huron Bridge Park
Northside Playground
Northside Sch
Beckley Park
Fairview Cem
ANN ARBOR TWP
University of Michigan (North Campus)
ARBORCREST CEMETERY
Gaging Station
Riverview Park
Summit Playground
BM 765
St Thomas Sch
St Joseph Hospital
Jones Sch
U of M Med Center
Courthouse
City Hall
BM 845
Library
BM 879
FOREST HILL CEMETERY
Nichols Arboretum
VA Hospital
Gravel Pit
St Paul Sch
Dixboro
BM 819
Gravel Pit
U of M Botanical Gardens
Gale Sch
Wines Field
Ferry Field
U of M Stadium
Burns Sch
BURNS PARK
Douglas Park
Tappan Jr High Sch
Frisinger Park
St Francis Assisi Sch
Baden Sch
Water County Hospital
Pattengill Sch
Allen Sch
Buhr Park
Community Park
Pittsfield Sch
Shopping Center
Holy Ghost Mission Seminary
St Johns Ch
Drive-in Theater
Gallup Lake Park
Concordia College
Sewage Disp
Geddes
Substation
Gravel Pit
Fletcher Sch
University of Michigan (East Campus)
Sinclair Drain
Snidecar Drain
HURON RIVER
NEW YORK CENTRAL ROAD
ANN ARBOR ROAD
PLYMOUTH ROAD
GEDDES ROAD
FORD ROAD
CHERRY HILL ROAD
VREELAND RD
GOSS ROAD
CLARK ROAD
DIXBORO ROAD
EARHART ROAD
NIXON ROAD
STATE ROAD
HURON PARKWAY
1.9 MI. TO U.S. 23
46 MI. TO INTERSTATE 75
12 MI. TO INTERSTATE 96
SOUTH LYON 6 MI
PLYMOUTH 9 MI
DETROIT 34 MI
JACKSON (VIA INTERSTATE 94) 35 MI
2 MI TO INTERSTATE 94
1.9 MI. TO INTERSTATE 94
DETROIT (CITY HALL) 33 MI.
5
6

83°45′ 42°22′30″ 83°37′30″ 42°15′
274 000m E. 2 160 000 FEET 2 190 000 FEET
4694 000m N. 4681 000m N.
T. 1 S. T. 2 S. T. 3 S.
310 000 FEET 280 000 FEET
20′ 17′30″

Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken 1963–64. Field checked 1965

Polyconic projection. 1927 North American datum
10,000-foot grid based on Michigan coordinate system, south zone
1000-meter Universal Transverse Mercator grid ticks,
zone 17, shown in blue

Red tint indicates areas in which only landmark buildings are shown

Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked

MN GN 2½° 44 MILS 1°48′ 32 MILS
UTM GRID AND 1965 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000
1 MILE 1000 0 1000 2000 3000 4000 5000 6000 7000 FEET 1 KILOMETER
CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, WASHINGTON, D. C. 20242
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

ROAD CLASSIFICATION
Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
U. S. Route — State Route

MICHIGAN
QUADRANGLE LOCATION

USGS
Historical File
Topographic Division

MAY 17 1967

3615

FILE COPY
TOPOGRAPHIC DIVISION

U.S.G.S. ANN ARBOR EAST, MICH.
SW/4 SOUTH LYON 15' QUADRANGLE
N4215—W8337.5/7.5
1965
AMS 4268 I SW—SERIES V862

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—1967

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ANN ARBOR WEST QUADRANGLE
MICHIGAN—WASHTENAW CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
SE/4 DEXTER 15' QUADRANGLE

Mapped, edited, and published by the Geological Survey

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Topography by photogrammetric methods from aerial photographs taken 1963–64. Field checked 1965

Polyconic projection. 1927 North American datum
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1000-meter Universal Transverse Mercator grid ticks, zone 17, shown in blue

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SCALE 1:24000

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

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ROAD CLASSIFICATION
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Interstate Route · U. S. Route · State Route

QUADRANGLE LOCATION

ANN ARBOR WEST, MICH.
SE/4 DEXTER 15' QUADRANGLE
N4215—W8345/7.5
1965
AMS 4268 IV SE—SERIES V862

USGS Historical File Topographic Division
U.S.G.S. FILE COPY TOPOGRAPHIC DIVISION
3535
APR 12 1967

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STATE OF MICHIGAN

YPSILANTI WEST QUADRANGLE
MICHIGAN—WASHTENAW CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
NW/4 YPSILANTI 15' QUADRANGLE

4268 IV SE (ANN ARBOR WEST)
4268 I SW (ANN ARBOR EAST)
4268 I SE (DENTON)
4268 III NE (SALINE)
4268 II NE (YPSILANTI EAST)
4268 II SW (MILAN)
(MACON) 4268 III SE
(MAYBEE) 4268 II SE

ANN ARBOR (CH.) 2.5 MI.
ANN ARBOR (CH.) 5 MI.
1.3 MI. TO U.S. 23
23 MI. TO INTERSTATE 96
6 MI. TO MICH. 14
3.2 MI. TO U.S. 12
17 MI. TO INTERSTATE 94
4 MI. TO INTERCHANGE 172
JACKSON 36 MI.
1.5 MI. TO INTERCHANGE 184
DETROIT (INTERSTATE 75) 34 MI.
CLINTON 16 MI.
SALINE 2 MI.
MILAN 2.7 MI.
TOLEDO, OHIO 40 MI.

83°45′ — 42°15′ — 83°37′30″ — 42°07′30″
R. 6 E. — R. 7 E.
2 160 000 FEET — 2 190 000 FEET
4680000m N. — 4667000m N.
270 000 FEET — 230 000 FEET

ANN ARBOR
YPSILANTI
PITTSFIELD
YPSILANTI STATE HOSPITAL
YORK
AUGUSTA

INTERCHANGE 177
INTERCHANGE 180
INTERCHANGE 181

Pittsfield Sch
Stone Sch
Buhr Park
Clinton Sch
Mitchell Sch
Scarlett Jr High Sch
Drive-in Theater
Radio Towers (WAAM)
Golf Course
Trailer Park
Water Tank
Eastern Michigan University
St John High Sch
Estabrook Sch
West Jr High Sch
Chapelle Sch
Park
Begole Sch
Rest Area
Gravel Pit
Sandpit
Beacon
ANN ARBOR MUNICIPAL AIRPORT
Gravel Pits
Meadowview Sch
Thorne Sch
McBrinan Airport
Camp Crawford
Sewage Disposal
York Cem
Allen Sch

Ann Arbor Drain
Swift Drain
Pittsfield Drain
No. 2 Drain
Warner Drain
Koch Drain
Hewens Creek
Stony Creek
Stony Creek
Stony Creek
Burk Creek

WATERS ROAD
PACKARD RD
ELLSWORTH ROAD
MORGAN ROAD
TEXTILE ROAD
MERRITT ROAD
BEMIS ROAD
BISHOP ROAD
WILLIS ROAD
JUDD ROAD
JEWELL ROAD
SAMER ROAD
BEGOLE ROAD
TALLADAY ROAD
WRIGHT ROAD
CENTRAL ROAD
PENN ROAD
WASHTENAW AVE
CROSS ST
SHERMAN ST
PLATT ROAD
CARPENTER ROAD
MUNGER ROAD
PIPELINE ROAD
PITMAN ROAD
SANFORD ROAD
MILAN RD

T. 3 S.
T. 4 S.

Mapped, edited, and published by the Geological Survey
in cooperation with State of Michigan agencies

Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken 1965. Field checked 1967

Polyconic projection. 1927 North American datum
10,000-foot grid based on Michigan coordinate system, south zone
1000-meter Universal Transverse Mercator grid ticks,
zone 17, shown in blue

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UTM GRID AND 1967 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24000

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

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USGS
Historical File
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MICHIGAN
QUADRANGLE LOCATION

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Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
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INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—1969

YPSILANTI WEST, MICH.
NW/4 YPSILANTI 15' QUADRANGLE
N4207.5—W8337.5/7.5

1967

AMS 4268 II NW—SERIES V862

2510

DEC 11 1969

HURON RIVER 2013 SRF PROJECT PLAN AMENDMENT

PREPARED FOR

Huron River Green Infrastructure Drainage District

APPENDIX G
SITE PHOTOS – NOT INCLUDED

HURON RIVER 2013 SRF PROJECT PLAN AMENDMENT

PREPARED FOR

Huron River Green Infrastructure Drainage District

APPENDIX H
WATERSHED MANAGEMENT PLANS – EXECUTIVE SUMMARIES – NOT INCLUDED

HURON RIVER 2013 SRF PROJECT PLAN AMENDMENT

PREPARED FOR

Huron River Green Infrastructure Drainage District

APPENDIX I
VILLAGE OAKS-CHAUCER COURT DRAINAGE PLAN – EXECUTIVE SUMMARY – NOT INCLUDED

HURON RIVER 2013 SRF PROJECT PLAN AMENDMENT

PREPARED FOR

Huron River Green Infrastructure Drainage District

APPENDIX J
ANN ARBOR GREEN STREET POLICY

Policy Statement

City of Ann Arbor, Michigan

Stormwater Management Guidelines for Public Street Construction and Reconstruction

Public Streets Construction and Reconstruction projects in the City of Ann Arbor will utilize Green Infrastructure to infiltrate stormwater runoff from impervious areas that are disturbed. At a minimum, infiltration techniques implemented on the project shall be similar to those described in the Low Impact Development Manual for Michigan, Sept. 2008. This policy does not apply to maintenance and/or resurfacing projects.

Based on an analysis of the soil borings, the project manager shall determine the area(s) of the project with the most favorable infiltration potential. Within the potential infiltration area(s), the infiltration rate(s) shall be determined by lab test or field test. The infiltration test location and depth shall be determined by the designers anticipated green infrastructure improvement. The infiltration standard shall be calculated for the entire project area and shall be determined using the following site condition factors:

Site Conditions	Infiltration Standard
• Within the floodplain, or • Slopes > than 20%, or • Soil infiltration rate < 0.6 in/hr	First 1 inch
• Not in the floodplain, and • Slopes < than 20%, and • Soil infiltration rate between 0.6 in/hr – 2.0 in/hr	50% annual chance - 24 hour event (2.35")
• Not in the floodplain, and • Slopes < than 20%, and • Soil infiltration rate >2.0 in/hr	10% annual chance – 24 hour event (3.26")

Notes: Soil Infiltrations Rates are based on A and B soil classifications in the Soil Survey of Washtenaw County, Michigan (1977).
Rainfall frequency estimates are derived from NOAA Atlas 14 Volume 8 (2013).

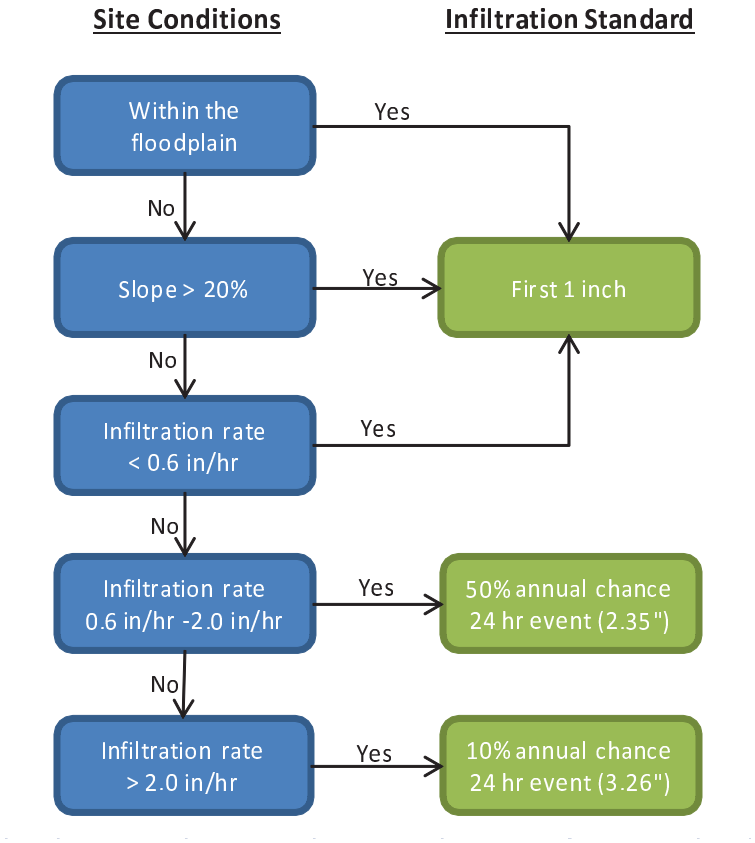
Notes:

- All public street construction and reconstruction projects are required to comply with the stormwater management requirements of Chapter 63 to the maximum extent practicable. Chapter 63 utilizes the Rules of the Washtenaw County Water Resources Commissioner. Within these rules, there is guidance for both detention and infiltration facilities.
- The above infiltration standards are separate from and supplemental to the requirements of Chapter 63. However, the volume of runoff infiltrated would count toward a reduction of the volume required to be detained per Chapter 63 by an equal amount.
- If the site conditions suggest multiple infiltration standards, utilize the highest feasible standard.
- Where site conditions allow, infiltration beyond the minimum standard is encouraged.
- The chosen green infrastructure improvement can be placed at any location within the project area, so long as the total volume to be infiltrated is captured and hydraulically connected to the disturbed area.
- If the project area contains groundwater within 5 feet of the surface, contaminated soil, or other limiting conditions the infiltration standards will have to be examined on a case-by-case basis to determine what infiltration rate and practices are feasible. In situations where the First 1-inch cannot be infiltrated, a lower infiltration standard may be used if approved by the Public Services Administrator.
- All infiltration facilities require the development of maintenance plans that are coordinated with the City of Ann Arbor Field Operations Staff.

Infiltration Standard Flowchart

City of Ann Arbor, Michigan

Stormwater Management Guidelines for Public Street Construction and Reconstruction



HURON RIVER 2013 SRF PROJECT PLAN AMENDMENT

PREPARED FOR

Huron River Green Infrastructure Drainage District

APPENDIX K
UPPER MALLETT'S CREEK STUDY EXCERPTS

Upper Malletts Stormwater Conveyance Study

Washtenaw County Water Resources Commissioner
Washtenaw County, Michigan

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March 21, 2014

ENGINEERS • SURVEYORS • PLANNERS

TRUSCOTT ROSSMAN

Project I.D. Number 120365SG2013

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I. EXECUTIVE SUMMARY

Over the past several decades, neighborhoods within the Upper Malletts Creek watershed have experienced several flooding episodes. Flooding is most pronounced along Churchill, Wiltshire Court, Wiltshire, Delaware, Morehead, Mershon and Scio Church Roads, as well as Village Oaks/Chaucer Court. The drainage area includes developed and undeveloped land in the City, and in the surrounding townships west of I-94 - Pittsfield, Lodi, and Scio. Problems range from localized street flooding due to clogged catch basins to basement flooding due to overwhelmed storm sewers. The stormwater conveyance system is mostly piped with a few reaches of open channel. There have been recent storm events, including the March 15, 2012 storm, where flooding has damaged residential property.

The Washtenaw County Water Resources Commissioner (WCWRC) commissioned a stormwater conveyance study of the Upper Malletts Creek watershed. The study was requested by the City of Ann Arbor by resolution of the City Council and the City funded the study. The purpose stated in the resolution is to evaluate and identify opportunities for conveyance and storm water improvements in the Churchill Downs and Lansdowne sub-watershed areas that may be necessary or appropriate to provide, improve and restore storm water management and water quality protection functions within the drainage district. The study goals, discussed and confirmed during public process, include:

- Reduce probability of flooding by improving stormwater management
- Identify cost of implementation per level of service
- Avoid adversely impacting downstream interests
- Maintain and/or enhance water quality
- Create long-term sustainability

After gathering background information and public input, a comprehensive list of stormwater management techniques was created based on preliminary site observations. The key concepts for addressing surface flooding included reducing stormwater runoff volume, detaining stormwater runoff, and adequately conveying stormwater to detention or green areas. Examples of techniques that have been successfully implemented in other communities, generally listed from lowest to highest cost and from least to most impact, include:

- Curb and drainage inlet structure enhancements
- Street maintenance procedures
- Cleaning and/or repair of existing drainage infrastructure
- Enhancement or modification of existing detention facilities
- Overland stormwater flow management
- Bio retention or natural approaches
- New open/surface stormwater detention
- New underground storm water detention
- Upsizing and enhancement of storm sewer capacity

Experience has shown that long standing flooding problems in large developed watersheds often require a combination of management techniques to solve the issues. Over the course of the study, a list of these techniques was developed, refined and compiled into design alternatives. The alternatives were evaluated through engineering analysis and public engagement. Figure I-1 below indicates the sites that were considered for new detention or improvements to existing detention facilities.

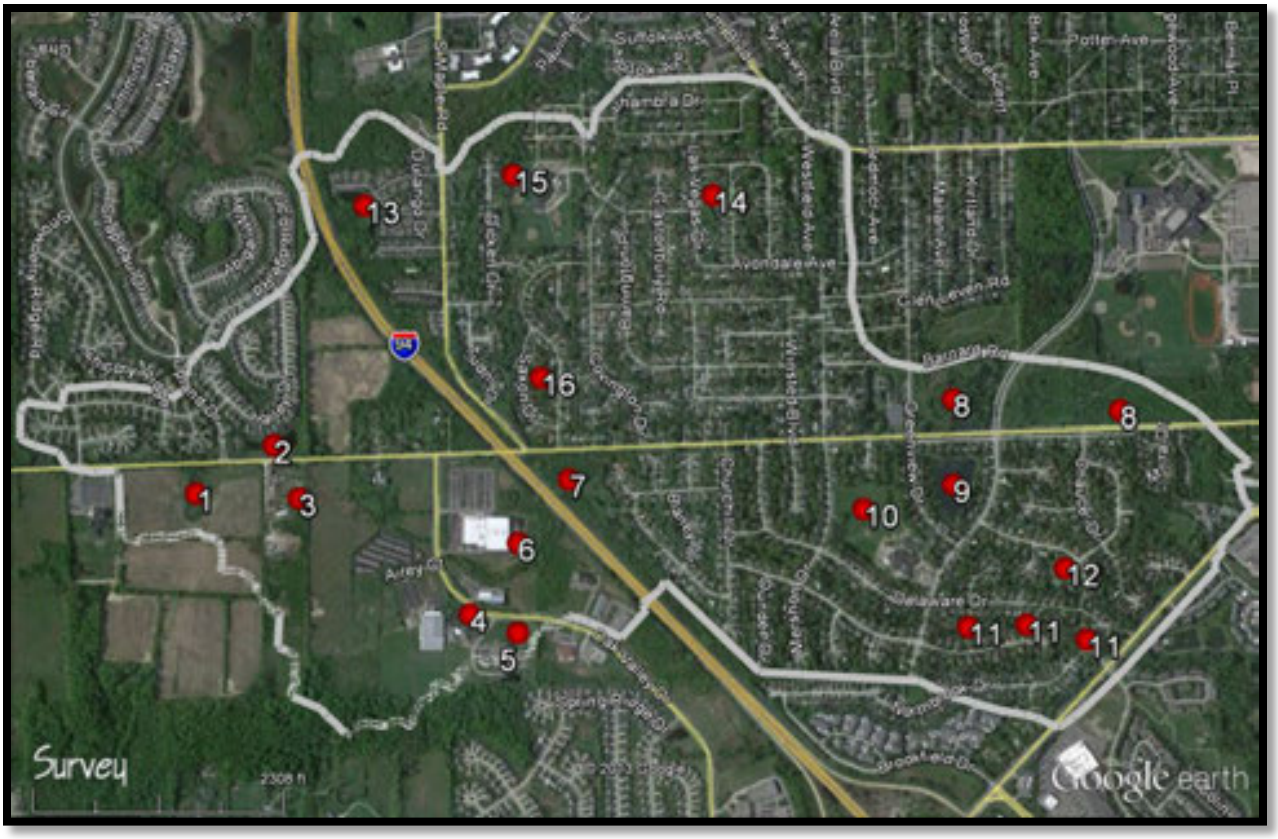

Figure I-1: Screened Detention Locations

Based on the cost benefit analysis performed during the screening phase of the study, three detention projects in combination with storm sewer improvements were chosen for further analysis - Eisenhower Park, Lawton Park, and Pioneer High School (East of 7th Street) combined with Scio Church storm sewer improvement project. Each project manages stormwater for a portion of the watershed and reduces a percentage of the overall flooding previously experienced. In order to control the entirety of the flooding experienced in March of 2012, all three detention projects and the Scio Church storm sewer improvements must be implemented. In addition, there are several storm sewer retrofit projects associated with each basin that must be completed for the system to work properly.

Project A – Eisenhower Park Basins and Storm Sewer Improvements

This alternative would add two detention basins in Eisenhower Park. The two basins together are 2.5 acres in size, would have a combined storage volume of 10.8 acre-ft., and are connected by a 42" pipe (Figure I-2). For comparison purposes, an acre is approximately the size of one football field. Flow from the Covington Road storm sewer would be diverted to these new basins.

Figure I-2: Project A - Eisenhower Park Basins and Sewer Improvements

Project B – Pioneer Basin and Scio Church Storm Sewer Improvements
A detention basin would be created along the north side of Scio Church Road just east of 7th Street (Figure I-3). This basin is 2.8 acres in area and has a storage volume of 9.2 acre-ft. Since Scio Church Road will soon be completely reconstructed, the storm sewer in Scio Church could be upsized to accommodate a portion of the detention volume thereby reducing the detention area on land owned by Ann Arbor Public Schools. The amount of storage that could be achieved in the Scio Church storm sewer will be determined during detailed design.

Figure I-3: Project B – Pioneer Basin and Sewer Improvements

by evaporation and seepage thru the bank wall. The area east of the pond has potential for a large volume of storage. The area is low, and has a substantial outlet with the 60" pipe under I-94. Maintenance work to restore the basin to working condition was completed during the study.

Site 7 – Eisenhower / Churchill Park

- **Property Type:** Public property owned by the City of Ann Arbor. Permanent easements or ROW are not necessary.
- **Land Use:** The area has an active-use park with some open space, a play structure and a small basketball court, and an undeveloped wooded area.
- **Elevation:** The site has both high and low points; significant earthwork may be necessary to create any storage. The site is located at the mid-point of overall system.
- **Outlet:** The outlet is very good, with two large (60") pipes within the park boundary.
- **General Comments:** There are some small wetland areas on the southern end of the parcel. The site has several areas that could be stormwater storage areas but would require large amounts of earthwork. Since the City already owns the parcel, this has strong potential for becoming part of the long term system management areas.

Site 8 – Pioneer High School East and West of 7th Street

- **Property Type:** Public property owned by Ann Arbor Public Schools. Permanent easements or ROW would be necessary for any work.
- **Land Use:** The area is two large undeveloped parcels. The area west of 7th Street is wooded, but many of the trees are dead. The area east of 7th Street is mostly scrub brush and small trees. There are a number of trails running through the area, and the area east of 7th has a disc golf course.
- **Elevation:** The area is at the high end of the watershed in the area.
- **Outlet:** There are several outlet points for runoff from these parcels. These are all overland flow points that discharge either into catch basins and/or over the curb into Scio Church Road. This is a large area that discharges into several small pipes, which may be contributing to street flooding. The outlet state is prone to debris accumulation.
- **General Comments:** The area appears to be comprised of heavy soils with little ability to absorb runoff. There is a pond on the parcel west of 7th that outlets via a small swale to the corner of 7th and Scio Church. The pond has no capacity for storage. The outlets are very poor. The perched pond would have some storage potential if the outlet was reconstructed. The area east of 7th could be graded to provide storage without much difficulty. The City should ensure the drainage is properly accommodated during the reconstruction of Scio Church.

Site 9 – Lans Lake

- **Property Type:** Private property that appears to be owned by an HOA. Easements would be necessary to do any work.
- **Land Use:** The parcel is a large pond.
- **Elevation:** The area is at the higher end of the system and appears to be a naturally perched pond.
- **Outlet:** The pond elevation is controlled by a small PVC pipe overflow located on the east side of the pond. The pipe is connected to the Lans Way storm sewer system and eventually outlets to the creek.
- **General Comments:** This area has the potential for a very large volume of storage with very little capital investment. A flooding easement would be required around the entire perimeter of the pond, which may be difficult due to the numbers of property owners involved. The overflow control structure would need to be revised. The pond could be tied to the Scio Church reconstruction project and the pond could be an overflow mechanism for the entire area. Permitting for improvements would be problematic.

Table V-1: Preliminary Detention Alternatives

Areas Within City Boundary					
Name	**Area (ac)**	**Depth (ft)**	**Potential Volume (ft^3)**	**Volume (ac-ft)**	**Potential Area (sq. ft.)**
Lawton Park	2.62	7.25	825,000	18.9	114,000
Eisenhower Park	2.23	6.5	630,000	14.5	97,000
Lans Lake	4.36	2.5	475,000	10.9	190,000
Lans Basin	1.86	2.5	200,000	4.6	81,000
Pioneer HS (W of 7th)	0.6	3	80,000	1.8	26,000
Pioneer HS (E of 7th)	0.87	1	40,000	0.9	38,000
Cardinal Homes	0.83	2	70,000	1.6	36,000
Las Vegas	0.18	0.5	4,000	0.1	8,000
	Subtotal		**2,324,000**	**53.4**	
Areas Outside of City Boundary					
Ice Cube	0.37	5.5	90,000	2.1	16,000
Meadowinds Basin	1.17	1	50,000	1.1	51,000
	Subtotal		**140,000**	**3.2**	
Total Potential Volume in Watershed			**2,464,000**	**56.6**	

Excess runoff was compared to outlet capacity at Ann Arbor-Saline Road, the most downstream point in the study, to determine an approximate volume of storage that would be needed to fully address flooding on March 15, 2012. Excess runoff was calculated by summing all sub-basin hydrographs in the stormwater model and comparing the peak flow rate generated to the hydraulic capacity of the culvert under Ann Arbor-Saline Road. Based on this analysis, approximately 26 ac-ft of storage would be needed throughout the system to fully address flooding on March 15, 2012. Though this calculation did not include a flow routing analysis which would account for variations in the timing of peak flows, it did indicate an order of magnitude for storage that would be necessary. Ultimately, this estimation of storage volume was very close to the total storage included in the final solution. The large volume requirement indicated that potential storage improvements of only one (1) or two (2) ac-ft would have minimal impact on flooding such as that observed in 2012. To contain study costs, the impact of constructing or improving all of the potential stormwater basins was not included in the detailed modeling. Rather, the initial concepts were expanded and evaluated during the study using a weighted alternative system.

Public feedback played a significant role in the decision-making process. A comprehensive public education and feedback process, as described in Section III, was used to solicit public input during multiple stages of alternative development. For example, although Lans Lake had the potential of storing upwards of 10 ac-ft, all possible site access and use of the existing detention facility was privately owned. Permits and easements would be very difficult to obtain, and the lake's water quality degradation would be severe. Based on these challenges, the decision was made to eliminate the option from further analysis.

2. *Alternative Scoring*

After developing conceptual volumes for the basins and sizes for the storm sewer improvements, each management alternative was evaluated against a list of criteria (Table V-2). Scoring was on a scale of 1 to 10 and was based on a combination of engineering calculations and judgment. The scores for each category were then tabulated to get a composite score for the alternative. This allowed an empirical evaluation of each alternative.

Alternative Scoring

- **Property Ownership:** High scores were given for projects on property already owned by the City or WCWRC. Low scores were given to solutions on private property that would require a large number of easements.
- **Capital Cost:** Low-cost projects received high scores; high-cost projects were assigned low scores.
- **Operation and Maintenance Costs:** Projects requiring little to no long-term maintenance were scored high, while projects requiring maintenance for normal operation were scored low.
- **Flood Mitigation Impact:** Alternatives with the greatest impact on the overall watershed were given high scores, while projects with no or minimal impact were scored low. Projects that had significant impact on a local area within the watershed were also scored higher.
- **Water Quality Improvements:** Alternatives with the greatest impact on water quality were given high scores. Projects that typically result in high Total Suspended Solids (TSS) removal and Total Phosphorous (TP) were judged as significantly improving water quality.
- **Social and Cultural Impact:** High scores were assigned to projects that did not significantly alter land use or that would result in improved facilities or property usage. Low scores were given if a project would negatively change the use of the property.
- **Public Acceptance:** Projects that would be generally supported by the public were given high scores. Projects that may be negatively received were given low scores.
- **Ability to Implement:** Projects that could be easily constructed were scored high while difficult, complex and time-consuming projects were rated low.
- **Funding Potential:** If funding beyond normal City/WRC budget categories was available for a project it was scored high. If projects could not be funded from grants or loans, they were given low scores.

Table V-2: Alternative Scoring

Name	Prop. Owner	Capital Cost	O&M Costs	Flood Mitigation Impact	Water Quality Improv.	Social & Cultural Impact	Public Accept	Ability to Implement	Funding Potential	Total Score
Detention Alternatives										
Eisenhower Park	10	4	8	9	8	6	7	5	8	**65**
Ice Cube	3	10	10	2	8	8	9	9	1	**60**
Lawton Park	10	1	5	9	8	8	8	2	8	**59**
Pioneer HS (E of 7th)	7	5	7	9	8	5	6	5	5	**57**
Pioneer HS (W of 7th)	7	5	6	4	8	7	6	5	5	**53**
Lans Basin	5	2	7	6	8	6	6	2	8	**50**
Las Vegas	10	5	8	2	8	4	6	5	2	**50**
Lans Lake	3	8	9	7	8	2	1	9	1	**48**
Meadowinds Basin	3	9	8	2	8	2	3	10	1	**46**
Cardinal Homes	3	6	9	2	8	7	5	4	1	**45**
Storm Sewer Improvement Alternatives										
Scio Church Road	10	6	8	5	2	8	8	6	3	**56**
Hanover/Dogwood	10	3	8	3	2	8	8	3	1	**46**
Wiltshire/Churchill	10	2	8	4	2	8	8	3	1	**46**
Chaucer/Ascot/Lans	10	2	8	3	2	8	8	3	1	**45**
Low Impact Design Solutions										
Road Diets	10	6	8	3	10	4	3	4	2	**50**
Porous Pavements	7	3	3	4	10	5	6	3	2	**43**
Rain Gardens	3	7	5	1	10	7	7	2	1	**43**

3. Storm Sewer System Improvements

In addition to detention, areas where storm sewer improvements could potentially mitigate or manage flooding were considered. Potential improvements include replacing the existing sewer with new, larger diameter sewer to increase flow capacity, new sewer to provide relief for an existing sewer, or new oversize sewer to provide additional detention. Specific areas reviewed include:

- Scio Church Road – New oversize sewer to provide local detention. This option was evaluated and is easily implemented as part of the planned road reconstruction project. The additional underground pipe storage will offset the volume needed in the nearby detention basin. The final size of the storm sewer and the exact amount of storage will need to be determined during detailed design.
- Chaucer/Ascot/Lans – New, larger diameter sewer. Preliminary analysis determined enlarging this sewer was found to have a detrimental impact downstream of Ann Arbor-Saline Road. While it eliminated the local flooding, a larger volume was sent downstream at a rate that exceeded the storage available downstream.
- Hanover/Dogwood - New, larger diameter sewer. This option could be completed with future road reconstruction; however the impact on residents and high cost exceeded the benefit.
- Wiltshire/Churchill/Delaware – A new relief sewer to provide additional capacity. The existing sewer would remain in place with new overflow controls to manage the flow in the new sewer. Like Hanover/Dogwood, this is a potential future option but the cost is high for the benefit provided.
- Mershon– New, larger diameter sewer. Similar to those noted directly above, this is a future option.

4. Green Infrastructure and Under Street Storage Solutions

Green infrastructure solutions and street stormwater storage were also considered. Green infrastructure includes Low Impact Design (LID) methods, which are an effective and responsible stormwater management technique, especially when combined with other upgrades to improve water quality and reduce time of concentration for runoff. While not a LID method, the utilization of oversize storm sewers for detention within the street right-of-way (ROW) was included in this potential solution set. ROW storage is very effective when combined with LID methods and is easily completed as part of a road reconstruction project. The types of ROW treatment solutions considered included:

- Porous pavement for select road reconstructions and private parking lots. Stone reservoirs for runoff storage under the pavement are also very possible.
- Road diets (reducing the road cross section width) to reduce impervious area
- Rain gardens at surface detention areas and rear yards – private
- Oversize pipe storage

A cost benefit analysis for the ROW treatment improvements was completed utilizing information from completed projects. Several sample ROW treatment projects were chosen that would be similar to stormwater management projects that could be completed within the watershed. Note that the chosen projects were generally street reconstruction projects on City controlled rights-of-way, although there are some small basin improvements included. For study purposes, LID solutions for large parcels within the Upper Malletts watershed were evaluated as part of the detention screening alternatives.

- Stone School Road Stormwater Facilities (I-94 to Eisenhower) – The project includes constructing oversize pipe for storage and 20 small rain gardens to manage the "first flush" storm and a large portion of the bankfull event. The first flush system is designed to control the first 0.5 inches of rain and the bankfull storm event is approximately equal to a 2-year storm.
- Miller Road Green Corridor (Maple to Newport) - The project includes constructing oversize pipe for storage and small rain gardens. Bioretention facilities are also included in the project outside of the road right-of-way. The improvements manage the first flush storm and a portion of the bankfull event.
- W. Madison Ave – The project has one block of infiltration via stone trench along with small rain gardens at intersections. It also includes oversized pipe for additional storage. Overall, the project will manage the first flush and bankfull events.

Table V-3 summarizes the potential storage volume and costs for each of the sample projects. The volume of storage per foot of street and the cost per cubic feet of storage were also averaged for use in the LID analysis. The recommended projects are also shown for comparison purposes.

Table V-3: LID Volume/Cost Analysis

Street / Project Site Name	Storage Volume (cf)	Project Costs	Cost/Volume Storage	Length (ft)	Volume per Length (cf/ft)
Project Recommendations					
Eisenhower Churchill Park Basin	470000	$2,095,000	$4.46		
Pioneer Basin (Scio Church)	400000	$1,169,000	$2.92		
Lawton Park Basin	280000	$5,362,000	$19.15		
Comparative Projects (as constructed)					
Pioneer Basin (Stadium)	255000	$4,203,543	$16.48		
Doyle Park*	1910000	$3,646,668	$1.91		
Right-of-Way Storage Projects (as constructed)					
Stone School	15300	$5,404,000	$353	1615	9.5
Miller Road	41200	$1,792,000	$43	4600	9
W. Madison Ave.	17700	$3,196,200	$181	2500	7.1
Equivalent Needed to Treat Upper Malletts Stormwater in Road ROW					
Eisenhower	470000	$65,677,900	$139.74	55078	8.5
Pioneer	400000	$55,896,100	$139.74	46875	8.5
Lawton	280000	$39,127,300	$139.74	32812	8.5

* Doyle Park involved a retrofit of a basin that was originally constructed in 1977. Excavation costs were low as a result.

To compare the ROW solutions with other types of management techniques, the sample projects were averaged for the volume provided per foot of street reconstruction and the cost per cubic foot of storage achieved. As a general rule, the ROW solutions are not as cost effective as the open detention or underground detention systems. The ROW solutions cost per cubic feet of storage ranges from $43 to $353 with an average of $119.08. Comparatively, proposed open detention ranges between $2.92 to $4.46 per cubic foot (an average of $3.69) and underground detention is estimated at $19.15 per cubic foot.

In addition to cost, the length of street required to provide an equivalent volume of storage was compared, and the total cost for providing that detention was calculated. The average value for volume per foot of street storage of 8.5 cubic foot/foot was used for this calculation. Also, the average cost per mile for the sample ROW treatment projects was calculated at $6.63 million, which was used to determine the total project costs for an equivalent road length needed to treat the Upper Malletts stormwater using ROW treatment.

City street mileage within the defined Upper Malletts watershed is approximately 15.8 miles. That is not enough mileage, even after reconstructing all the streets, to provide total the required detention volume necessary to manage the March 2012 flooding. If detailed engineering studies of each street were conducted, it is likely the volume of storage available per foot of street could be increased. The stone reservoir under the street could be increased in depth or some type of open bottom chamber could be utilized. Other utilities located in the right-of-way, such as water main and sanitary sewer, may also limit the amount of storage that could be achieved. Ultimately a cost versus benefit analysis for each street should be conducted to determine the amount of storage that can be achieved.

Underground storage was also evaluated for a simpler alternative. During future road construction, storm sewer trench backfill or two feet of road base material could be replaced with stone backfill instead of the typical granular material. Using some typical cross sections – sewer trenches 5 feet deep, 36" sewer, 1:1 side slopes and road base 24 feet wide and two feet deep – additional storage could be obtained with a nominal cost increase. Assuming 35% void space, the stone storm trench and stone road base would generate approximately 8 and 17 cubic feet of storage per foot of length, respectively. Incremental cost for stone versus sand backfill is approximately $17 per foot of length for both options. The net result is the cost for volume of storage for pipe trench backfill is $2.13 and for road base backfill is $0.94. This compares very favorably to the per cubic foot costs for open and underground detention systems. Note that the storage amount per foot would likely end up less than the amount calculated due to underground conflicts, but this may be a reasonable alternative to other types of street detention.

After the initial public meetings and reviewing the soils information, small individual rain gardens were not further quantified or analyzed. Soil saturation is an issue and there have been a number of basement seepage complaints in the watershed. Comments were also made about how frequently sump pumps in various areas are running. WCWRC has assisted in private property rain garden construction, on an individual basis, in Upper Malletts and will continue to do so.

This analysis was completed to provide a comparison of ROW storage methods versus open land storage possibilities. Because they are large impervious surfaces, roads and streets are significant contributors to the stormwater volume in any particular area. In many areas of the City, open land simply isn't available for construction of basins to store street runoff. ROW storage becomes the only viable option for reducing stormwater impact. Fortunately, in the Upper Malletts area there are several large open spaces where detention can be implemented and is very cost effective when compared to other alternatives, hence the recommendations. These methods are not mutually exclusive. ROW rain gardens and swales, stormwater retrofit storage under road surfaces, tree boxes and other Low Impact practices should be considered as opportunities arise. The upcoming road work at S. Seventh and Scio Church represent such an opportunity.

Where opportunities exist, ROW treatment and private rain gardens should be combined with other improvements to improve water quality and provide some additional storage, but the significant amount of volume required to mitigate events like the March 2012 storm simply cannot be cost effectively managed by LID solutions. Depending on order of implementation, the final basin sizes recommended by the study may be reduced by the volume achieved using LID storm detention in the streets.

It should also be noted that both the Eisenhower basin and the Pioneer basin can be developed as LID solutions. The design should include grading to minimize impact on the surrounding area and the proper plantings to allow future infiltration.

C. Recommendation of Alternatives for Detailed Analysis

Based on public feedback and an evaluation of the feasibility of each alternative, the project team, in conjunction with the Citizens Advisory Group, identified seven potential alternative combinations of detention options. The Eisenhower Park, Lawton Park, and Pioneer High School (East of 7th Street) were selected based on having the highest scores, particularly in their storage potential and ability to meet project goals. The Scio Church storm sewer improvement project was also chosen due to its connection to the Pioneer detention project and the fact that it is on the City's Capital Improvements Plan for 2015. This made it very likely that a stormwater management project would be completed soon.

F. Alternatives

Three different alternatives were analyzed using the model. The alternatives were derived from the preliminary analysis of detention/storage locations. The alternatives incorporate sewer improvements plus engineered detention basins. The alternatives are cumulative or a progression based upon the previous alternative.

1. Project A – Eisenhower Park

This alternative would add two detention basins in Eisenhower Park. The two basins together are 2.5 acres in size, would have a combined storage volume of 10.8 acre-ft. and are connected by a 42" pipe (Figure VI-7). Flow from the Covington Road storm sewer would be diverted to these new basins by installing 42" storm sewer along Scio Church Road. It is expected that LID techniques would be incorporated into the project.

Figure VI-7: Project A - Eisenhower Park Basins and Sewer Improvements

2. Project B – Pioneer High School

Building upon Project A, a detention basin would be created along the north side of Scio Church Road just east of 7th Street as shown in Figure VI-8. This basin is 2.8 acres in area and has a storage volume of 9.2 acre-ft. Since Scio Church Road will be completely reconstructed soon, the storm sewer in Scio Church would also be sized to accommodate a portion of the detention volume for the area. The amount of storage that could be achieved in the Scio Church storm sewer will be determined during detailed design and deducted from the open detention basin volume.

Figure VI-8: Project B – Pioneer Basin and Sewer Improvements

3. *Project C – Lawton Park*

An underground detention basin would be constructed along the eastern edge of Lawton Park along with a new storm sewer under Scio Church Road and Mershon Drive as shown in Figure VI-9. The project also includes the replacement of a small section of the Upper Malletts Drain storm sewer between the Lans Basin and 7th Street and the removal of a sediment bar in the west portion of Lans Basin. The storm sewer replacement may help mitigate upstream flooding with Projects A and B as well, however; since excess runoff is not fully detained in these two (2) projects, increasing the pipe size at 7th Street could result in adverse downstream effects. Adding a basin at Lawton Park maximizes upstream detention before improving downstream hydraulics. Improved hydraulic components near 7th Street were not included in the hydraulic modeling process for Projects A or B.

The underground detention basin uses connected box culverts to create a storage capacity of 6.4 acre-ft. The basin encompasses an area of approximately 1.1 acres. The basin will be connected to an overflow structure that will prevent the flooding of the storage chamber and allow flow downstream through the storm sewer under Mershon Drive. The location shown on Figure VI-9 is a schematic and conceptual only to determine if sufficient area exists within the park to construct a basin. During the final design process, the location and shape of the basin should be refined based on a thorough public input process. Concerns about construction disturbance were voiced during the study public process that will need to be addressed. The intent would be to locate the basin as far as possible from the homes.

Note that the property at 2036 Mershon has a gravity feed drain for the house's footing drain that was installed in lieu of a sump pump. The gravity line from the footing drain is connected to the storm sewer in Mershon. This connection should be maintained when the storm sewer in Mershon is replaced to accommodate the Lawton Park basin.

The proposed culvert replacement at Seventh Street should be installed after all three detention facilities have been constructed. With Project A or Project B, the design storm will likely still produce overland flow at Seventh Street. Therefore, all of the stormwater is not reaching the main Malletts Creek storm sewer in these projects. Only in Project C is the stormwater completely contained within the pipe system

G. Flood Maps

Flood maps (Appendix A: Flood Maps) were created for all four models (existing conditions, Eisenhower Park, Pioneer HS, Lawton Park) for four (4) rainfall events (March 15, 2013, 2, 10, and 100 year design storms). The maps show locations where there is a possibility of flooding the roadway or adjacent land. As a benchmark for quantifying improvement for each project, the March 15 storm event will be used as reference in the following section. As noted previously, this storm event was roughly equivalent to a 10-year, 3-hour storm event.

1. Project A – Eisenhower Park Basin

Analysis of Project A showed a substantial decrease in flooding due to the addition of the Eisenhower Basin, specifically along Wiltshire Court and Churchill Drive. There was also some decrease in flood levels shown along Delaware Drive and Mershon Drive. The decrease in flooding shown along Covington Drive and Hanover Road was attributed to inlet improvements above and beyond the improvements created by adding the Eisenhower Basin. Overall, model results indicate approximately 11 acres less flooding in Project A in comparison to existing conditions for the March 15 storm.

2. Project B – Pioneer High School Basin

With the addition of the Pioneer Basin and Scio Church storm sewer as part of Project B, modeled flooding areas were shown to decrease by an additional two (2) acres beyond what was predicted for Project A. Improvements under this alternative would be focused primarily along Scio Church Road, Ascot Road, and Chaucer Drive.

3. Project C – Lawton Park Basin

By implementing Project C, model results indicate approximately two (2) fewer acres of flooding for the March 15 storm when compared to Project B. This would bring the total reduction in flooding during the March 15 storm to around 15 acres when compared to existing conditions. The focus of flooding reduction generated by Project C would be near the proposed Lawton Basin, along Delaware Drive and in back yards between Delaware Drive and Morehead Drive.

H. Cost Analysis

Detailed line item cost estimates were prepared for the recommended alternatives. The costs were based on conceptual designs and the best available information. The costs were developed using 2013 dollars and can be used for future budgeting or funding applications with the appropriate inflation factored in. A contingency factor of approximately 20%, costs for professional services and permitting are included in the cost estimates to give a true picture of the scope of the investment necessary to implement the projects. Copies of the detailed estimates are included in Appendix E.

In order to provide comparison against other types of projects, including the LID projects previously analyzed and projects recently constructed, the total costs for each of these projects was also converted to cost per cubic feet of storage.

Table VI-4: Alternative Costs

Street / Project Site Name	Storage Volume (cf)	Project Costs	Cost/Volume Storage
Eisenhower Park Basin	470,000	$2,100,000	$4.50
Pioneer Basin	400,000	$1,170,000	$2.90
Lawton Park Basin	280,000	$5,155,000	$18.40
Total		**$8,425,000**	

For comparison purposes, the Doyle Park project noted in Table V-3 was recently completed at a cost of $3.65 million, including all construction and professional costs. The project involved 1.91 million cubic feet of storage, resulting in a per cubic foot cost for storage of $1.91.

These projects are significant in size and scope. Project funding may be available for projects of this type through the State of Michigan State Revolving Fund, SAW Program, and other programs may be available in the future. However, most programs would be loans rather than grants, requiring long term payback of the principal with interest. If these projects will be implemented, they will be included in the City's long-term capital improvement planning to determine priority and the feasibility of future funding.

VII. RECOMMENDATIONS & CONCLUSION

Five public meetings were held with an average attendance of more than 50 citizens. Field meetings were held at more than 20 reported flooding locations. To reach the conclusions in this study, specific problems identified by neighborhood residents were compiled and analyzed, overall goals were agreed upon during public process, and a cost-benefit analysis including modeling and simulation of dozens of situations was performed. Storage within the project area was found to best meet project goals.

Of 17 potential storage sites, three detention solutions and one storm sewer improvement must be completed to effectively manage the flooding within the Upper Malletts Creek watershed to meet the stated objective of a dramatic reduction in surface flooding during an event like March 15, 2012. Storage at Eisenhower Park, Lawton Park, and Pioneer High School (east of 7th Street) were selected. The Scio Church storm sewer improvement project was also chosen due to its connection to the Pioneer detention project. Each solution manages stormwater for a portion of the watershed and reduces a percentage of the overall flooding previously experienced. In addition, there are other minor storm sewer improvements included with each basin that must be completed for the system to work properly.

This report provides a suite of three solutions because none of the 17 storage sites or other alternatives considered were found to have a substantial positive impact on all of the reported flooding problems, mainly due to three factors. The 886 acre watershed, topography, and resulting flow paths of the water did not allow for development of other feasible alternatives (to this suite of three projects) that would provide a benefit to all or even a majority of the neighborhood. Thus, each phase provides relief to specific geographic sub-areas with Project A having the most immediate positive impact for the most residents, both on quantity of flow managed and reduction in severity and number of problems in future rain events. Project B is listed second primarily due to the programming of Scio Church Road in the near future. In summary, the City could choose any sequencing desired, but based on the analysis described in this report, if phasing is required, we would recommend Project A as the first to move forward.

Details on the recommended improvements include:

Project A – Eisenhower Park Basins and Storm Sewer Improvements
This alternative adds two detention basins in Eisenhower Park. The two basins have a combined storage volume of 10.7 acre-ft. and are connected by storm sewer. In addition to the two detention basins, flow from the Covington Road sewer was diverted directly into the proposed North basin, to provide the most cost-effective relief for downstream residents.

Project B – Pioneer Basin and Scio Church Storm Sewer Improvements
A detention basin would be created along the north side of Scio Church Road just east of 7th Street. This basin has a storage volume of 9 acre-ft. The storm sewer in Scio Church would also be sized to accommodate a portion of the detention volume for the area.

Project C – Lawton Park Basin and Storm Sewer Improvements
An underground detention basin would be constructed along the eastern edge of Lawton Park. This underground detention basin would use connected box culverts to create a storage capacity of 6.4 acre-ft. The basin would be connected to an overflow structure that would prevent the flooding of the storage chamber and allow flow downstream through the Mershon storm sewer. New storm sewer would be installed along Mershon Drive and Scio Church Road to convey water into the new basin. Also, a small section of the Malletts Creek storm sewer would be replaced at 7th Street and sediment would be cleaned out of the western end of Lans Basin.

The total project cost for all projects is approximately $8.425 million.

Also as part of the study, cleaning and storm sewer inspection of over 35,000 feet of City and County owned pipes and structures within the watershed was completed. The inspection found the sewer system to be in generally good condition and functioning at design capacity. Minor deterioration or sediment and debris deposits, consistent with expectations for a system of this size and age, were found and the initial findings were that pipe deterioration or obstructions in the main line of the storm sewer system were not a significant factor in previous flooding events, with the exception of a likely external blockage on 3/15/12 of the 42" diameter pipe west of Wiltshire Boulevard. Corrective measures were completed or are being planned for this suspected issue along with the few routine maintenance issues that were found. In addition, the County worked with Pittsfield Township to resolve long-standing deficiencies with a large detention basin at the Ice Cube, and that construction is nearly complete.

After gathering public input and feedback on the stormwater management alternatives, selections were made that were both functional and acceptable to stakeholders who shared a common goal of improved stormwater management in the area. Implementation of the recommended solutions will effectively achieve the project goals, including reducing the severity and probability of future surface flooding in the Upper Malletts Creek watershed, using the 3/15/12 storm event as the basis of conceptual design.

Should the City wish for the WCWRC to proceed with one or more of the recommended solutions, a petition would be required. As with other joint projects to implement study concepts, a project-specific public engagement and design process would allow further input from neighbors on both implementation and restoration.

Appendix E: Detailed Cost Opinions

PRELIMINARY ESTIMATE OF COST

UPPER MALLETTS STORMWATER CONVEYANCE STUDY
PIONEER DETENTION BASIN
CITY OF ANN ARBOR
WASHTENAW COUNTY

Item No.	Estimated Quantity	Unit	Description	Unit Price	Amount
DETENTION POND CONSTRUCTION					
1.	1	Lump Sum	Mobilization	$7 000.00	$7 000.00
2.	4	Acres	Site Clearing and Tree Removal	$8 000.00	$32 000.00
3.	25 000	Cu. Yd.	Earth Excavation	$8.00	$200 000.00
4.	25 000	Cu. Yd.	Spoil Hauling	$13.00	$325 000.00
5.	1	Lump Sum	Allowance for Relocate Disc Golf Course	$5 000.00	$5 000.00
6.	1	Lump Sum	Landscaping, Final Grading, Seeding and Mulching	$25 000.00	$25 000.00
Subtotal Detention Pond Construction					$594 000.00
STORM SEWER IMPROVEMENTS					
7.	230	Lin. Ft.	36" Storm Sewer	$120.00	$27 600.00
8.	130	Lin. Ft.	10" Storm Sewer	$40.00	$5 200.00
9.	2	Each	36" Flared End Section	$200.00	$400.00
10.	1	Each	48" Outlet Control Structure	$4 000.00	$4 000.00
11.	1	Each	5' Diameter Manhole	$6 000.00	$6 000.00
12.	2	Each	Disconnect Existing Storm Sewer	$600.00	$1 200.00
13.	1	Lump Sum	Ditch Maintenance	$4 000.00	$4 000.00
14.	100	Lin. Ft.	Concrete Curb & Gutter, Remove and Replace	$30.00	$3 000.00
15.	100	Sq. Ft.	Concrete Sidewalk, Remove and Replace	$6.00	$600.00
16.	1	Lump Sum	Site Clean-Up	$2 000.00	$2 000.00
17.	1	Lump Sum	Soil Erosion and Sedimentation Control	$4 000.00	$4 000.00
18.	1	Lump Sum	Traffic Control	$15 000.00	$15 000.00
Subtotal Storm Sewer Improvements					$73 000.00
SCIO CHURCH ROAD 24" STORM SEWER PROJECT					
19.	1 600	Lin. Ft.	24" Storm Sewer	$60.00	$96 000.00
20.	4	Each	4' Diameter Manhole	$3 000.00	$12 000.00
21.	8	Each	Storm Inlet Connection	$500.00	$4 000.00
Subtotal Scio Church Road 24" Storm Sewer Project					$112 000.00
Subtotal - Pioneer Detention Basin					**$779 000.00**
Contingency					$160 000.00
Professional Services and Permitting					$230 000.00
TOTAL PROJECT COSTS					**$1 169 000.00**

NOTE: All costs associated with pavement removal, replacement, and restoration of Scio Church Road shall be performed by others as part of a separate project.