Washtenaw County Water Resources Commissioner

2019 State Revolving Fund Project Plan

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Section I - Introduction

The Washtenaw County Water Resources Commissioner's office (WCWRC) submitted a project plan for SRF funding on July 1, 2017. This 2019 Project Plan is intended to revise several existing projects from that plan, remove some and provide an opportunity for funding for several new projects that were not included in a previous project plan.

The Washtenaw County Water Resources Commissioner (WCWRC) has chosen to take action to improve water quality in the Malletts, Allen, Millers, and Traver watersheds, as well as the watershed which directly discharges to the Huron River and Stony Creek from Paint Creek. The purpose of this Project Plan is to help reduce non-point source stormwater pollutants (NPS) and manage flow in County drains by detention and treatment or retention and infiltration of stormwater runoff.

Focusing on NPS pollutant removal will help the County achieve the Michigan Department of Environment, Great Lakes, and Energy's (EGLE), enforced Total Maximum Daily Loads (TMDL) for phosphorous, *Escherichia coli (E. coli)*, dissolved oxygen (D.O.) and biota along the Huron River and Stony Creek from Paint Creek. Associated volume reductions will improve hydrologic conditions throughout the basin and limit downstream hydraulic impacts.

In 2005, the County developed an SRF Project Plan for Marybeth Doyle Park project located in the Malletts Creek watershed. In 2008 and 2009, the County 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 of Ann Arbor. This plan was updated with an amendment in 2011. In 2013, the County submitted another SRF Project Plan which was revised in 2014. 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 runoff volumes due to urbanization which causes neighborhood flooding and poor downstream water quality. The Paint Creek recently was a coldwater tributary that flows south though an in-stream detention basin, thence, to the confluence of Stony Creek. 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 completion of the first SRF NPS funded project started in 2006 - 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 County waterways.

The locations and projects presented in this 2019 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 14 projects that will be presented in this year's amended Project Plan are listed herein.

Projects were partially 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 practicable 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. Additional projects were selected in surrounding townships by the WCWRC.

1. Briarwood Mall Ponds – Water quality improvements at 4 inline basins, including outlet reconfigurations.
2. Churchill Downs Park Stormwater Improvements – Regional detention basins will be constructed on the existing park property, and an additional property upstream of the existing location to reduce flashiness and improve water quality.
3. 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 and detain bankfull volume and provide stormwater quality enhancements. Based on the preliminary soil borings, this site is not suitable for infiltration.
4. 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.
5. Lawton Park Detention Basin – A regional detention basin will be constructed on the existing park property to improve water quality and reduce flashiness downstream.
6. Malletts Creek Streambank Stabilization – Various areas as noted herein:
    - Main St to Eisenhower Parkway – Streambank stabilization from the six culverts site to Eisenhower.
    - Ann Arbor Saline Rd to Main St – Streambank stabilization/restoration. This project segment is referred to as Cranbrook Park.
    - Fire Station Pond to Signature – Streambank stabilization.
7. Millers Creek Reach 5 Channel Modification – Project to take place from Glazier Way to Lake Haven Dr. to reduce streambank failures and address heavy sediment loading.
8. S. Seventh Street (Greenview Drive to Scio Church Road) – Resurfacing including narrowing roadway and providing stormwater management.
9. Street Tree Planting – Throughout city rights-of-way, easements, and public properties.
10. Traver Creek Tributary Streambank Stabilization – Streambank erosion.
11. Springwater Phase IV – Replacement of existing storm sewer system in streets slated for reconstruction using green street design. Installing oversized sewers to contain first-flush volume.
12. Swift Run MDOT – Naturalized detention basins will be constructed in the MDOT right-of-way to reduce flashiness and improve water .
13. Carpenter Road Drain Project – Streambank Stabilization. Redirecting flow from Upper Paint Creek to allow siphon to outlet to Upper Paint Creek. Redirecting flow from Upper Paint Creek and retrofitting existing pond in order to improve water quality.
14. Miller Drain/Upper Paint Creek - Streambank Stabilization to reduce sediment loading.

Section II - Project Background

A. Study Area Characteristics

1. Delineation of the Study Area

The Study Area is defined as the portion of Washtenaw County contributing flow from the Malletts, Miller, Traver, Upper Paint Creek, Swift Creek 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 and Paint Creek as shown on Figure 1. The contributing area is approximately 29.7 square miles.

The Study Area is primarily located in the City's metro-downtown area; 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.

The activities proposed within this Project Plan are focused on numerous locations throughout the Ann Arbor – Ypsilanti area. See Figure 2 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 3). 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 4 through 8 for locations of park and recreation areas owned by the City, Townships, and County. There are approximately 38 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 County:

Table II-1: Washtenaw County 2008 Land Use/Land Cover (acres/%)

Land	Acres	Percent
Residential	192,409	41.6%
Single-Family Residential	189,512	41%
Multiple-Family Residential	2,897	0.6%
Non-Residential	93,621	20.2%
Park, Recreation, and Open Space	35,031.2	7.6%
Transportation, Communication & Utility	19,104.5	4.1%
Industrial	15,317	3.3%
Governmental/Institutional	13,560.4	2.9%
Water	10,607.9	2.3%

Source: SEMCOG website, Land Cover was derived from SEMCOG's 2010 Leaf off Imagery.

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. Nearly the only available green space that is not developed is associated with City-owned and Township-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 and Stony Creek. The landscape is highly impervious, 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 EGLE established TMDLs. The TMDLs for the Study Area are as follows:

Geddes Pond (Huron River) – *E. coli*

Malletts Creek – Biota

Ford and Belleville Lakes – Phosphorus

Swift Run Creek – Biota

Paint Creek (Stony Creek) – Dissolved Oxygen, *E. coli*

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

There are several lakes and impoundments located within Washtenaw County 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 3 for the locations of the wetlands within the Study Area and Figure 9 for the locations of the floodplains and floodways. The following are the waterways within the Study Area:

- Huron River
- Malletts Creek
- Allen Creek
- Miller Creek
- Swift Run Creek
- Traver Creek
- Upper Paint 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 EGLE 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.

The water supply in Ypsilanti and Pittsfield Townships are provided by the Ypsilanti Community Utilities Authority (YCUA). The water is obtained from the Great Lakes Water Authority (GLWA) and is sourced from the Detroit River.

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 County's current NPDES permit.

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	33,225
Trinity Health	7,435
U.S. Government	3,060
Ann Arbor Public Schools	2,225
Faurecia North America	2,178
Eastern Michigan University	1,559
Integrated Health Associates (IHA)	1,442
State of Michigan	1,409
Washtenaw County	1,264
Thomson Reuters	1,155

Source: Crain's List: Washtenaw County's Largest Employers (dated July 2018)

2. Household Income

The median annual household income in 2015 (per SEMCOG) in Washtenaw County was $61,003.

3. Economic Climate

Washtenaw County is most affected by the presence of the University of Michigan, which influences the composition of the County'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 the County into the year 2045.

C. Existing Facilities

WCWRC is responsible for the design, construction, and operation and maintenance of over 500 stormwater management systems and flood control systems within Washtenaw County. This accounts for approximately 700 miles of drains. These range from open channel flow, to enclosed systems, and lake level controls. Additionally, the City of Ann Arbor has over 540 miles of stormwater conveyance system, and over 23,000 inlets and catch basins. NPDES Phase I or Phase II stormwater permit holders include Washtenaw County, the City of Ann Arbor, the University of Michigan, Ann Arbor Public School District, and the Michigan Department of Transportation.

The Study Area is primarily located in the City's metro-downtown area; storm sewers serving most of the community are owned and operated by the City of Ann Arbor and generally drain to County Drains. Figure 8B shows a map of WCWRC County Drains located in Ann Arbor Township (available on the WCWRC website).

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, Stony Creek and its many contributing waterways by the EGLE has led to the establishment of several TMDLs in the County. 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*
- Malletts Creek – Biota
- Swift Run Creek – Biota
- Paint Creek – Dissolved Oxygen, *E. coli*

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), Stony Creek Watershed Management Plan (SCWMP), the Malletts Creek Restoration Project (MRP), (2000). 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 and Stony Creek watersheds and their 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.

Most of the 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, Malletts Creek, Swift Run, Traver, 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.

Paint Creek has existing TMDL's for Dissolved Oxygen and *E. coli*. Projects that focus on TSS reduction and infiltration, and streambank stabilization will be beneficial toward these existing TMDLs.

EGLE does not issue TMDLs for TSS. However, TSS is a surrogate for the biota TMDL. Malletts Creek has a biota TMDL. Projects within this creekshed that reduce 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 stormwater improvement projects like Geddes Avenue (Arlington Boulevard to Huron Parkway), the S. Forest street project, Rain Gardens Project for the Huron River Green Infrastructure Drainage District, Streambank Stabilization in Traver Creekshed, Stadium Blvd from Main St to Kipke, and Green Infrastructure in the Allen Creekshed. Finally, over 7,000 tree plantings have been completed in the last 7 years. This task has continued over the last two years and will continue.

The need for most of these locations come from the City's Capital Improvement Process (CIP) which entails a system evaluation where paving needs, other utility needs, or flooding concerns is ongoing. 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, Paint Creek and contributing waterways within the City and County 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 now 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 County is included in Appendix D.

c. Discharge Data

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

2. Orders

This section is not applicable to this Project Plan. There have been no orders of any kind.

3. Water Quality Problems

a. Point and Non-Point Sources of Pollution

The priorities 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, SCWMP, 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 River and Stony Creek watersheds and their 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 in the CIP Projects. 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 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), total suspended solids (TSS), dissolved oxygen, and *E. coli*.

Phosphorous is a nutrient commonly found in water affected by eroded soils, and attributed to erosion, 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, Stony Creek 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 Malletts 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 Malletts Creek 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 (2001) 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.

Dissolved oxygen results in fish kills, especially trout, since there must be sufficient available oxygen to fulfill minimum metabolic demands. Fish can sometimes resist or tolerate short-term oxygen reductions and/or temperature increases. It has been determined that certain trout species may temporarily adjust to reduced D.O. levels or increased temperatures if D.O. declines and/or temperature increases are not abrupt. The oxygen deficit causing the dissolved oxygen nonattainment status is evident by the TDML for Paint Creek, which flows to Stony Creek.

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, Stony Creek, and improve base flows.

b. Unsewered Areas

The project areas are served 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 City 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:

- 1250 N. Main Area Storm Main Relocation
- Allen Creek Railroad Berm Opening
- Arboretum Culverts and Headwalls (School Girls Glen)
- Capital Reconstruction of Structures/Resurfacing
- Edgewood/Snyder SWMM Area Stormwater
- Evergreen Subdivision Storm Water (Phase II)
- Flood Mitigation Implementation Grant Matching
- Glendale/Charlton SWMM Area Stormwater Storage
- Huron Parkway Median Bio-swales
- Lower Allen Creek SWMM Area Stormwater Improvements
- Marlborough Storm Main Replacement
- Michigan Stadium Storm Sewer Reroute
- Mulholland Drive SWMM Area Stormwater Improvements
- Park Place Apartments SWMM Stormwater Improvements
- Parkwood/Pittsfield Village SWMM Area Stormwater Improvements
- Placid Way Culvert and Headwall Replacement
- Signature Drive SWMM Area Stormwater Improvements
- Sister Lakes Stormwater Improvements
- South University/E. University SWMM Area Stormwater Improvements
- Springwater Phase V Stormwater Improvements
- Stadium Blvd (Main to Kipke) Storm Sewer Replacement
- State St. (Kinglsey to Fuller/Depot) Storm Sewer Improvement
- State St MDOT Stormwater Management Improvements
- Storm Sewer Rehabilitation and Lining Projects
- Stormwater Asset Management Plan
- Stream Bank Stabilization (Future locations)
- Traver Rd/Barton SWMM Area Stormwater Improvements
- Tuebingen Culvert Rehabilitation
- Village Oaks-Chaucer Court Stormwater Improvements

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 within Washtenaw County 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 projected populations provided by SEMCOG:

Table II-3: Existing and Projected Population in Washtenaw County

Year	Population
2010 (actual Census)	344,791
2015	*358,551*
2020	*375,486*
2025	*395,790*
2030	*415,606*
2035	*431,785*
2040	*444,139*
2045	*452,791*

Source: Census Data for Washtenaw County, SEMCOG website, accessed March 2019. U.S. Census Bureau and SEMCOG 2045 Forecast.

2. Current population served by existing facilities

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

3. Current and future population served by the proposed improvements

Discussion of this item is not applicable for an 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 seven (7) Project Plans and Project Plan amendments, which included many projects. These projects are outlined in Table II-4 below:

Table II-4: Status of NPS Projects

Project	**Status**
2005 Project Plan:	
Doyle Park	Completed
2008 Project Plan:	
Pioneer High School	Completed
Miller Road	Completed
Farmer's Market	Completed
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 – Completed
2009 Project Plan:	
Stadium – Suffolk to Seventh	Completed
Stadium – Seventh to Kipke	Included in 2013 Plan
West Park	Completed
Madison – Seventh to Main	Completed
Miller – Chapin to Main	Completed (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
Malletts/Ellsworth Basin	On hold (unlikely to proceed)
Stone School Road Retrofits	Completed
South State Street	On hold (MDOT)
Swift Run MDOT Improvements	On hold (MDOT)

Burns Park Alley	Completed
Millers Creek Projects	Included in 2017 Plan
Malletts Creek – Chalmers to Huron Parkway	Completed
Malletts Creek – S. Huron Parkway	Completed
Malletts Creek – Platt/Manchester	Completed
Malletts Creek – Packard to Outfall	Removed from List
Malletts Creek – E/W Research Drive	Included in 2017 Plan
Malletts Creek – Boardwalk/South State	Removed from List
Malletts Creek – Eisenhower to Oakbrook	Included in 2017 Plan
Traver Creek – Barton Drive	Completed
Millers Creek Drainage District Establishment	Completed
Tree Plantings	Completed
Cistern Installations and Downspout Disconnections	Completed
Lans Basin	Completed
2011 Project Plan:	
Miller Road – Maple to Newport	Completed
Willard Street	Completed
Stadium Road Bridges	Completed
Fourth Avenue – Huron to Liberty	Completed
Stone School Road – Packard to I-94	Future Project
Seventh – Pauline to Madison	Completed (Mill and Fill, No SRF)
South Forest – Hill Street to University	Completed
Springwater Subdivision	Completed
Detention Basin Retrofits	Briarwood – 2017 Plan
Compost Center	Not Needed
Dexter Ann Arbor Road – N. Maple to Revena	Completed
Madison – Seventh to Main	Completed
Stadium – Hutchins to Kipke	Included in 2013 Plan, Main to Kipke Completed
Leslie Park	Completed
Leslie Science Nature Center	Future Project
2013 Project Plan:	
Geddes Avenue – Arlington to Huron Pkwy	Completed
Detroit Street – Catherine to Division St	In 2017 Plan
Farmers Market Parking Lot	Not Completed
Briarwood Mall Ponds	In 2017 Plan
Malletts Creek – Cranbrook Park	In 2017 Plan
Huron Hills Baffle Box	Not Completed

State Street – Eisenhower to south of I-94	Not Completed
Scio Church – Main to east of Seventh St	In 2017 Plan
Stadium Drive – Hutchins to Kipke	In 2017 Plan, Main to Kipke Completed
Research Park Wetlands Detention	In 2017 Plan
Huron Hills Golf Course	In 2017 Plan
S. Seventh Street – Greenview to Scio Church Rd	In 2017 Plan
721 N. Main Street	Not Completed
Village Oaks	Underway
Maple Village Shopping Center	Not Completed
Lawton Park Detention Basin	In 2017 Plan
Churchill Downs Park	In 2017 Plan
2017 Project Plan:	
Briarwood Mall Ponds	In 2019 Plan
Churchill Downs Park Stormwater Improvements	In 2019 Plan
Detroit Street Brick Road	In 2019 Plan
Division Avenue Stormwater Improvements	Not Completed
Fifth Avenue Stormwater Improvements	Not Completed
Geddes Avenue Stormwater Improvements	Not Completed
Huron Hills Golf Course	In 2019 Plan
Lawton Park	In 2019 Plan
Mallets Creek Streambank Stabilization	In 2019 Plan
Millers Creek Reach 5	In 2019 Plan
Millers Creek Reach D	Underway
Pioneer High Stormwater Basin	Future Project
Scio Church Road (Main to Seventh Street)	Not Completed
Scio Church Road (Maple to Seventh Street)	Not Completed
Seventh Street (Scio Church to Greenview)	In 2019 Plan
Stadium Drive	Not Completed
Street Tree Planting	Underway
Traver Creek Tributary	In 2019 Plan
Research Park	Not Completed
Chalmers Drive (Wasthenaw to Woodcreek)	Not Completed
Nixon Road (Huron to Barclay)	Not Completed

G. Environmental Setting

1. Cultural Resources

The City is committed to preserving and protecting historical sites. The Historic Preservation Coordinator at Ann Arbor 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. The Michigan State Historic Preservation Office (SHPO) was contacted and a research appointment conducted. The Miller Drain project area was identified as a potential area for further investigation. All projects will comply with further SHPO review once funding is received. WCWRC and the City will work closely with the City's Historic Society and SHPO to preserve cultural resources of these areas.

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. An EGLE 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 EGLE 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 Malletts, Swift Run, Upper Paint Creek, Traver, Huron River, and Millers Creek, 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 EGLE 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. Several of the project locations are within Huron Hills Golf Course, which is owned by the City, Churchill, Traver, Cranbrook, and Glazier. Montibeller Park is owned by Pittsfield Township.

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 presence of steep slopes. Topography maps for each project area are currently pending and will be provided in the final draft.

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.

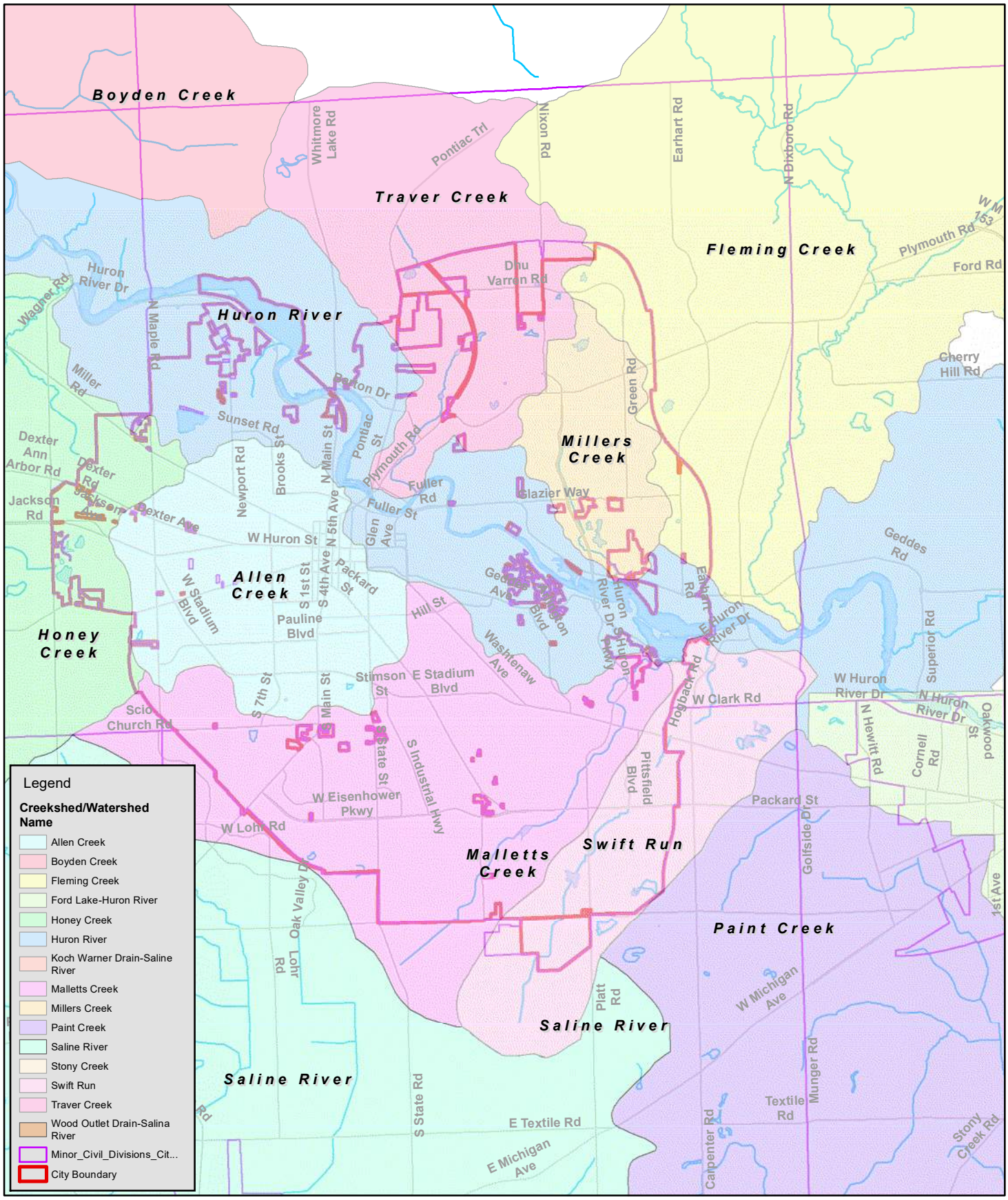
o. Existing Plant and Animal Communities:

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 2019, using the U.S. Fish and Wildlife Service's (USFWS) website for Endangered Species Section 7(a)(2) Consultation Process (https://www.fws.gov/Midwest/endangered/section7/index.html.) Endangered species listed as

having a presence in Washtenaw County include the Indiana bat, Mitchell's satyr butterfly and the long-eared bat. Candidate species include the Eastern massasauga snake. Best management practices will be implemented to minimize and avoid impacts to threatened and endangered species.

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.



Watersheds Map
WCWRC 2019 Project Plan

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Figure 1

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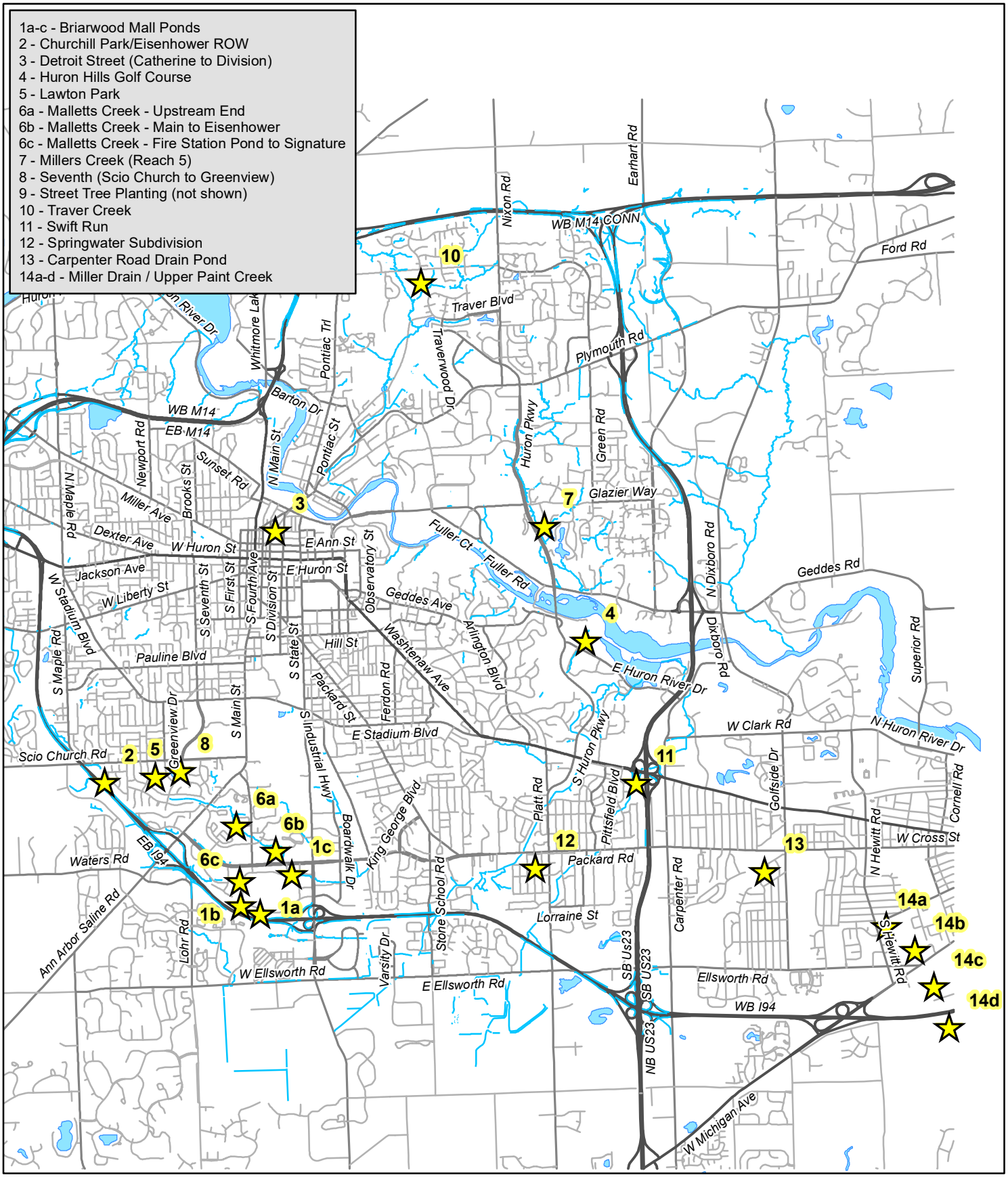

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Overall Project Locations
SRF Project Plan 2019

Figure 2

0 0.8 1.6 Miles

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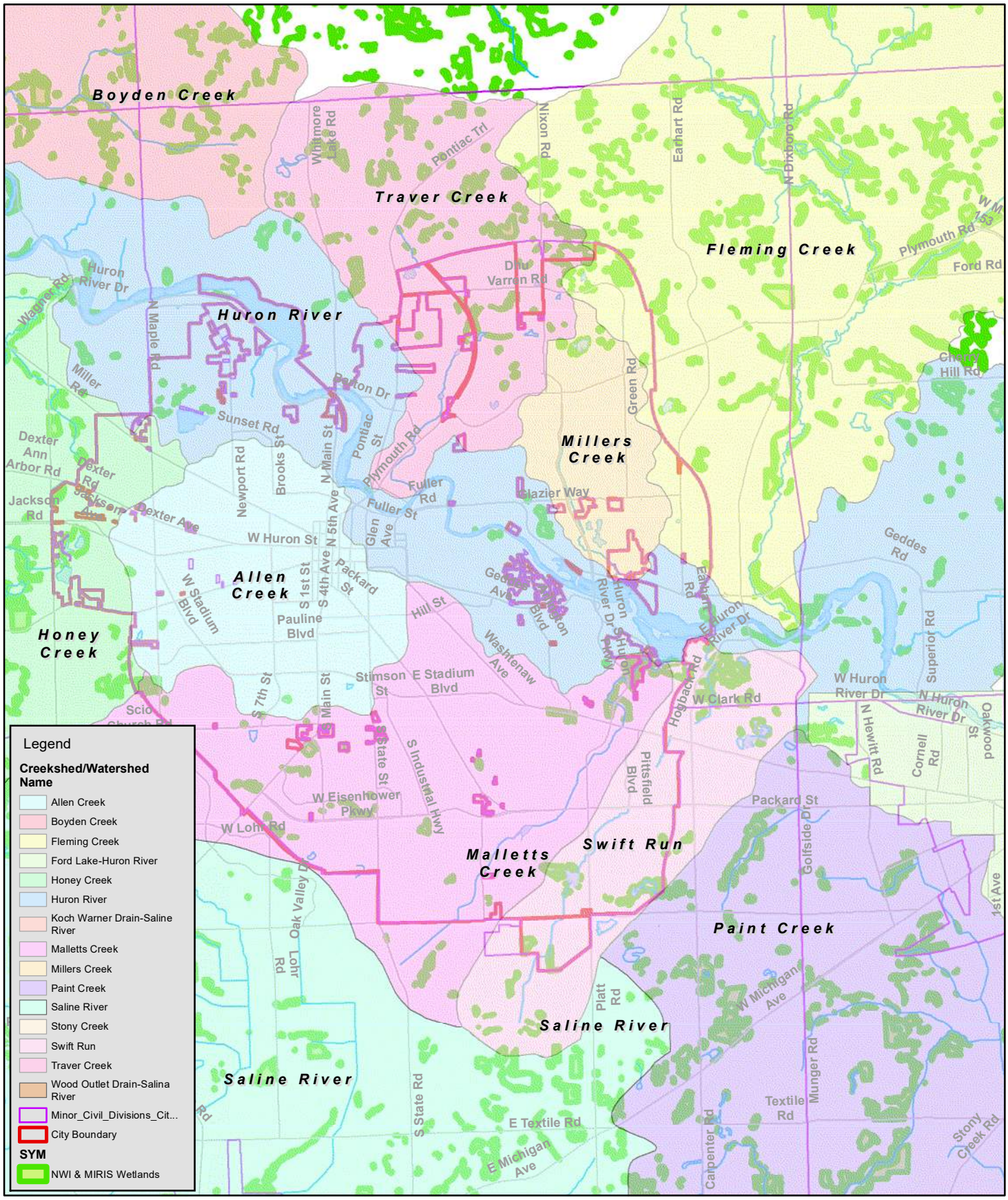

Wetlands
WCWRC 2019 Project Plan

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Figure 3

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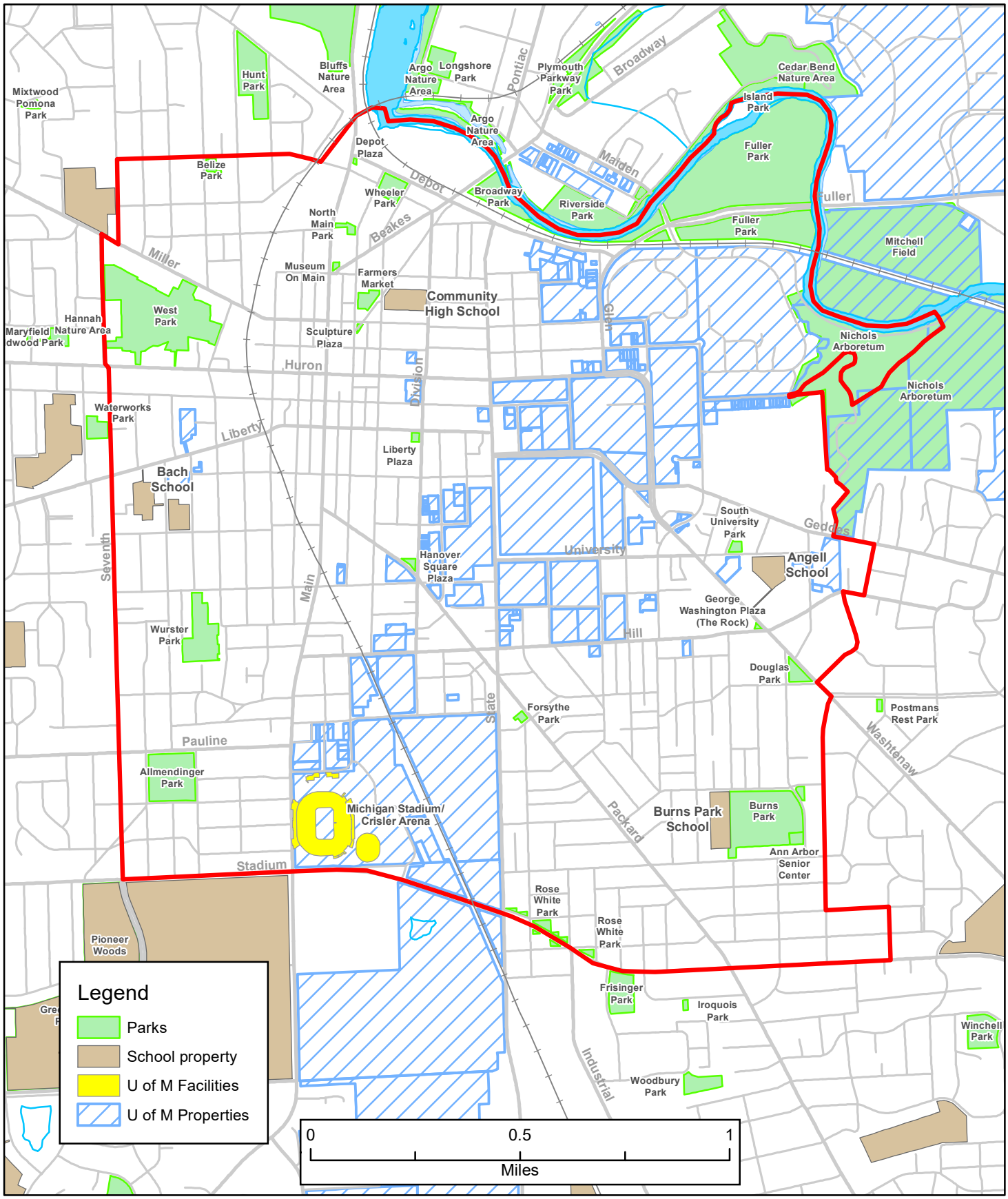

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Park Locations
Central Planning Area
WCWRC 2019 Project Plan

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Figure 4

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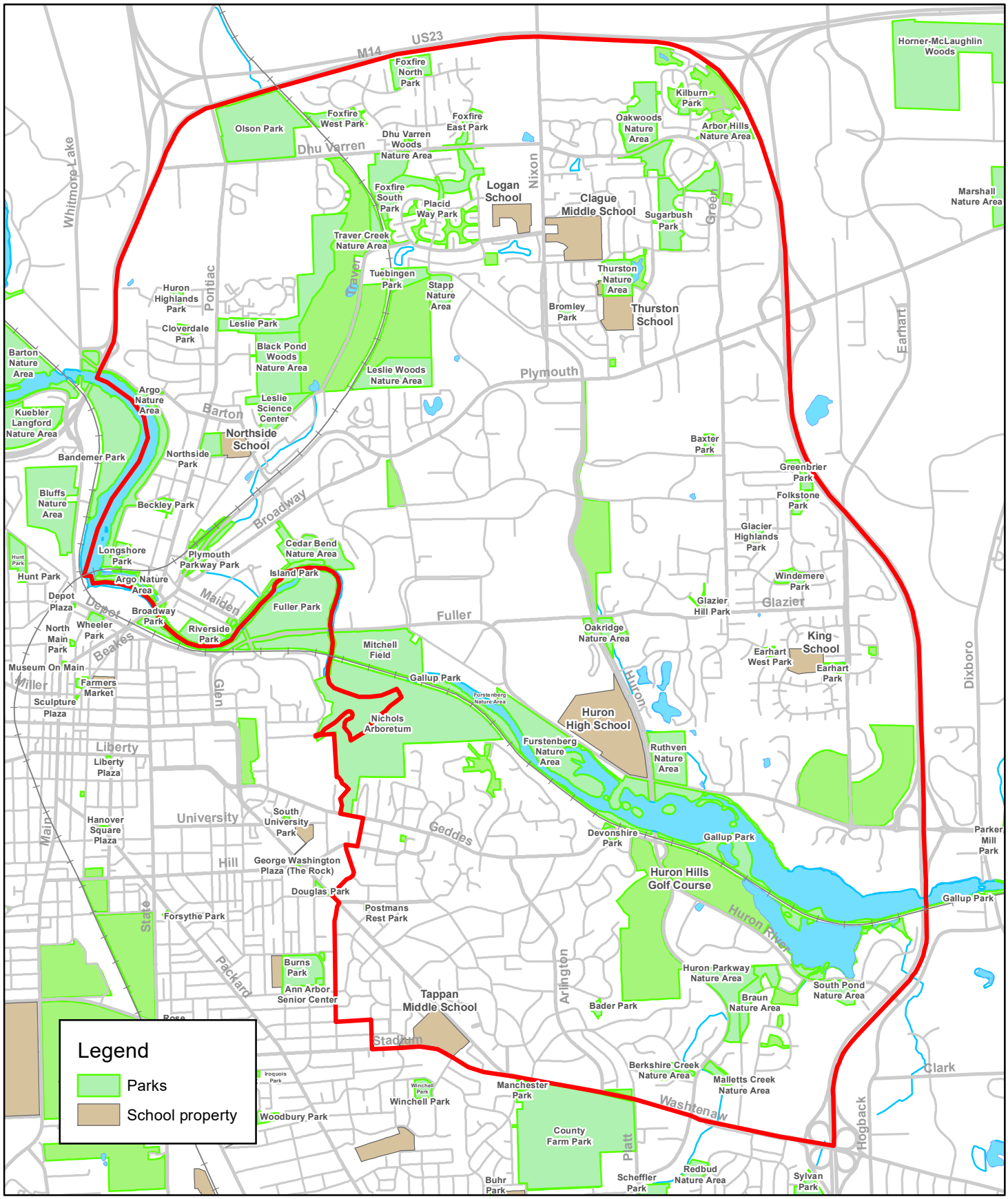

Park Locations
Northeast Planning Area
WCWRC 2019 Project Plan

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Figure 5

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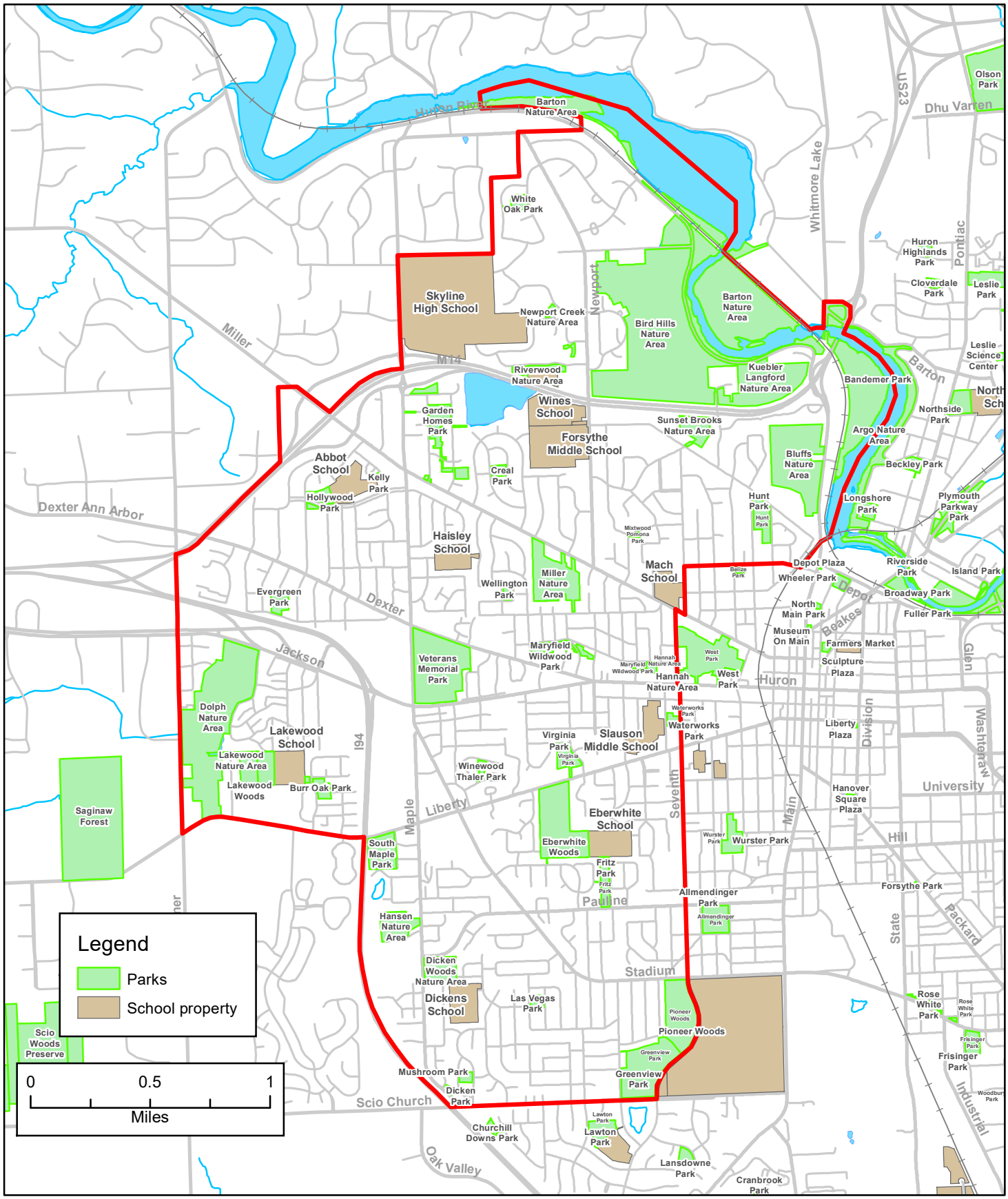

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Park Locations
West Planning Area
WCWRC 2019 Project Plan

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Figure 6

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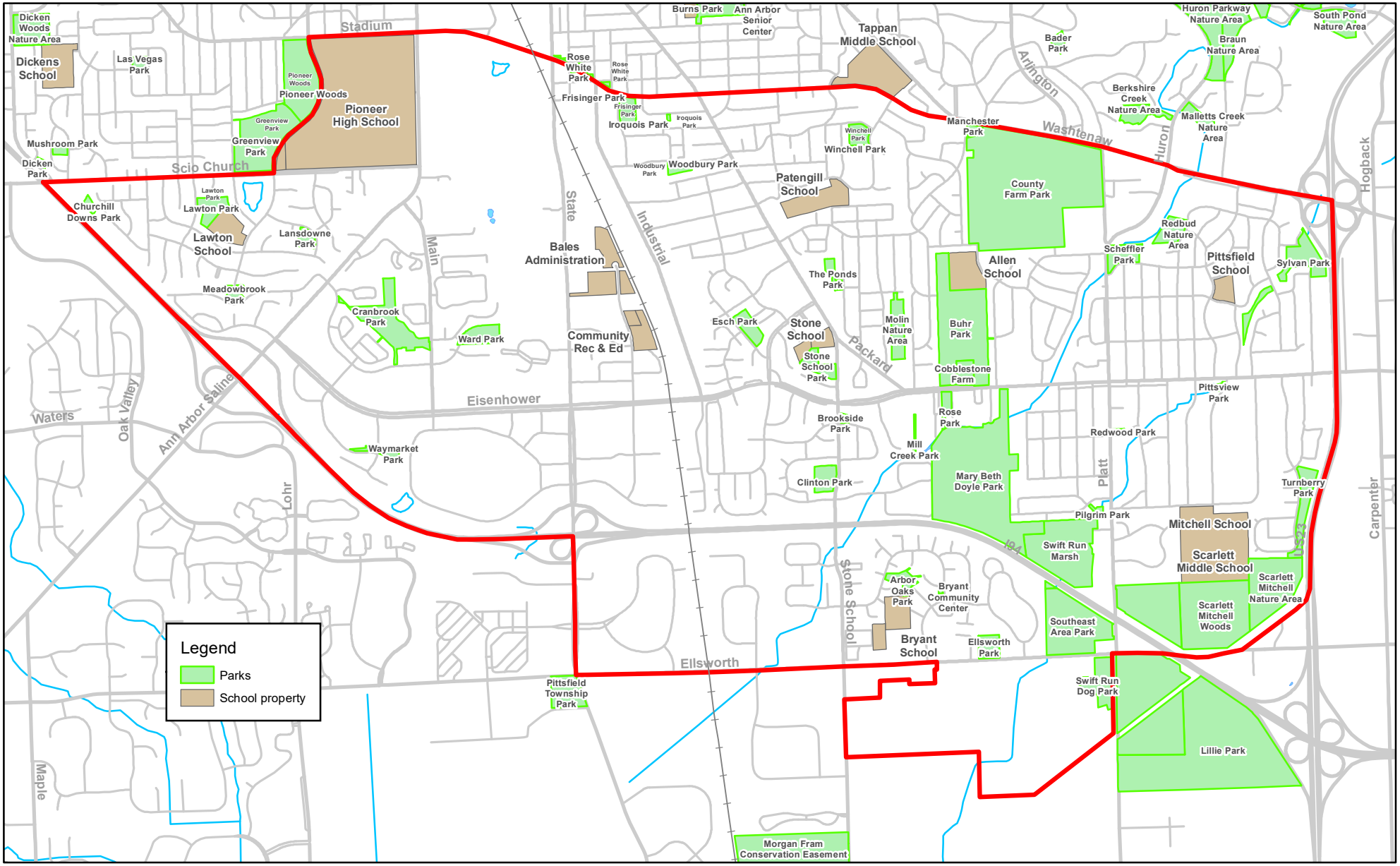

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Park Locations
South Planning Area
WCWRC 2019 Project Plan

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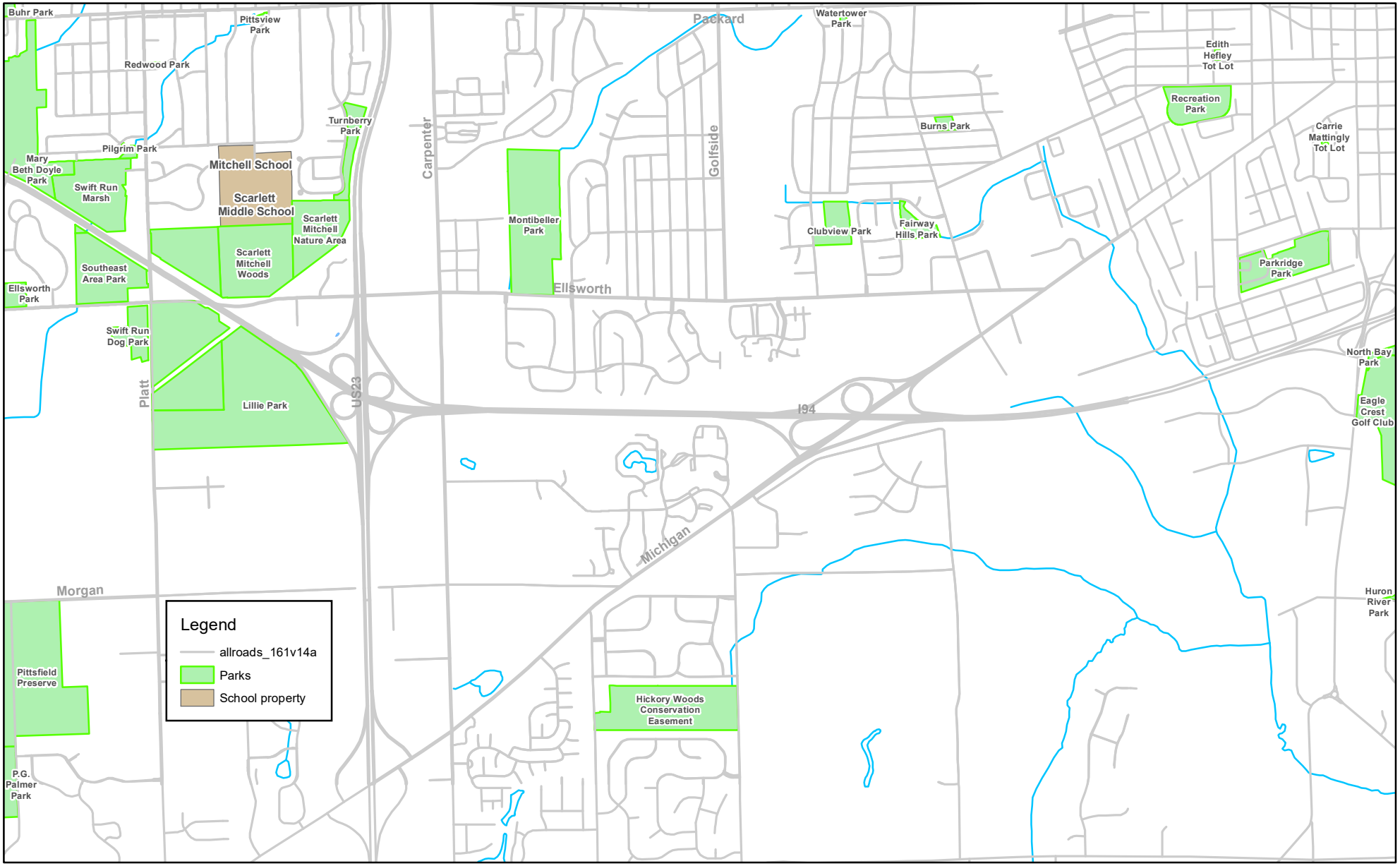
Figure 7



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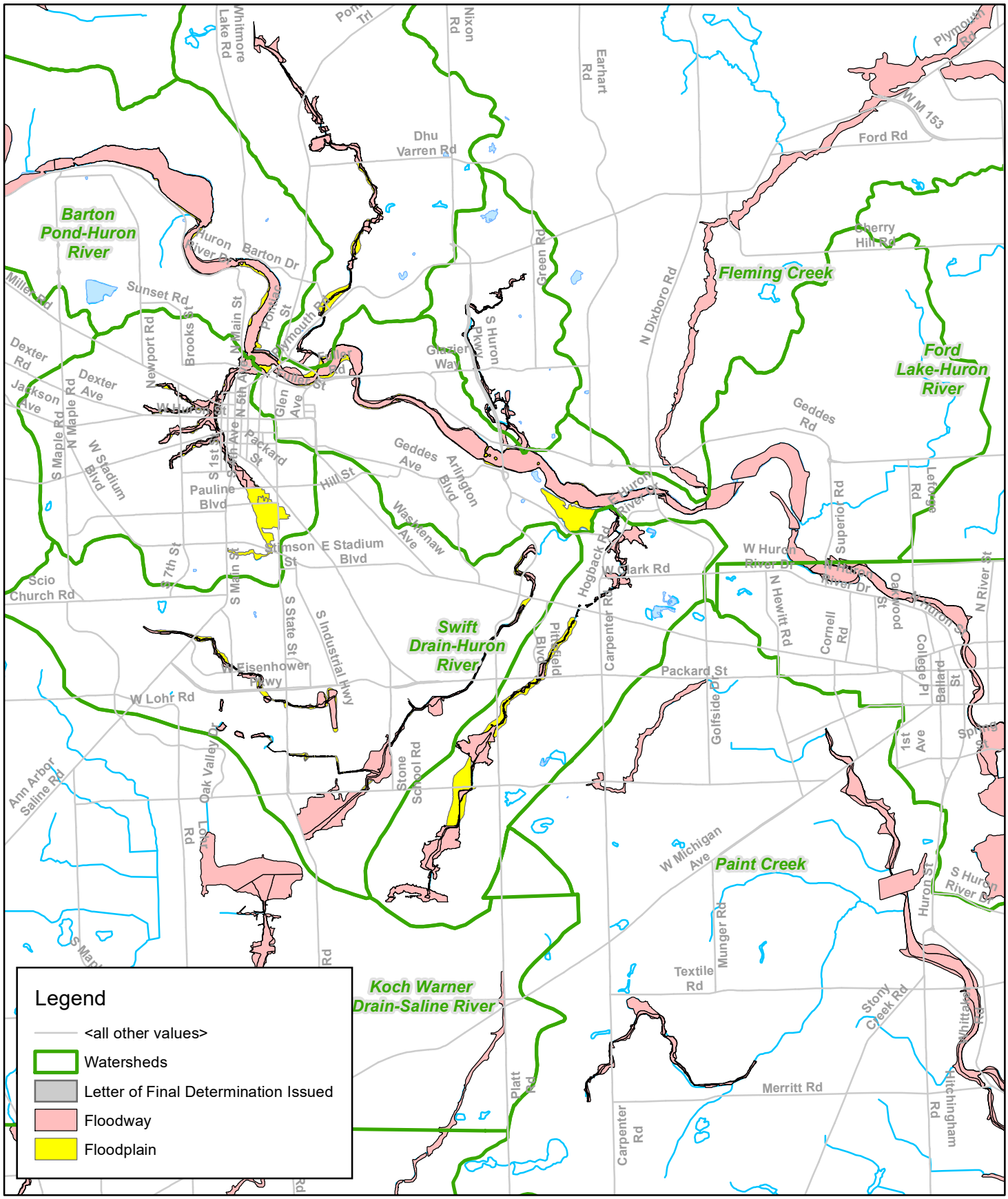
Park Locations
Southeast Planning Area
WCWRC 2019 Project Plan

Figure 8



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Floodplain and Floodway Locations
WCWRC 2019 Project Plan

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Figure 9

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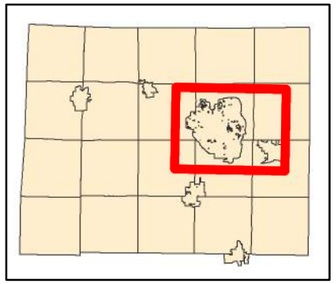
County Drain Map
Washtenaw County, Michigan

Legend

- GravityMain
- OpenDrains
- Waters of the State
- Lakes

Figure 10



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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 are available at some locations or nearby locations of project areas.

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. The creeksheds addressed in this Plan are largely contained within the City of Ann Arbor. By submitting numerous projects, the cumulative effect of the proposed work suggests a Regional Approach. Policies, Codes, and BMPs from the watershed plan also equate to a Regional Approach. 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 three 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 Washtenaw County, the City of Ann Arbor 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 County 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 2 – Water Quality BMPs

As an alternative to “No action”, water quality improvements as described below can be made on the various project’s sites. This includes Water Quality BMPs, Optimization of Existing Facilities, and Streambank Stabilization. Water quality BMPs are being proposed at 14 locations within the

Study Area. All 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:

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. 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.

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. Stormwater Retention/Infiltration Basins

Stormwater infiltration basins are any stormwater device or system which causes the majority of runoff from small storms to infiltrate into the ground rather than be discharged to a stream. Most infiltration devices also remove waterborne pollutants by filtering water through the soil. Stormwater infiltration can provide a means of maintaining the hydrologic balance by reducing impervious areas. Infiltration devices can include any of the following: basins, trenches, permeable pavement, modular pavement, or other systems that collect runoff and discharge it into the ground. Infiltration devices should only be used on locations with gentle slopes, permeable soils, and relatively deep water tables and bedrock levels. New developments that are located in areas of sandy soils would be candidates for these types of practices.

e. Grassed Swales

Grassed swales are open channel management practices designed to treat and attenuate stormwater runoff. As stormwater runoff flows through these channels, it is filtered first by the vegetation in the channel, then through a subsoil matrix, and finally infiltrates into the underlying soils. Grassed swales are improvements on the traditional drainage ditch and are well suited for treating highway or residential road runoff. Grassed channels are the most similar to a conventional drainage ditch, with the major differences being flatter side and longitudinal slopes and a slower design velocity for water quality treatment of small storm events. The type and coverage of vegetation grown in the swales will influence pollutant treatment. Native plantings may provide greater pollutant reduction, but may also alter conveyance hydraulics. Using vegetation in these applications is important in order to filter contaminants that may enter the median from the surrounding pavement. Drainage swales are applicable on virtually all development sites.

f. Rain Gardens (Bioinfiltration)

The term "rain garden" refers to a constructed depressional area that is used as a small landscape tool, usually located in residential yards or roadway ditches, to improve water quality. Rain gardens are sometimes also referred to as bioinfiltration systems on a larger scale. Rain gardens should be placed strategically to intercept water runoff, and typically are placed beside impervious surfaces such as driveways, sidewalks, or below downspouts. Rain gardens are designed to allow for ponding "first flush" and increased infiltration. Nutrient removal occurs as the water comes in contact with the soil and the roots of the trees, shrubs or other vegetation planted in the depression. To enhance nutrient removal, plant choices should center on native wildflowers and grasses that are adapted to local conditions. Suitable applications for bioinfiltration systems, or rain gardens, are parking lot islands, residential developments utilizing swale drainage for pre-treatment, and commercial developments utilizing filter strips adjacent to parking lots for pre-treatment. Rain gardens are not ponds and should be designed to drain within 48 hours. Engineered soil mixes should be incorporated into the design to facilitate drainage in areas with less suitable soil conditions (such as clay or clay loam). Under-drainage is also typically installed to facilitate drainage.

g. 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.

h. 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.

i. 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. Interception averages range depending on the size and canopy of the tree. The intercept amount depends on the size and canopy of each tree. On average, there is 15-20% inches of reduction of rainfall over time under tree cover compared to open environments according to (Teague and Kuehler, 2016).

Water Quality BMP Installation Proposed for the Following Sites:

- Briarwood Mall Ponds Retrofit Project (see Figure 11) – There are three existing basins on the Briarwood Mall project along branches of Malletts Creek. These four ponds will be retrofitted to provide for stormwater quality in this area as follows:
    - Fire Station Pond – This pond is an inline pond located on the west side of the mall property. The pond is connected the Hilton Pond to the south. The project will include improvements to the inlet structure as well as sediment removal to restore capacity.
    - Hilton Pond – This pond is an inline pond located on the south side of the mall property. The pond is connected to the Von Maur Pond to the east. The project will include improvements to the inlet structure as well as sediment removal to restore capacity.
    - 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. It is a path to optimize performance of existing facilities. These ponds are fixed in size in a region that is fully developed on private property. These characteristics make significant changes to the system infeasible. The action that provide the most benefit is to maximize use of the currently available ponds. Thus, no other alternatives were considered for these projects.

Total Preliminary Costs	$1,200,000
Present Worth of Analysis	$630,000

Direct, Indirect, and Irreversible Impacts

This project includes retrofits to several inline ponds along Malletts Creek. Proposed improvements include creation of a sediment forebay, dredging existing structures, outlet improvements, first flush control 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.

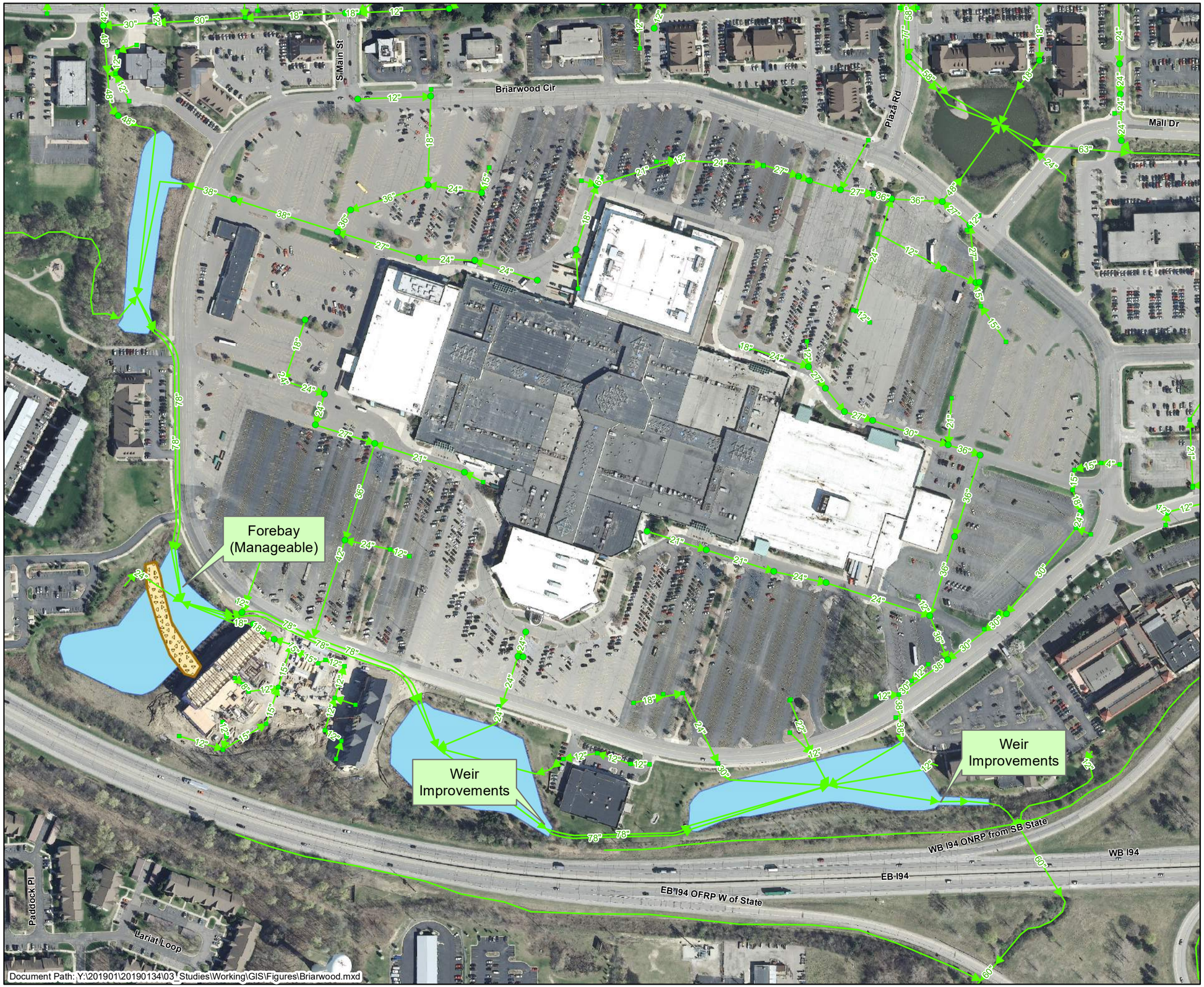

Figure 11

Proposed Stormwater Improvements

Briarwood Mall Ponds

2019 SRF Project Plan

Restoration Activities

- Storm Catchbasin
- Storm Manhole
- Storm Sewer
- Rock Weir

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1 inch = 350 feet

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- Churchill Park/Eisenhower ROW Basin (Figure 12) – An area that was identified in the review of the Upper Malletts Creek area was Churchill Downs Park. The project will involve new basins in two separate locations for storage and stormwater quality improvements. Churchill Downs/Eisenhower Park is located area south of Scio Church Rd and east of I-94. The second basin is located south of Scio Church Rd and west of Oak Valley Drive (directly across the Ann Arbor Ice Cube). Both basins are connected to the Upper Mallets Creek.

  A 330,000 cu ft above of ground storage basins will be constructed. This will include diverting of a 42" sewer to the basin at Eisenhower Park, and diverting the Upper Malletts Creek to the basin west of Oak Valley Drive. 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 Malletts 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 Malletts Creek. We'll include a maintainable sediment forebay.

  Alternatives such as underground storage were considered for this site. However, they were determined to not be cost-effective. The grades on the site are not conducive to a gravity release, and pumping the stormwater would add significant capital, operations, and maintenance costs.

Total Preliminary Costs	$3,200,000
Present Worth of Analysis	$1,488,000

Direct, Indirect, and Irreversible Impacts

This proposed project will provide stormwater management retrofits and additional storage in a portion of the Malletts Creek subwatershed. Adverse environmental impacts are expected. Wetland mitigation will be included as part of the project scope.

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 part of the project site is an active City-owned Park, there will be interruptions in the services offered at the Park (such as basketball) 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 be replaced. During scheduled maintenance, City crews will need to access the Park to perform the necessary cleanout.

Figure 12

Proposed Stormwater Improvements

Churchill Downs Park

2019 SRF Project Plan

Restoration Activities

Type

- Proposed Open Detention Area
- Potential Future Berm

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- Detroit Street Brick Rd Stormwater Management (Catherine to Division, Figures 13 and 14) – 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. The project may require using the same bricks currently in the road and in turn, would require extra attention and coordination with the Historic District Commission. This project is located within the Old Fourth Ward Historic District in the City. The City will work with members of the Historic District Commission 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 for the pavement replacement, but has potential opportunity along sidewalks and right-of-ways. 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 foot (2') diameter first flush storm sewer, with a pollutant separator at the downstream end, can be constructed to capture sufficient stormwater runoff. 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 <u>Principal Alternative</u>.

  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	$1,300,000
Present Worth of Analysis	$582,000

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 in addition to loading issues with the Farmers Markets. These disruptions will be temporary and will be communicated through project signage, website updates and stakeholder e-mails.

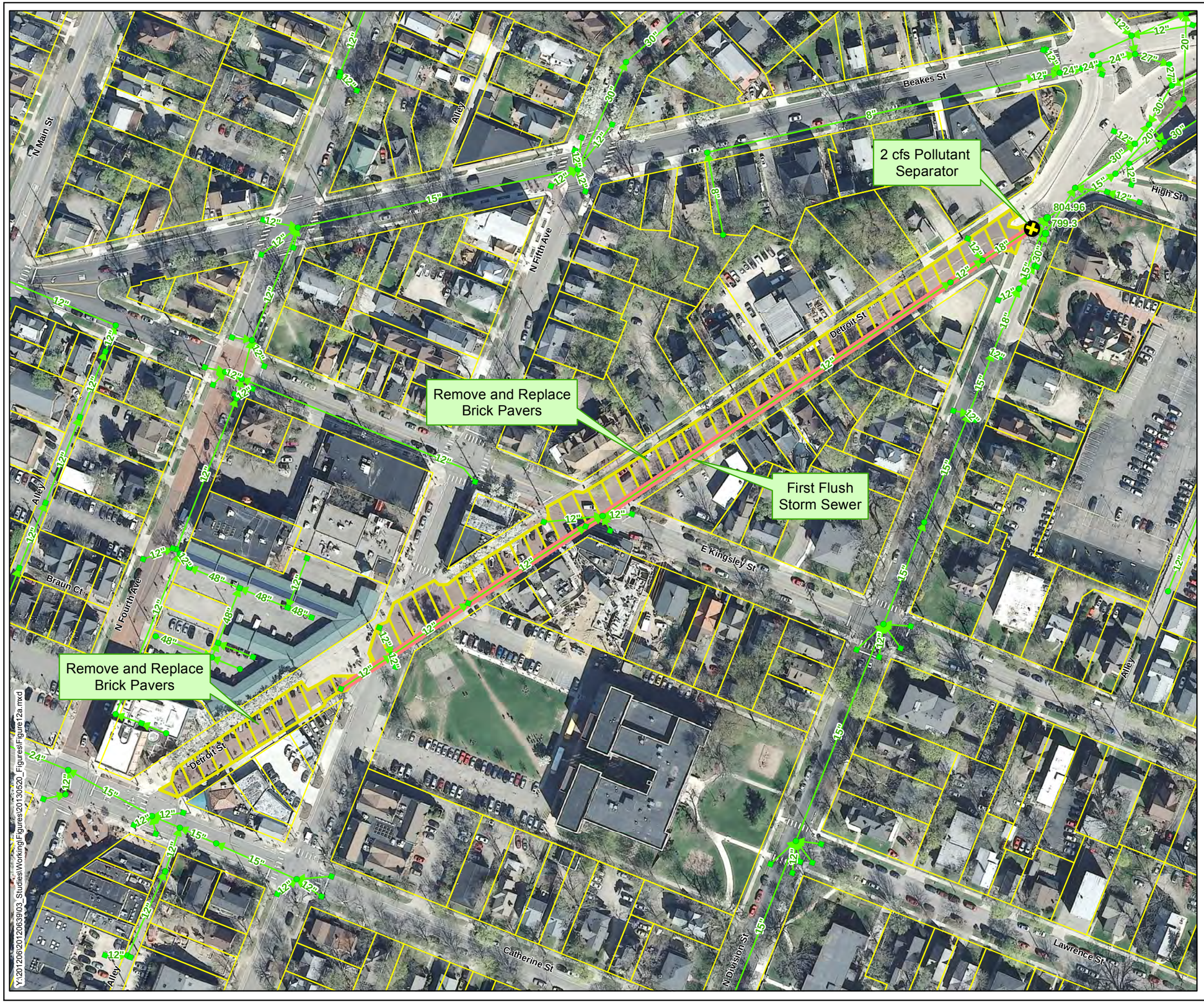

FIGURE 13

Proposed Stormwater Improvements

Detroit Street - First Flush Storm Sewer

2019 SRF Project Plan

Restoration Activities

- Pollutant Separator
- Storm Catch Basin
- Storm Manhole
- Storm Sewer
- Proposed 24" Storm Sewer
- Remove and replace brick pavers
- Parcels

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1 inch = 125 feet

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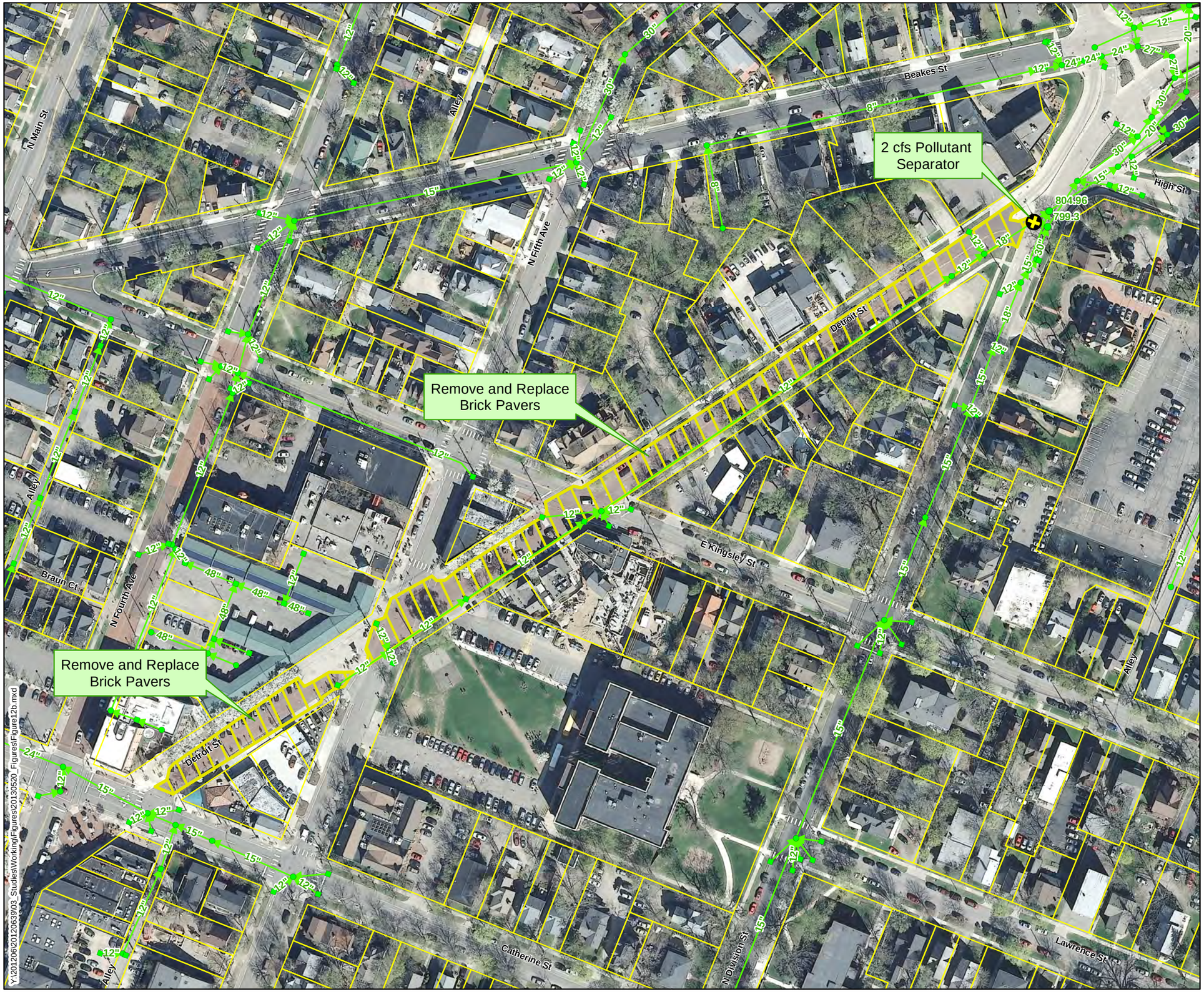
FIGURE 14

Proposed Stormwater Improvements
Detroit Street - Subsurface Stone Reservoir

2019 SRF Project Plan



Restoration Activities

- Pollutant Separator
- Storm Catch Basin
- Storm Manhole
- Storm Sewer
- Remove and replace brick pavers with Subsurface Stone Reservoir
- Parcels

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1 inch = 125 feet

HRC
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- Huron Hills Golf Course Stormwater Improvements (See Figures 15 and 16)

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 from 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 restoration of 1,030 feet of meandering wet meadow stream, including establishment of riparian vegetation with herbaceous understory and low growing shrubs. 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.

Some additional improvements could be made to the course layout. A location near an overflowing pond is suitable for raingardens and grassy swales. There is also potential locations for wetlands.

Total Preliminary Costs	$1,220,000
Present Worth of Analysis	$737,000

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. An expanded wetland will be constructed in the northeast quadrant between the creek and south pond. 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 tree removal. Adverse impacts on any historic resources are not anticipated.

FIGURE 15

Proposed Stormwater Improvements

Huron Hills Golf Course

2019 SRF Project Plan

Restoration Activities

- Floodplain Bridge
- Proposed Channel
- Native Buffer
- Offline Vernal Pool

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1 inch = 250 feet

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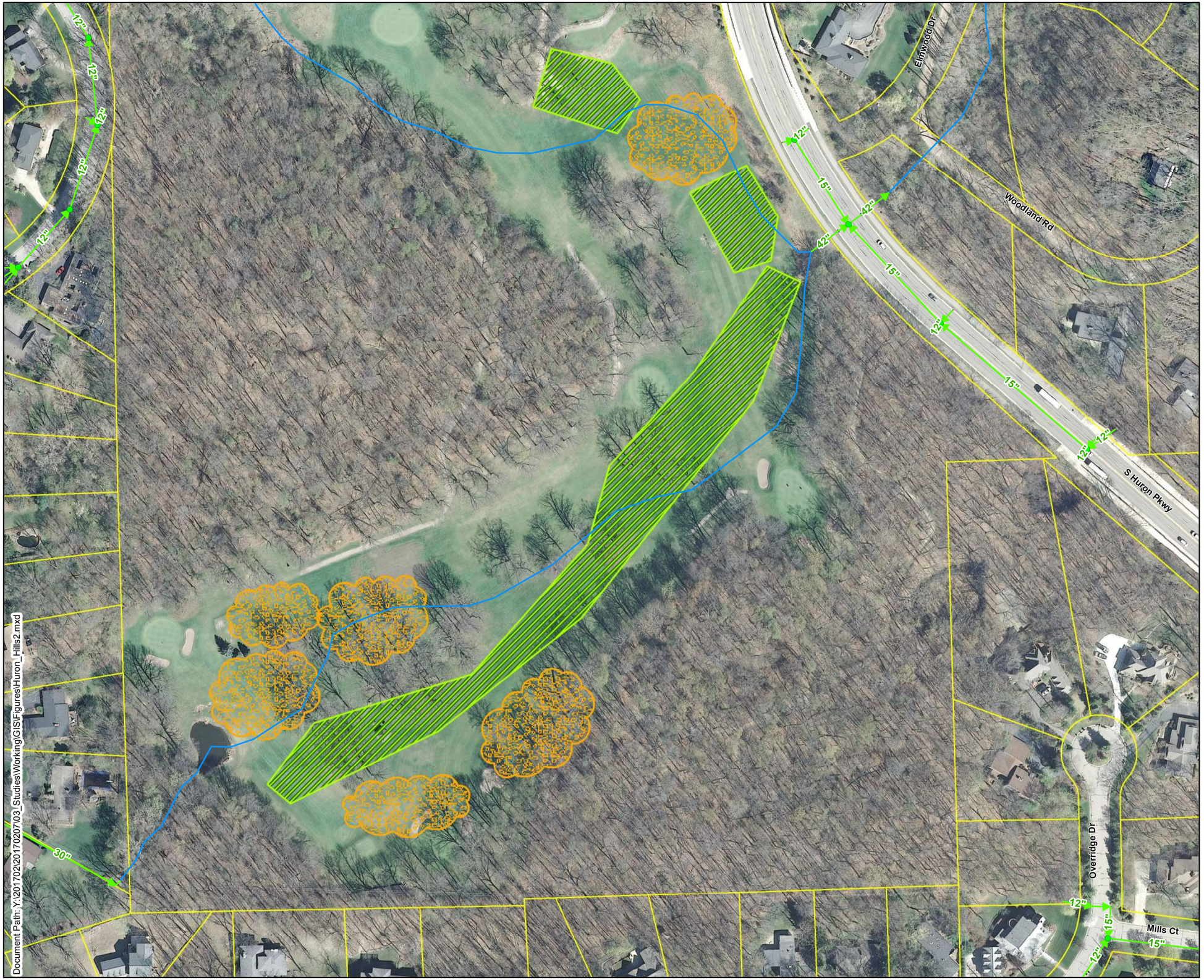

FIGURE 16

Proposed Stormwater Improvements

Huron Hills Golf Course

2019 SRF Project Plan

Restoration Activities

Bioretention

Trees

N
W E
S

1 inch = 200 feet

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- Lawton Park Stormwater Basin (Figure 17) –
  The City has recently undertaken a significant review of the stormwater management in the Upper Malletts 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 a 280,000 cu ft underground storage tank which will slowly outlet into Malletts Creek. Depending on the final soil, the basin may be able to be connected to a sand seam, which may allow for some infiltration.

  Storage to the volumes originally identified will increase the storage time and infiltration and decrease the excess flow to Malletts Creek. The sedimentation as a result of increased storage time in the basin will add maintainable sediment removal, and thereby reduce the amount of TSS into Malletts Creek.

  Alternatives are discussed in the 2014 Upper Malletts Stormwater Conveyance Study. The underground stormwater basin was determined a primary alternative through water quality improvements, public input, modeling, and cost analysis at that time.

Total Preliminary Costs	$5,155,000
Present Worth of Analysis	$3,265,000

Direct, Indirect, and Irreversible Impacts

This proposed project will provide stormwater management retrofits and additional storage in a portion of the Malletts Creek subwatershed. Adverse environmental impacts are expected to be minimal. All construction activities will take place on City-owned Park property.

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. Also, construction may affect the nearby school parcel, and will be timed in a manner that will minimize conflicts. During scheduled maintenance, City crews will need to access the Park to perform the necessary cleanout.

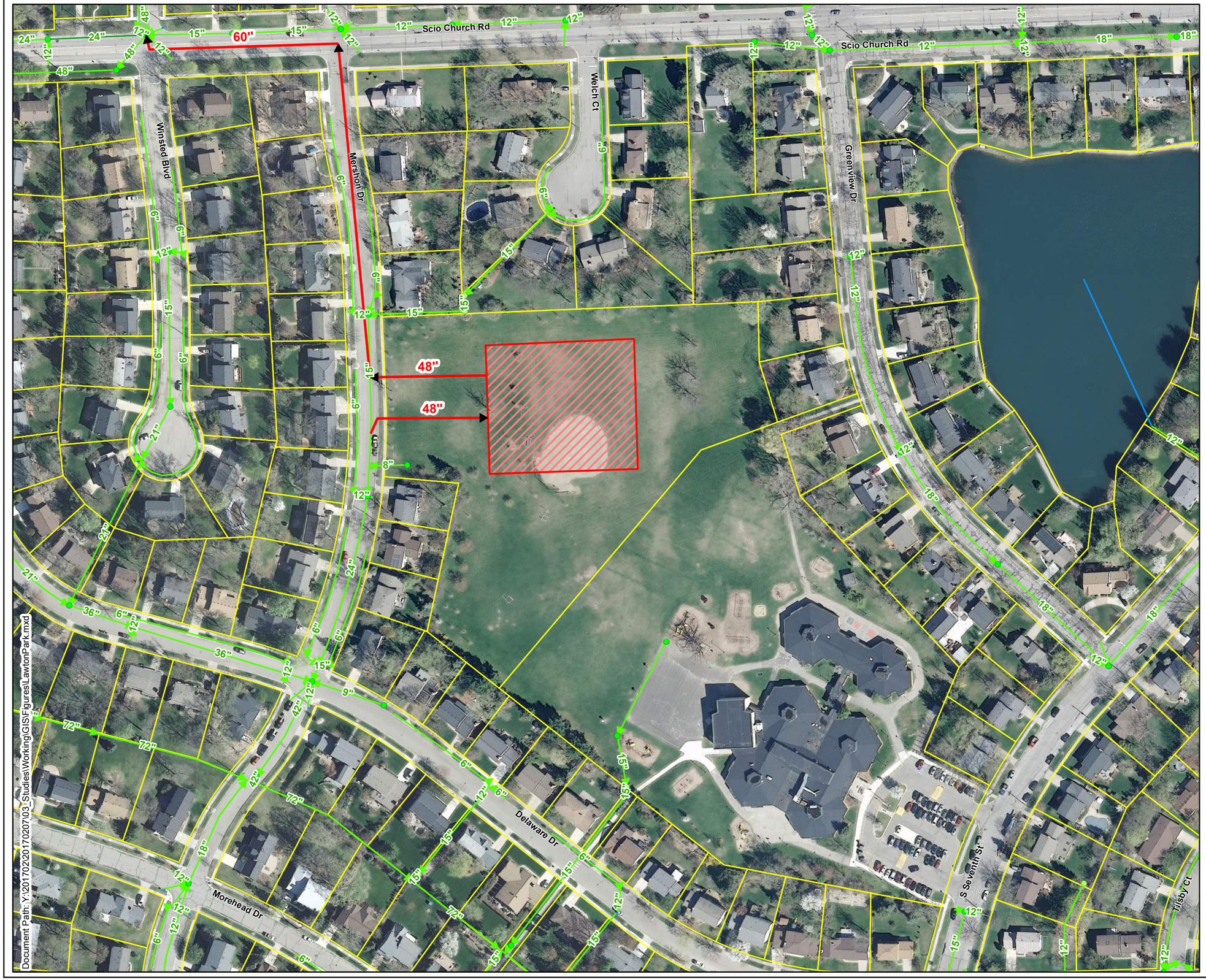

FIGURE 17

Proposed Stormwater Improvements

Lawton Park

2019 SRF Project Plan

Restoration Activities

Proposed Pipes

Proposed Underground Storage Basin

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1 inch = 200 feet

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- Malletts Creek Streambank Stabilization Phase II

  - Main St. to Eisenhower (See Figure 18)

The proposed project includes 600 feet of streambank stabilization including log step-pool channel with excavation of a narrow flood-prone 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. Work involves clearing the right side of the stream through this section. The step-pool channel reach will transition into 255 feet of further restoration upstream of E Huron Drive. The current bridge restricts flow and requires excessive attention and maintenance. An alternative to consider is replacing the bridge. Work involved will include stabilizing eroded streambanks using hard armoring, minimal site and tree disturbance, and stabilizing stream to reduce erosion and sediment transport.

The project includes an additional 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 six (6) culverts that currently cross under Oakbrook Drive with an appropriately sized single span culvert which meets current EGLE design criteria. The work will involve clearing one side of the bank.

  - Cranbrook Park (See Figure 19)

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. Vegetation management is also a component of this project site.

  - Fire Station Pond to Signature Blvd (See Figure 20)

This project is located west of Briarwood Mall near the Fire Station. Work will include removal of a concrete slab and installation of 2,000 square yards of erosion stabilization.

The current bridge restricts flow and requires excessive attention and maintenance. An alternative considered incorporated replacing the bridge however this option was cost prohibiting. The proposed project is the selected alternative.

Total Preliminary Costs	$2,770,000
Present Worth of Analysis	$1,248,000

Direct, Indirect, and Irreversible Impacts

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. These projects include streambank stabilization at three sites along Mallets Creek and its tributaries. The projects are within Malletts Creek and will have direct impacts on the floodway. Streambank stabilization will reduce erosion and sediment loading downstream. Limited tree removal may be necessary in order to install the stabilization measures. Adverse impacts on endangered species or historical resources are not anticipated.

Traffic disruptions and inconveniences for people living in the area during construction will be temporary, and will be communicated through project signage. 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 18

Malletts Streambank Stabilization Phase II - Oakbrook to Eisenhower

2019 SRF Project Plan

Restoration Activities

- Step-Pool Conveyance Channel
- Vegetation Management
- Storm Catch Basin
- Storm Manhole
- Storm Sewer
- Parcels

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1 inch = 200 feet

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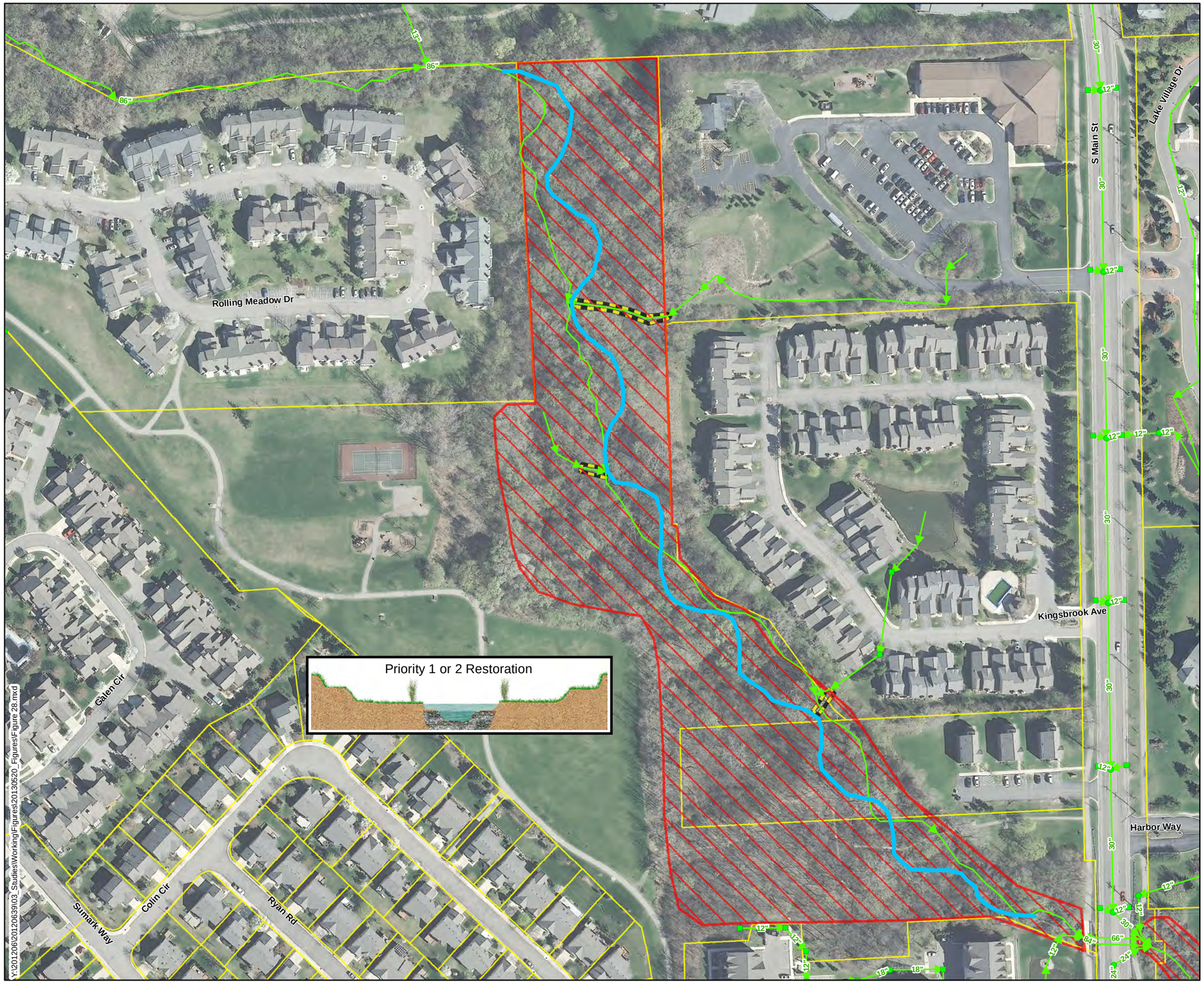

FIGURE 19

Malletts Streambank Stabilization Phase II

Proposed Stormwater Improvements

Cranbrook Park

2019 SRF Project Plan

Restoration Activities

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

N W E S

1 inch = 200 feet

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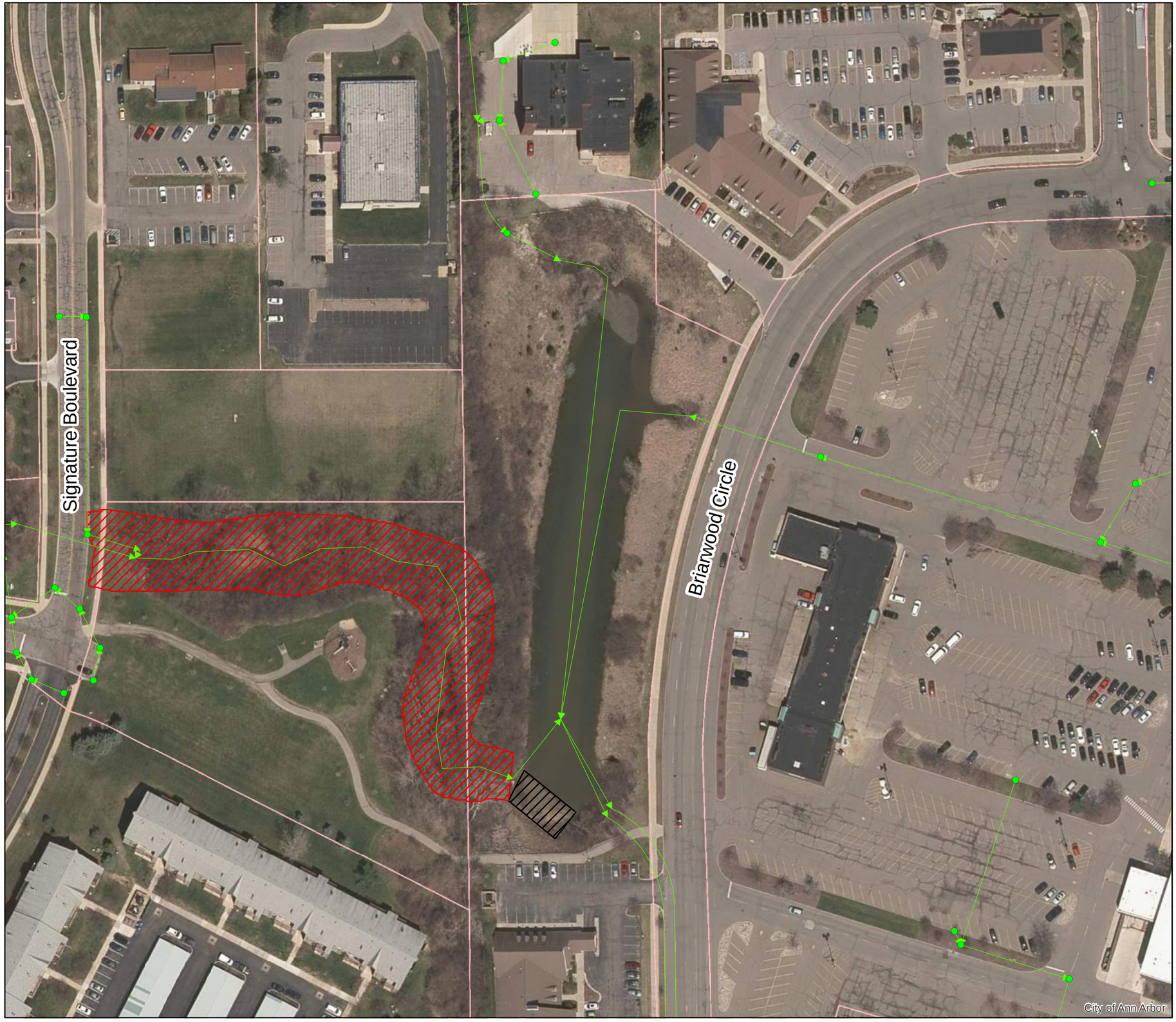
FIGURE 20

Malletts Streambank Stabilization Phase II Fire Station

Proposed Stormwater Improvements

2019 SRF Project Plan



Restoration Activities

- Storm Manhole/Catch Basin
- StormLines
- Flex-a-Mat
- Concrete Removal
- Parcels for Cityworks
- Boundary around Ann Arbor

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1 inch = 100 feet

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- Millers Creek Channel Modification - Reach 5 (See Figure 21)

  This portion of Millers Creek is from Glazier Way to Lake Haven Drive properties north of Lakehaven Drive is in poor condition and in need of streambank stabilization. This area is located downstream of an 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 erosive flow velocities. 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 streambed and streambank stabilization, slope stabilization along the west bank, and riparian vegetation management. Management of riparian vegetation includes invasive species control, seed of herbaceous groundcover, and supplemental plantings.

  The proposed project is the selected alternative.

Total Preliminary Costs	$650,000
Present Worth of Analysis	$347,000

Direct, Indirect, and Irreversible Impacts

This project includes streambank stabilization along one area of Millers Creek. 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, as well as keep it properly maintained.

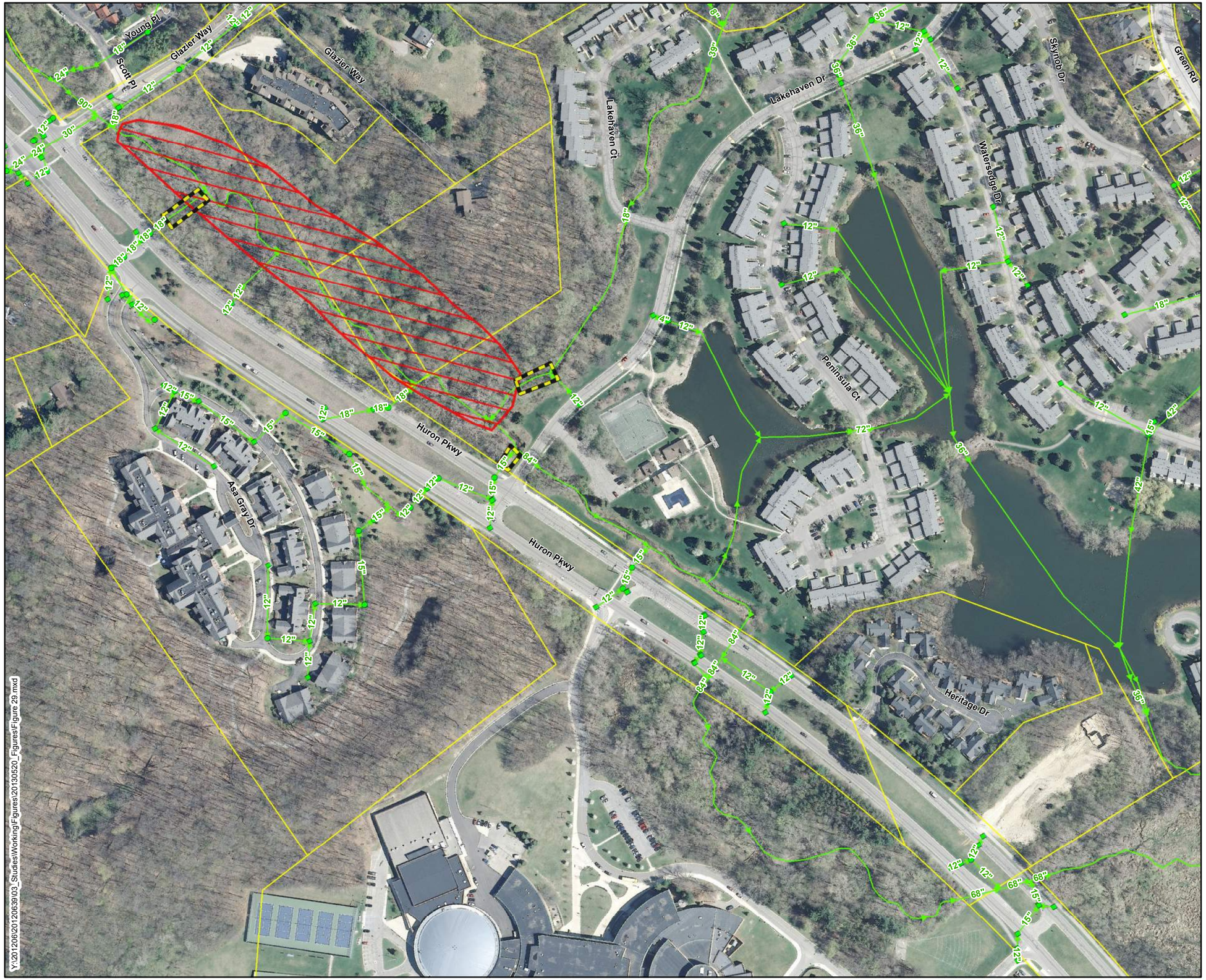

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FIGURE 21

Proposed Stormwater Improvements

Miller's Creek

2019 SRF Project Plan

Restoration Activities

- Step-Pool Conveyance Channel
- Vegetation Management
- Storm Catch Basin
- Storm Manhole
- Storm Sewer
- Parcels

N E S W

1 inch = 300 feet

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- S. Seventh Street Stormwater Improvement (Scio Church to Greenview – Figure 22) –

  This project includes reworking the right-of-way of S. Seventh Street in the area described. This project is located within the Malletts 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.

  A first-flush storm sewer is recommended to be installed under the green belt in the diet area to capture and detain stormwater runoff. Additionally, a stone reservoir and filtration bed could be installed to increase storage capacity. 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 a storm sewer and subsurface stone 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 1.9-ac of contributing area roadway.

  Additional work within the greenbelt at the surface level could include bioinfiltration. Due to the maintenance concerns of the City, and the aesthetics of the residential street, there would need to be a level of public interest and involvement. An alternative given consideration was to convert 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.

Total Preliminary Costs	$650,000
Present Worth of Analysis	$347,000

Direct, Indirect, and Irreversible Impacts

This proposed project will provide stormwater management retrofits as part of a road resurfacing project. This will also include reducing the amount of pavement as the street is overly wide. All road projects in the City of Ann Arbor are subject to the Green Streets Policy. The premise of a Green Streets Policy is to promote infiltration and reduce peak flood flow and peak velocity. 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.

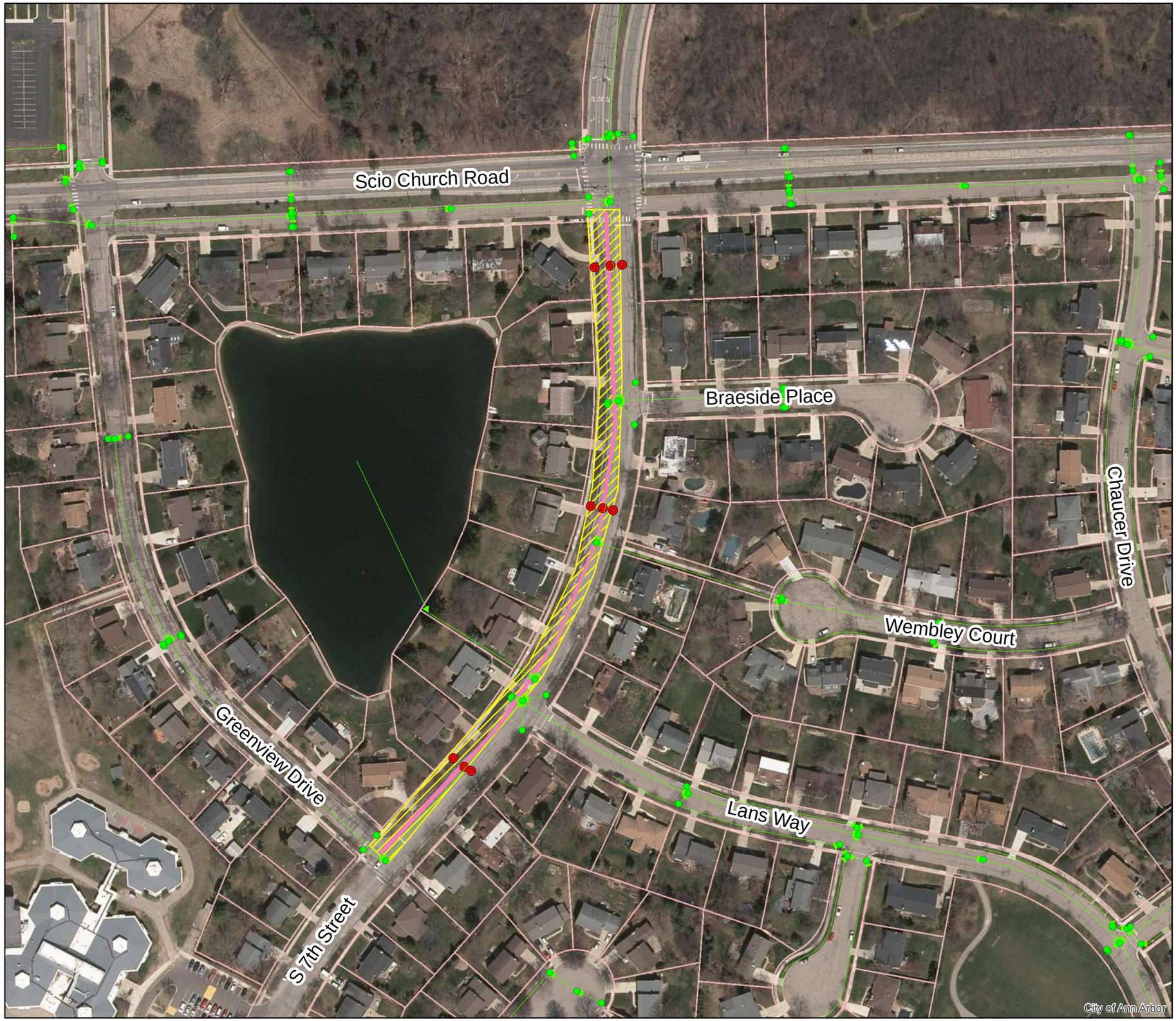
There is no anticipated tree removal or adverse effects on endangered species or historical, cultural resources.

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.

FIGURE 22

Seventh Street Concept Plan

Proposed Stormwater Improvements
2019 SRF Project Plan



Restoration Activities

- Storm Manhole/Catch Basin
- StormLines
- Infiltration Manhole
- First Flush Storm Sewer
- Greenbelt Subsurface Stone Reservoir
- Parcels for Cityworks
- Boundary around Ann Arbor

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1 inch = 150 feet

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- Street Tree Planting (FY2020-FY2024, Throughout the City) –

  Tree planting can be used to reduce runoff and pollutant loading. As part of the City's extensive tree replacement and enhancement program, the County seeks to supplement that program with the installation of approximately 1000 trees annually for the next 5 years. This is the continuation of a planting program, since July 2016. Total for all plantings is $2,021,000 including previous 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. The intercept amount depends on the size and canopy of each tree. On average, a tree can provide 15 – 20% reduction of rainfall intensity (Teague and Kuehler, 2016).

Total Preliminary Costs	$2,015,000
Present Worth of Analysis	$898,000

Direct, Indirect, and Irreversible Impacts

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

- Traver Creek Tributary Streambank Stabilization (Figure 23)

  The proposed project is a Traver Creek Tributary at Foxfire South Park from the railroad crossing to Omlesaad Drive. The major challenge is to reduce erosion and sediment transport.

  The proposed improvement is to relocate and reconstruct Traver Creek as a two-stage channel. Positive impacts include stabilizing hydrology to reduce erosion and sediment transport, as well as provide filtration to reduce pollution. In addition, stream habitat will increase. There are opportunities for wetland buffer areas adjacent to the relocated creek.

Total Preliminary Costs	$1,000,000
Present Worth of Analysis	$483,000

Direct, Indirect, and Irreversible Impacts

The proposed project will provide stormwater management, sediment and pollutant reduction, and increased habitat and wetland area. Adverse environmental impacts are expected to be minimal. 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.

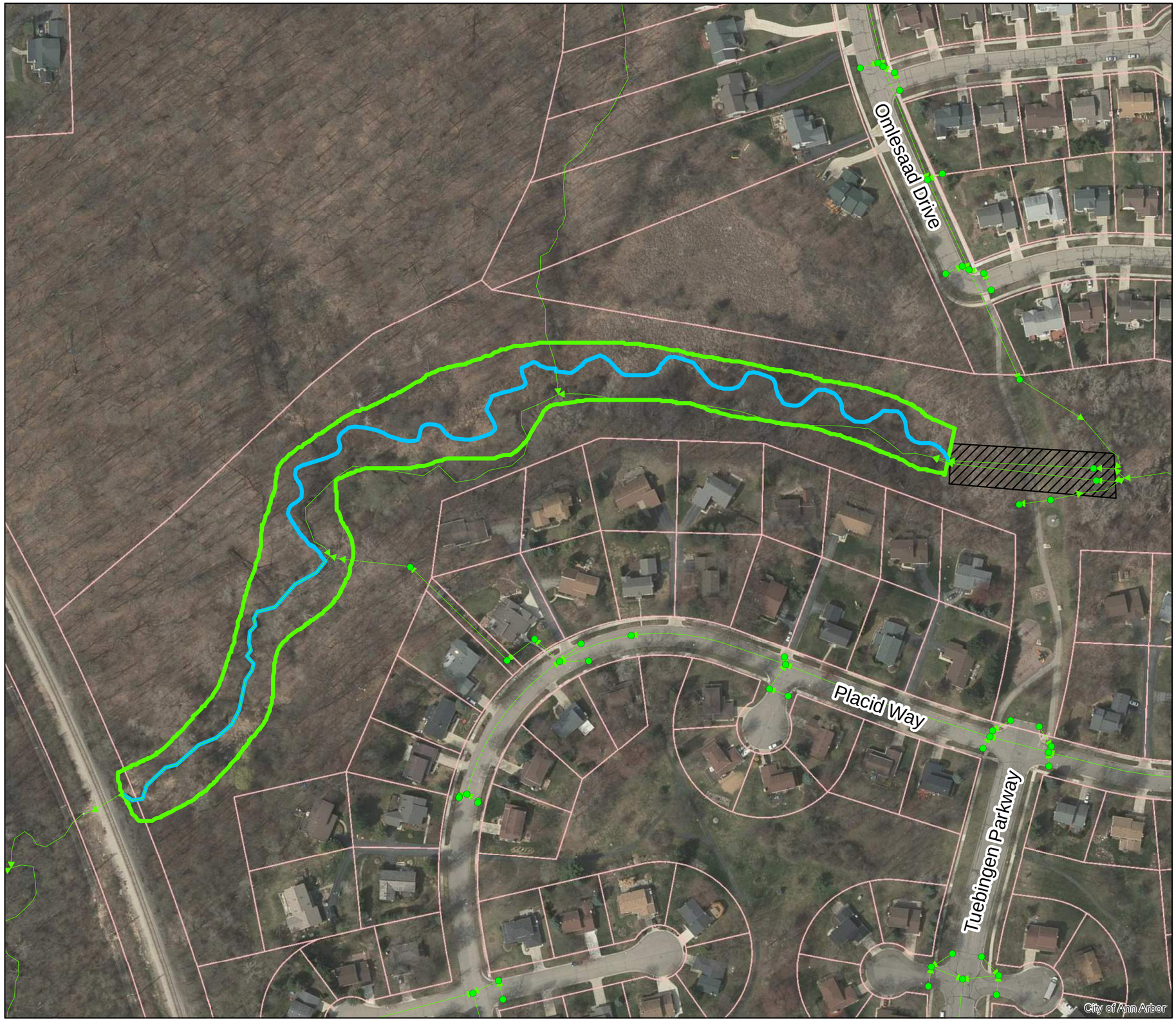
There will be traffic disruptions and inconveniences for people living in the area during construction. These disruptions will be temporary during construction and will be communicated through project signage. By narrowing the roadway, some on street parking may be lost.

FIGURE 23

Traver Creek Concept Plan

Proposed Stormwater Improvements

2019 SRF Project Plan



Restoration Activities

- Storm Manhole/Catch Basin
- StormLines
- Proposed 2-Stage Channel
- Wetland Buffer
- Control Structure Replacement
- Parcels for Cityworks
- Boundary around Ann Arbor

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1 inch = 150 feet

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- Springwater Phase IV Stormwater Improvements (Figure 24)

The proposed project includes evaluation of all storm sewers on the Cardinal Street and McComb Street for replacement of existing storm sewer on streets slated for reconstruction. Upsizing sewers will allow for first flush detention. Pollutant separators installed in previous phases will provide additional treatment for first flush incidences. Previous phases have completed reconstruction on sections of Springbrook St, Nordman Rd, and Redwood Ave.

Detention of the first flush will help improve watershed hydrology and downstream conditions as well as mitigate current flooding by reducing peak flows and increasing subsurface detention and infiltration. The project will reduce first flush flow into the Mallets Creek and reduce downstream sedimentation. The Phase IV improvements will upsize storm sewer under:

- Cardinal Avenue, from Butternut Street to Sharon Drive
- McComb Street, from Butternut Street to Sharon Drive

Tasks include replacing and upsizing existing storm sewers where necessary, dealing with existing storm sewer taps, evaluating downstream impacts if upsized, following with road construction, and coordinating with lining sanitary sewer. The goal is to implement Green Streets. This is a Principal Alternative.

Alternatives considered were infiltration catch basins and aggregate under the road for first flush management. The NRCS Soil Survey shows the soils as Type C and Type D which are typically poor for infiltration applications. The oversized first flush system was determined to be a better application for this project site.

Total Preliminary Costs	$950,000
Present Worth of Analysis	$519,000

Direct, Indirect, and Irreversible Impacts

The proposed project involves construction first flush storm sewer within the existing road right-of-ways. The project site is not located in or near a floodway, floodplain, wetland, or any other sensitive features.

There will be no tree removal, and adverse effects on endangered species or historical resources are not anticipated.

There may be minor disruptions to road traffic or limits on park usage during construction. These disruptions will be temporary and will be communicated through appropriate signage.

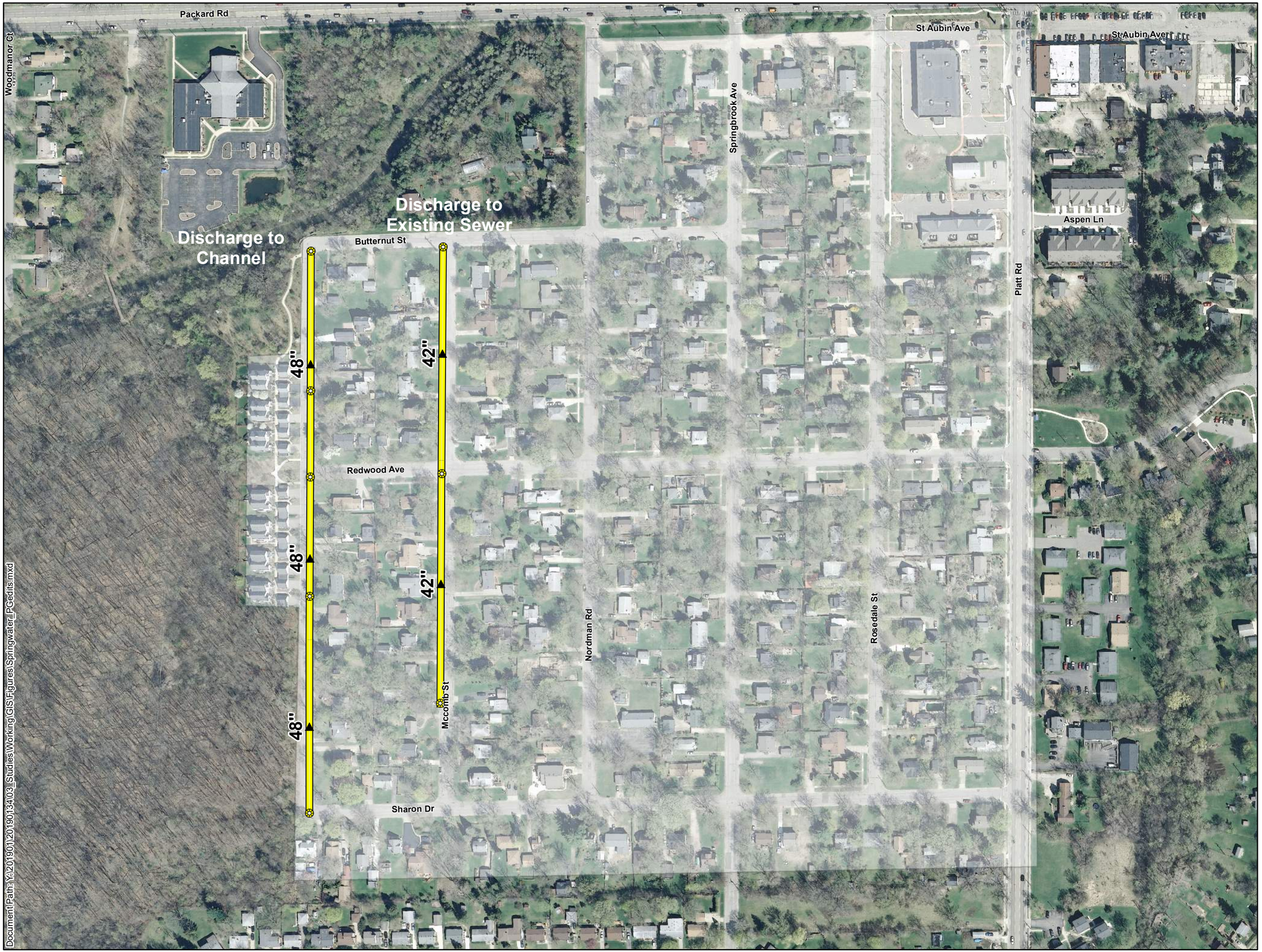

Figure 24

Proposed Storm System Improvements

Springwater Subdivision

2019 SRF Project Plan

Restoration Activities

- First Flush Manhole
- First Flush sewer
- Springwater Sub.

N
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0 125 250 500

Feet

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- Swift Run MDOT (Figure 25)

There is opportunity within the MDOT right-of-way along Swift Run Creek at the U.S. 23/Washtenaw Ave interchange. This area provides large open spaces between the ramps and highway for offline detention and treatment. A portion of flow would be diverted from the Swift Run Creek into a series of interconnected basins. A diversion sewer will be constructed to direct a portion of flow into a basin south of the southwest cloverleaf ramp. An additional sewer will be constructed under the cloverleaf ramp, still southwest of theUS23/Washtenaw intersection. An additional basin will be within the northwest cloverleaf ramp. This opportunity is expected to provide about 2-ft of stormwater storage in each basin (approximately 243,000 cft), sediment filtration, and nutrient uptake. Actual storage depth will be determined during design of the site once the topography has been surveyed. The adjacent channel flowing through this portion of Swift Run Creek has a contributing area of 1,340-ac. This is a Principle Alternative.

Total Preliminary Costs	$710,000
Present Worth of Analysis	$384,000

Direct, Indirect, and Irreversible Impacts

This proposed project will provide offline detention within the cloverleaf of the US-23 and Washtenaw Avenue intersection. The construction will occur within the US-23 right-of-way, which is under the jurisdiction of MDOT.

A portion of the existing Swift Run Creek channel that flows through the cloverleaf will be redirected to the detention basins. Wetland mitigation will be included as part of the project scope.

The proper permits will be obtained prior to beginning construction. Tree removal will be anticipated as part of this project. Adverse effects on endangered species will be mitigated by performing tree removals as directed within the permitting period. No adverse effects on historical resources are not anticipated.

Proposed Pollutant Removal Improvements

Swift Run

2019 SRF Project Plan

Restoration Activities

Type

Proposed Open Detention Area

Potential Future Berm

N
W E
S

0 125 250 500

Feet

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- Carpenter Road Drain Project (Figure 26)

The Carpenter Road Drain Project will involve redirecting flow from the Upper Paint Creek to the Carpenter Road Drain to provide additional detention, sedimentation, and nutrient uptake. The pond is currently oversized for the flow coming out of the drain. There is an opportunity to retrofit the pond for detention and treatment of the Upper Paint Creek. The Upper Paint Creek is a flashy system flowing through an urban watershed. Diverting a portion of the flow will allow for treatment, and reduction of first-flush volumes currently causing erosion downstream.

The Carpenter Road Drain is an enclosed system that has a siphon beneath the Upper Paint Creek before it outlets to the pond. The project will remove the siphon and allow the Carpenter Road Drain to outlet directly to the Upper Paint Creek. During design, flow will be calculated to ensure capacity.

A diversion channel or storm sewer will be constructed to direct flow from the Upper Paint Creek back into the Carpenter Road Drain pond. Improvements to the pond will include sediment removal to restore capacity and repairs to the existing outlet structure.

Streambank stabilization will be required at the new outlet from the Carpenter Road Drain. Additional streambank stabilization upstream of the outlet will help reduce sediment deposits.

This project is considered a Principal Alternative and a path to better use of existing facilities. The alternate considered is streambank stabilization throughout the stretch of Upper Paint Creek. This improvement would reduce erosion and sedimentation downstream. However, it would not provide sedimentation and reduction of first flush flows.

Total Preliminary Costs	$1,200,000
Present Worth of Analysis	$601,000

Direct, Indirect, and Irreversible Impacts

This project includes retrofits to a detention basin for the Carpenter Road Drain and diversion of the Upper Paint Creek. Proposed improvements include constructing a diversion, dredging existing structures, outlet improvements, first flush control, and other water quality measures. During design, all necessary permits will be secured prior to beginning construction. Tree removal may be necessary in order to install the stabilization measures. Tree removal will occur at times that are indicated in the permits to cause no impacts on endangered species. Adverse impacts on any historic resources are not anticipated.

There may be disruptions to private property as the Carpenter Road Drain basin is in the backyards of a residential development. These disruptions will be communicated appropriately.

Proposed Stormwater Improvements

Carpenter Road Drain Pond

2019 SRF Project Plan

Figure 26

Restoration Activities

- Repair Outlet Structure
- Weir Structure
- Streambank Stabilization
- Streambank Stabilization As Needed
- Remove Siphon
- Diversion Channel

N W E S

0 100 200 400

Feet

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CONSULTING ENGINEERS SINCE 1915

- Miller Drain/ Paint Creek (Figures 27-29)

  - Miller Drain – Hewitt Road to Paint Creek (Figure 27)

The proposed segment includes 1,020 feet of streambank stabilization. There are opportunities to create a two-stage channel in separate areas. However, there is a sanitary sewer running parallel to the north side of the channel that will limit the width on this side. The channel is incised with excessive bank erosion along the right bank (facing downstream). Work will require clearing the right side of the creek to access some of project reach. This work will also require repairing the crossing at Stevens Drive. The road has shown clear signs of a depression due to insufficient support above the culvert crossing.

  - Paint Creek – Congress Street to Michigan Avenue (Figure 28)

This segment includes 2,560 feet of stream restoration in order to address streambank erosion and sedimentation from upstream sources. The Paint Creek is mostly through lawn areas in this reach. Tree plantings or native plantings will be considered for shading and long-term stability.

  - Paint Creek – Michigan Avenue to Interstate 94 (Figure 29)

This segment will need intermittent streambank stabilization efforts in areas of major erosion concerns. The most critical sites will be determined during the design phase. Approximately 200 feet of stream restoration through this section of the Paint Creek.

  - Paint Creek – Interstate 94 to James L. Hart Parkway (Figure 29)

This segment includes 580 feet of stream restoration in order to address streambank erosion and sedimentation from upstream sources, as well as energy dissipation. Additional options are installation of riffles and log vanes to assist with the energy dissipation. The most effective measures for water quality management will be determined during the design phase.

Total Preliminary Costs	$2,280,000
Present Worth of Analysis	$1,032,000

Direct, Indirect, and Irreversible Impacts

During design, all necessary permits will be secured prior to beginning construction. There are some areas where easements will be required. These will be secured prior to construction. These segments include streambank stabilization at one reach on the Miller Drain, and three sites on the Paint Creek. The projects are within the Stony Creek Watershed. Streambank stabilization will reduce erosion and sediment loading downstream. Tree removal may be necessary in order to install the stabilization measures and to access the project areas. Tree removal will occur at times that are indicated in the permits to cause no impacts on endangered species. Adverse impacts on endangered species or historical resources are not anticipated.

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

Proposed Stormwater Improvements

Paint Creek - Miller Drain to Michigan
Figure 28

2019 SRF Project Plan

Restoration Activities

Crossing Repair

Name

Streambank Stabilization

Streambank Stabilization As Needed

N
W E
S

0 100 200 400
Feet

HRC
HUBBELL, ROTH & CLARK, INC
CONSULTING ENGINEERS SINCE 1915

Proposed Stormwater Improvements

Paint Creek - Michigan to James L Hart Pkwy.
Figure 29
2019 SRF Project Plan

Restoration Activities

Crossing Repair

Name

Streambank Stabilization

Streambank Stabilization As Needed

N
W E
S

0 200 400 800
Feet

HRC
HUBBELL, ROTH & CLARK, INC
CONSULTING ENGINEERS SINCE 1915

Proposed Stormwater Improvements

Miller/Paint Creek
Figure 27

2019 SRF Project Plan

Restoration Activities

Crossing Repair

Name

Streambank Stabilization

Streambank Stabilization As Needed

N
W E
S

0 100 200 400
Feet

HRC
HUBBELL, ROTH & CLARK, INC
CONSULTING ENGINEERS SINCE 1915

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 are 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.

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 – All Projects

Site	Proposed Alternative	Present Worth
1	Briarwood Mall Pond	$ 630,000.00
2	Churchill Park/Eisenhower ROW Basin	$ 1,488,000.00
3	Detroit Street Brick Rd Stormwater Management	$ 582,000.00
4	Huron Hills Golf Course Stormwater Improvements	$ 737,000.00
5	Lawton Park Stormwater Basin	$ 3,265,000.00
6	Mallets Streambank Stabilization Phase II	$ 1,248,000.00
7	Millers Creek Channel Modification - Reach 5	$ 293,000.00
8	Seventh (Scio Church to Greenview) Stormwater Improvement	$ 347,000.00
9	Street Tree Planting (FY2016-FY2020)	$ 898,000.00
10	Traver Creek Tributary Streambank Stabilization	$ 483,000.00
11	Springwater Subdvision Phase IV Improvements	$ 519,000.00
12	Swift Run MDOT	$ 384,000.00
13	Carpenter Road Drain Project	$ 601,000.00
14	Miller Drain / Paint Creek Streambank Stabilization	$ 1,032,000.00

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, Malletts and Swift Run Creek – 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 EGLE (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 has 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.*

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			
1	Briarwood Ponds	Stormwater Improvments	160.00	0.90	28.63	100	458,136	60%	67%	183,487
2	Churchill Downs Park	Stormwater Improvments	100.00	0.45	14.32	100	143,168	60%	979%	85,901
5	Lawton Park	Stormwater Improvments	100.00	0.45	14.32	100	143,168	60%	764%	85,901
9	Street Tree Planting	Tree Planting	Throughout City							

[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 Total Phosphorous 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			
1	Biarwood Mall Ponds	Stormwater Improvments	160.00	0.90	28.63	0.5	80	50%	67%	27
2	Churchill Downs Park	Stormwater Improvments	100.00	0.45	14.32	0.5	50	60%	979%	30
5	Lawton Park	Stormwater Improvments	100.00	0.45	14.32	0.5	50	60%	764%	30
9	Street Tree Planting	Tree Planting	Throughout City							

[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
1	Briarwood Mall Ponds	Stormwater Improvements	160.00	0.90	28.63	20,000	94,376
2	Churchill Downs Park	Stormwater Improvments	100.00	0.45	14.32	20,000	29,493
5	Lawton Park	Stormwater Improvments	100.00	0.45	14.32	20,000	29,493
9	Street Tree Planting	Tree Planting	Throughout City				

[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

coli will be removed to some degree when infiltration and/or TSS removal is incorporated into BMP projects.

5. Implementation and Public Participation

All the proposed project locations presented in this Plan are 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 developments 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. Structural Integrity

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

d. Industrial Pretreatment

This section is not applicable to this NPS Project Plan.

e. Growth Capacity

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

f. 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.

g. 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 EGLE 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.

h. Alternative Sites and Routings

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

i. Combined Sewer Overflows

This section is not applicable to this NPS Project Plan.

j. Contamination at the Project Site

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

k. Green Project Reserve (GPR)

There are several projects that will qualify for the Green Project Reserve (GPR) as seen in the table below.

Table III-5: Proposed GPR Projects

Site	Amount Description	
Briarwood Mall Pond	Naturalize Berm	$6,000
	Naturalize Basin Perimeter	$12,500
	Berm Construction	$36,000
		Total = $54,500
Huron Hills Golf Course	Streambank Stabilization - $1,300,000	
Lawton Park Stormwater Basin	Streambank Stabilization - $1,080,000	
Mallets Streambank Stabilization Phase II	Streambank Stabilization - $1,080,000	
Millers Creek Channel Modification - Reach 5	Streambank Stabilization - $650,000	
Seventh (Scio Church to Greenview) Stormwater Improvement	Limestone Aggregate Base	$32,000
	Infiltration Catch Basin	$36,000
	Rain Gardens	$120,000

		Total = $188,000
Street Tree Planting (FY2016-FY2020)	Plantings - $2,015,000	
Traver Creek	Streambank Stabilization - $1,000,000	
Swift Run MDOT	Native Plantings - $35,000	
Carpenter Road Drain	Native Plantings - $25,000	
Miller Drain/Upper Paint Creek	Streambank Stabilization – Miller	$306,000
	Streambank Stabilization – Paint	$570,000
	Native Plantings	$40,000
		Total = $916,000

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.

Table IV-1: Proposed Projects

Site	Alternative Type	Site
1	Optimization of Existing Facilities	Briarwood Mall Pond
2	Water Quality BMP	Churchill Park/Eisenhower ROW Basin
3	Water Quality BMP	Detroit Street Brick Rd Stormwater Management
4	Streambank Stabilization / Water Quality BMP	Huron Hills Golf Course Stormwater Improvements
5	Water Quality BMP	Lawton Park Stormwater Basin
6	Streambank Stabilization / Water Quality BMP	Mallets Streambank Stabilization Phase II
7	Streambank Stabilization / Water Quality BMP	Millers Creek Channel Modification - Reach 5
8	Water Quality BMP	Seventh (Scio Church to Greenview) Stormwater Improvement
9	Water Quality BMP	Street Tree Planting (FY2016-FY2020)
10	Streambank Stabilization / Water Quality BMP	Traver Creek Tributary Streambank Stabilization
11	Water Quality BMP	Springwater Phase IV
12	Water Quality BMP	Swift Run MDOT

13	Streambank Stabilization / Water Quality BMP	Carpenter Road Drain
14	Streambank Stabilization / Water Quality BMP	Miller Drain/Upper Paint Creek

1. Relevant Design Parameters

a. The major process features, or proposed projects, are outlined in Table IV-1. Each sites' pollutant loads and BMP reductions are outlined in the previous tables.

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

The BMP sizing was performed as 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.

c. A schematic flow diagram of the treatment process.

This is not applicable for stormwater treatment projects.

d. 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. Events of this size account for the majority of the 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, minimizing erosion, improving habitat 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.

e. 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.

f. 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. Specific street and locations can be found in Section III. 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.

g. 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.

h. 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 2019 – July 2027. There are six major tasks identified for the selected alternatives completion. These tasks include:

- Submittal of the Project Plan to EGLE – July 1, 2019
- Project Plan review and approval – EGLE 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 guidelines 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. Pedestrian or Traffic Impact

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, Churchill Park/Eisenhower ROW, Springwater Subdivision, and Seventh Street.

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 and S. Seventh Street.

c. Topographic Constraints

Steep topography can limit the accessibility for construction and maintenance of the proposed BMPs. The slopes along Miller Drain/Upper Paint Creek and Traver Creek are very steep. Additional analysis during design and construction may be required.

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 Malletts Creek, Millers Creek, Swift Run, and Paint Creek.

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.

4. Sensitive Features

Sensitive features, such as agricultural lands, archeological sites will not be impacted by the proposed projects Threatened and endangered species habitat has been evaluated and will be further evaluated during design phase. Additional information can be found in Appendix F. All protocols will be mitigated in accordance with federal and State Law. Figure 3 provides the location of the existing wetlands that are near several of proposed projects.

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 the EGLE Joint Permit Application process. See Figure 9 for locations of the Floodways and Floodplains in Washtenaw County.

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 EGLE 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. Special Assessment District Projects

There are no Special Assessment District (SAD) projects within the scope in the proposed Study Area, except for previously determined county drainage disctricts.

7. Schedule for Design and Construction

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

Advertise Public Hearing.....May 12, 2019

Draft Project Plan on Display .....May 13, 2019

Public Hearing .....June 13, 2019

Adoption of Project Plan by the Statutory Drain Board .....June 17, 2019

Final Project Plan Submittal to EGLE ..... July 1, 2019

Dates for Design, Financing, Bidding, Permit Procurement, Seasonal Restrictions, and Mitigation of Environmental Impacts will vary for each project.

Table IV-2 below outlines the proposed fiscal year(s) of the proposed improvement projects for each site. All project years were outlined by the City of Ann Arbor's CIP.

Table IV-2: Proposed Project Schedule

Site	Project	Year
1	Briarwood Mall Ponds	2022
2	Churchill Park/Eisenhower ROW Basin	2020
3	Detroit Street Brick Rd Stormwater Management	2025
4	Huron Hills Golf Course Stormwater Improvements	2021

5	Lawton Park Stormwater Basin	2024
6	Mallets Streambank Stabilization Phase II	2024
7	Millers Creek Channel Modification - Reach 5	2024
8	Seventh (Scio Church to Greenview) Stormwater Improvement	2022-2023
9	Street Tree Planting (FY2016-FY2025)	Continuous
10	Traver Creek Tributary Streambank Stabilization	2024
11	Swift Run MDOT Stormwater Management Improvements	2023
12	Springwater Phase IV Stormwater Improvements	Beyond FY 2025
13	Carpenter Road Drain Project	2024
14	Miller Drain/Upper Paint Creek	2024

8. 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 along with administration, financial and legal services, land acquisition, mitigation, and other project-related activities. As the summary indicates, the total cost for all of the selected alternatives is approximately $24,300,000. See Appendix A for a detailed cost breakdown of each site.

Table IV-3: Total Project Costs

Site	Proposed Alternative	Preliminary Cost
1	Briarwood Mall Ponds	$1,200,000
2	Churchill Park/Eisenhower ROW Basin	$3,200,000
3	Detroit Street Brick Rd Stormwater Management	$1,300,000
4	Huron Hills Golf Course Stormwater Improvements	$1,220,000

5	Lawton Park Stormwater Basin	$5,155,000
6	Mallets Streambank Stabilization Phase II	$2,770,000
7	Millers Creek Channel Modification - Reach 5	$650,000
8	Seventh (Scio Church to Greenview) Stormwater Improvement	$650,000
9	Street Tree Planting (FY2016-FY2025)	$2,015,000
10	Traver Creek Tributary Streambank Stabilization	$1,000,000
11	Swift Run MDOT Stormwater Management Improvements	$950,000
12	Springwater Phase IV Stormwater Improvements	$710,000
13	Carpenter Road Drain Project	$1,200,000
14	Miller Drain/Upper Paint Creek	$2,280,000
	TOTAL	$24,300,000

B. Authority to Implement the Selected Alternative

The Washtenaw County Water Resources Commissioner is chair of the Statutory Drain Board which oversees all activities within the District. Washtenaw County includes all land located within individual districts where activity is proposed: Allen, Traver, Stony and Malletts. Planning will take place under the authority of Washtenaw County with the partnership of City of Ann Arbor; 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 Washtenaw County and are either publicly owned, or within a public ROW or easement. The tree planting project, which takes place throughout the City, is financed under the Huron River Green Infrastructure Drainage District which aggregates all lands in the City.

C. Users Costs

The Washtenaw County Study Area is made up of several entities based on jurisdictional authority. The proposed projects must be initiated by a petition and reviewed by the Statutory Drain Board with comments taken from the County.

This project will be funded through loans from Michigan's State Revolving Fund. The fourteen project sites have a combined estimated construction cost of $24,300,000. This equates to $8.17 per residential equivalent unit on a quarterly basis.

The 2 project sites in Pittsfield Township and Ypsilanti Township, as well the portion of the Churchill project in Lodi Township are within Drainage Districts. The proposed projects must be presented and

approved at a Board of Determination and offered a chance at a Public Day of Review. Project costs will be assessed based on previously determined apportionment percentages within the appropriate drainage districts.

D. Disadvantaged Community

The proposed projects and municipalities within this NPS plan do not qualify for Disadvantaged Community Status.

E. Useful Life

The useful life calculations are part of the present worth analysis costs presented in Section III and Appendix A.

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 injury. Contractors selected to perform work will have workplace Safety plans and managers in addition to OSHA requirements. 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 regarding 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 or natural setting, culturally or recreationally significant areas, 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 EGLE /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.

For MNFI compliance, Washtenaw County will comply with both state and federal threatened and endangered species legislation. For SHPO compliance, Washtenaw County will require that individual projects be subject to further SHPO review once financing and design begin. For USFWS, best management practices will be implemented to minimize and avoid impacts to massasauga rattlesnake and tree removal will have restrictions typically between April 1 through September 30 for the seasonal bat breeding/roosting season.

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

Most of the project alternatives were developed from recommendations presented in the Ann Arbor CIP. The public went through traditional means to receive input at public meeting and workshops. The findings, directives, and recommendations outlined in the CIP were utilized to develop this SRF Project Plan. The project areas are 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 will be taking place on June 13, 2019. An advertisement will be posted in the Ann Arbor News on May 12, 2019. The Project Plan will be made available to the public for review on May 13, 2019 on the first floor of the WCWRC Office, 705 N. Zeeb Rd. for 30 days. Electronic copies will also be available via email. A verbatim transcript of the hearing will be included in the final Project Plan along with comments raised by the public.

C. Adoption of the Project Plan

The final Project Plan will be submitted by July 1, 2019 to EGLE after the plan is adopted by the Statutory Drain Board.

Section VIII - References

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APPENDIX A

COST AND BMP ANALYSIS

SITE	PROPOSED ALTERNATIVE	PRELIMINARY COST
1	Briarwood Mall Pond	$ 1,200,000.00
2	Churchill Park/Eisenhower ROW Basin	$ 3,200,000.00
3	Detroit Street Brick Rd Stormwater Management	$ 1,300,000.00
4	Huron Hills Golf Course Stormwater Improvements	$ 1,220,000.00
5	Lawton Park Stormwater Basin	$ 5,155,000.00
6	Mallets Streambank Stabilization Phase II	$ 2,770,000.00
7	Millers Creek Channel Modification - Reach 5	$ 650,000.00
8	Seventh (Scio Church to Greenview) Stormwater Improvement	$ 650,000.00
9	Street Tree Planting (FY2016-FY2020)	$ 2,015,000.00
10	Traver Creek Tributary Streambank Stabilization	$ 1,000,000.00
11	Springwater Subdvision Phase IV Improvements	$ 950,000.00
12	Swift Run MDOT	$ 710,000.00
13	Carpenter Road Drain Pond Retrofit	$ 1,200,000.00
14	Miller Drain / Paint Creek Streambank Stabilization	$ 2,280,000.00
		$ 24,300,000.00

SITE	PROPOSED ALTERNATIVE	PRESENT WORTH
1	Briarwood Mall Pond	$ 630,000.00
2	Churchill Park/Eisenhower ROW Basin	$ 1,488,000.00
3	Detroit Street Brick Rd Stormwater Management	$ 582,000.00
4	Huron Hills Golf Course Stormwater Improvements	$ 737,000.00
5	Lawton Park Stormwater Basin	$ 3,265,000.00
6	Mallets Streambank Stabilization Phase II	$ 1,248,000.00
7	Millers Creek Channel Modification - Reach 5	$ 293,000.00
8	Seventh (Scio Church to Greenview) Stormwater Improvement	$ 347,000.00
9	Street Tree Planting (FY2016-FY2020)	$ 898,000.00
10	Traver Creek Tributary Streambank Stabilization	$ 483,000.00
11	Springwater Subdvision Phase IV Improvements	$ 519,000.00
12	Swift Run MDOT	$ 384,000.00
13	Carpenter Road Drain Pond Retrofit	$ 601,000.00
14	Miller Drain / Paint Creek Streambank Stabilization	$ 1,032,000.00

PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COSTS

2019 SRF Project Plan
Briarwood Mall Ponds - Retrofits
5/14/2019

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
1	Mobilization (5%)	**LS**	1	$20,000	$20,000
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	Naturalize Berms	**SYD**	1,200	$5	$6,000
9	Naturalize Basin Perimeter	**SYD**	2,500	$5	$12,500
10	Surface Restoration	**SYD**	15,000	$3	$45,000
11	Aggregate Surface	**SYD**	1,500	$10	$15,000
12	Easement Acquisition	**LS**	1	$60,000	$60,000
13	Restoration	**LS**	1	$40,000	$40,000
	SUBTOTAL				$734,500
	Construction Contingency (20%)				$146,900
	TOTAL CONSTRUCTION COST				$881,400
	Engineering and Construction Services (25%)				$220,400
	Geotechnical Investigation				$5,000
	Geotechnical Services During Construction				$20,000
	Financial and Legal (5%)				$44,100
	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				$1,200,000

Washtenaw County Water Resources Commissioner
2019 SRF Project Plan
Non Point Source Projects

Briarwood Mall Ponds - Retrofits
Present Worth Calculations

CAPITAL COST		CAPITAL COST[1]	SERVICE LIFE (YEARS)		PRESENT WORTH[2]
Briarwood Ponds - Retrofits	$	1,200,000.00	50	$	508,000.00
TOTAL CAPITAL COST	**$**	**1,200,000.00**		$	508,000.00
INTEREST DURING CONSTRUCTION Assumes 1 year interest at 2.5%				$	24,000.00
ANNUAL OPERATION AND MAINTENANCE COST					
ANNUAL O, M & R COST (NON-ENERGY)			$ 5,000.00		
PRESENT WORTH OF OM&R COST (NON ENERGY)				$	98,000.00
ANNUAL O, M & R COST (ENERGY)			$ -		
PRESENT WORTH OF OM&R COST (ENERGY)					
PRESENT WORTH				**$**	**630,000.00**
AVERAGE ANNUAL EQUIVALENT COST				**$**	**32,000.00**

Notes:

(1) May 2019 ENR 20 Cities CCI = 11230

(2) Cost is based on a study period of 20 years and a discount rate of 0.2%.
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

2019 SRF Project Plan
Churchill Park
5/14/2019

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
1	Mobilization	**LS**	1	$75,000	$75,000
2	Traffic Control	**LS**	1	$1,000	$1,000
3	Erosion Control	**LS**	1	$10,000	$10,000
4	Basin excavation	**CFT**	330,000	$5	$1,650,000
5	Sanitary Sewer Relocation	**LS**	1	$100,000	$100,000
6	Creek Diversion	**LFT**	40	$500	$20,000
7	Land acquisiton	**LS**	1	$40,000	$40,000
8	Wetland Mitigation	**LS**	1	$35,000	$35,000
9	Restoration	**LS**	1	$75,000	$75,000

SUBTOTAL	$2,006,000
Construction Contingency (20%)	$401,200
TOTAL CONSTRUCTION COST	$2,407,200
Engineering and Construction Services (25%)	$601,800
Geotechnical Investigation	$5,000
Geotechnical Services During Construction	$20,000
Financial and Legal (5%)	$120,400
ALLOWANCES	
Easement acquisition costs, if required	$10,000
Major utility relocation	$20,000
Permit fees, bonds and inspection fees from permitting agencies.	$10,000
TOTAL COST	$3,200,000

Washtenaw County Water Resources Commissioner
2019 SRF Project Plan
Non Point Source Projects

Churchill Park
Present Worth Calculations

CAPITAL COST		CAPITAL COST[1]	SERVICE LIFE (YEARS)		PRESENT WORTH[2]
Churchill Park	$	3,200,000.00	50	$	1,355,000.00
TOTAL CAPITAL COST	**$**	**3,200,000.00**		$	1,355,000.00
INTEREST DURING CONSTRUCTION Assumes 1 year interest at 2.5%				$	64,000.00
ANNUAL OPERATION AND MAINTENANCE COST					
ANNUAL O, M & R COST (NON-ENERGY)			$ 3,500.00		
PRESENT WORTH OF OM&R COST (NON ENERGY)				$	69,000.00
ANNUAL O, M & R COST (ENERGY)			$ -		
PRESENT WORTH OF OM&R COST (ENERGY)					
PRESENT WORTH				**$**	**1,488,000.00**
AVERAGE ANNUAL EQUIVALENT COST				**$**	**76,000.00**

Notes:

(1) May 2019 ENR 20 Cities CCI = 11230

(2) Cost is based on a study period of 20 years and a discount rate of 0.2%.
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

2019 SRF Project Plan
Detroit Street - Catherine to Division - Alternate A - First Flush Storm Sewer
5/14/2019

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
1	Mobilization (5%)	**LS**	1	$30,000	$30,000
2	Traffic Control	**LS**	1	$30,000	$30,000
3	Erosion Control	**LS**	1	$5,000	$5,000
4	Storm Sewer, 24" RCP	**FT**	1,200	$60	$72,000
5	2 cfs Pollutant Separator (First Flush: 1.6 cfs)	**EACH**	1	$10,000	$10,000
6	Brick Paver Remove and Replace	**SFT**	68,600	$9	$617,400
7	Restoration	**LS**	1	$30,000	$30,000
	SUBTOTAL				$794,400
	Construction Contingency (20%)				$158,900
	TOTAL CONSTRUCTION COST				$953,300
	Engineering and Construction Services (25%)				$238,300
	Geotechnical Investigation				$5,000
	Geotechnical Services During Construction				$20,000
	Financial and Legal (5%)				$47,700
	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				$1,300,000

Washtenaw County Water Resources Commissioner
2019 SRF Project Plan
Non Point Source Projects

Detroit Street - Catherine to Division - Alternate A - First Flush Storm Sewer
Present Worth Calculations

CAPITAL COST		CAPITAL COST[1]	SERVICE LIFE (YEARS)		PRESENT WORTH[2]
Detroit Street - Alternate A	$	1,300,000.00	50	$	551,000.00
TOTAL CAPITAL COST	**$**	**1,300,000.00**		$	551,000.00
INTEREST DURING CONSTRUCTION Assumes 1 year interest at 2%				$	26,000.00
ANNUAL OPERATION AND MAINTENANCE COST					
ANNUAL O, M & R COST (NON-ENERGY)			$ 250.00		
PRESENT WORTH OF OM&R COST (NON ENERGY)				$	5,000.00
ANNUAL O, M & R COST (ENERGY)			$ -		
PRESENT WORTH OF OM&R COST (ENERGY)					
PRESENT WORTH				**$**	**582,000.00**
AVERAGE ANNUAL EQUIVALENT COST				**$**	**30,000.00**

Notes:

(1) May 2019 ENR 20 Cities CCI = 11230

(2) Cost is based on a study period of 20 years and a discount rate of 0.2%.
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

2019 SRF Project Plan
Detroit Street - Catherine to Division - Alternate B - Subsurface Stone Reservoir
5/14/2019

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
1	Mobilization (5%)	**LS**	1	$30,000	$30,000
2	Traffic Control	**LS**	1	$25,000	$25,000
3	Erosion Control	**LS**	1	$5,000	$5,000
4	2 cfs Pollutant Separator (First Flush: 1.6 cfs)	**EACH**	1	$10,000	$10,000
5	Brick Paver Remove and Replace with Stone Reservoir	**SFT**	68,600	$15	$1,029,000
6	Restoration	**LS**	1	$20,000	$20,000
	SUBTOTAL				$1,119,000
	Construction Contingency (20%)				$223,800
	TOTAL CONSTRUCTION COST				$1,342,800
	Engineering and Construction Services (25%)				$335,700
	Geotechnical Investigation				$5,000
	Geotechnical Services During Construction				$20,000
	Financial and Legal (5%)				$67,100
	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				$1,800,000

Washtenaw County Water Resources Commissioner
2019 SRF Project Plan
Non Point Source Projects

Millers Creek - Reach 5 Streambank Restoration
Present Worth Calculations

CAPITAL COST		CAPITAL COST[1]	SERVICE LIFE (YEARS)		PRESENT WORTH[2]
Millers Creek - Reach 5	$	650,000.00	50	$	275,000.00
TOTAL CAPITAL COST	**$**	**650,000.00**		$	275,000.00
INTEREST DURING CONSTRUCTION				$	13,000.00
Assumes 1 year interest at 2.5%					
ANNUAL OPERATION AND MAINTENANCE COST					
ANNUAL O, M & R COST (NON-ENERGY)			$ 250.00		
PRESENT WORTH OF OM&R COST (NON ENERGY)				$	5,000.00
ANNUAL O, M & R COST (ENERGY)			$ -		
PRESENT WORTH OF OM&R COST (ENERGY)					
PRESENT WORTH				**$**	**293,000.00**
AVERAGE ANNUAL EQUIVALENT COST				**$**	**15,000.00**

Notes:

(1) May 2019 ENR 20 Cities CCI = 11230

(2) Cost is based on a study period of 20 years and a discount rate of 0.2%.
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

2019 SRF Project Plan
Seventh Street Stormwater Improvements (Scio Church to Greenview)
5/14/2019

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
1	Mobilization	**LS**	1	$30,000	$30,000
2	Traffic Control	**LS**	1	$10,000	$10,000
3	Erosion Control	**LS**	1	$10,000	$10,000
4	12" - 24" First Flush Storm Sewer	**FT**	1,200	$55	$66,000
5	MDOT 22A Crushed Limestone Aggregate Base	**Cu Yd**	1,600	$20	$32,000
6	Earth Excavation	**Cu Yd**	1,600	$20	$32,000
7	Infiltration Catch Basin	**Each**	9	$4,000	$36,000
8	Rain Gardens	**CYD**	12,000	$10	$120,000
9	Curb and Gutter	**LFT**	1,300	$15	$19,500
10	Site Restoration	**LS**	1	$30,000	$30,000
	SUBTOTAL				$385,500
	Construction Contingency (20%)				$77,100
	TOTAL CONSTRUCTION COST				$462,600
	Engineering and Construction Services (25%)				$115,700
	Geotechnical Investigation				$5,000
	Geotechnical Services During Construction				$10,000
	Financial and Legal (5%)				$23,100
	ALLOWANCES				
	Easement acquisition costs, if required				$10,000
	Major utility relocation				$10,000
	Permit fees, bonds and inspection fees from permitting agencies.				$10,000
	TOTAL COST				$650,000

Washtenaw County Water Resources Commissioner
2019 SRF Project Plan
Non Point Source Projects

Seventh Street Stormwater Improvements (Scio Church to Greenview
Present Worth Calculations

CAPITAL COST		CAPITAL COST[1]	SERVICE LIFE (YEARS)		PRESENT WORTH[2]
Seventh Street	$	650,000.00	50	$	275,000.00
	$	-			
TOTAL CAPITAL COST	**$**	**650,000.00**		$	275,000.00
INTEREST DURING CONSTRUCTION				$	13,000.00
Assumes 1 year interest at 2.5%					
ANNUAL OPERATION AND MAINTENANCE COST					
ANNUAL O, M & R COST (NON-ENERGY)			$ 3,000.00		
PRESENT WORTH OF OM&R COST (NON ENERGY)				$	59,000.00
ANNUAL O, M & R COST (ENERGY)			$ -		
PRESENT WORTH OF OM&R COST (ENERGY)					
PRESENT WORTH				**$**	**347,000.00**
AVERAGE ANNUAL EQUIVALENT COST				**$**	**18,000.00**

Notes:

(1) May 2019 ENR 20 Cities CCI = 11320

(2) Cost is based on a study period of 20 years and a discount rate of 0.2%.
Present Worth Costs are based on Straight Line Depreciation and no inflation.

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

Washtenaw County Water Resources Commissioner
2019 SRF Project Plan
Non Point Source Projects

Detroit Street - Catherine to Division - Alternate B - First Flush Storm Sewer
Present Worth Calculations

CAPITAL COST		CAPITAL COST[1]	SERVICE LIFE (YEARS)		PRESENT WORTH[2]
Detroit Street - Alternate B	$	1,800,000.00	50	$	762,000.00
TOTAL CAPITAL COST	**$**	**1,800,000.00**		$	762,000.00
INTEREST DURING CONSTRUCTION Assumes 1 year interest at 2%				$	36,000.00
ANNUAL OPERATION AND MAINTENANCE COST					
ANNUAL O, M & R COST (NON-ENERGY)			$ 250.00		
PRESENT WORTH OF OM&R COST (NON ENERGY)				$	5,000.00
ANNUAL O, M & R COST (ENERGY)			$ -		
PRESENT WORTH OF OM&R COST (ENERGY)					
PRESENT WORTH				**$**	**803,000.00**
AVERAGE ANNUAL EQUIVALENT COST				**$**	**41,000.00**

Notes:

(1) May 2019 ENR 20 Cities CCI = 11230

(2) Cost is based on a study period of 20 years and a discount rate of 0.2%.
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

2019 SRF Project Plan
Huron Hills Golf Course
5/14/2019

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
1	Mobilization	**LS**	1	$100,000	$100,000
2	Erosion Control	**LS**	1	$20,000	$20,000
3	Construction Access Road and Restoration	**LS**	1	$15,000	$15,000
4	Streambank Stablization/Naturalize Stream Corridor	**LFT**	1,030	$300	$309,000
5	Earth Excavation	**CYD**	3,000	$10	$30,000
6	Cart Path Reconstruction	**EA**	3	$10,000	$30,000
7	Weir Structure	**EA**	1	$10,000	$10,000
8	Outlet Control Structure	**EA**	1	$10,000	$10,000
9	Flow Velocity Reduction Inline Wetland	**LS**	1	$100,000	$100,000
10	Rain Gardens	**CYD**	6,000	$10	$60,000
11	Swales	**LFT**	1,500	$10	$15,000
12	Restoration	**LS**	1	$50,000	$50,000
	SUBTOTAL				$749,000
	Construction Contingency (20%)				$149,800
	TOTAL CONSTRUCTION COST				$898,800
	Engineering and Construction Services (25%)				$224,700
	Geotechnical Investigation				$5,000
	Geotechnical Services During Construction				$20,000
	Financial and Legal (5%)				$44,900
	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				$1,220,000

Washtenaw County Water Resources Commissioner
2019 SRF Project Plan
Non Point Source Projects

Traver Creek Tributary Streambank Stabilization
Present Worth Calculations

CAPITAL COST		CAPITAL COST[1]	SERVICE LIFE (YEARS)		PRESENT WORTH[2]
Traver Creek	$	1,000,000.00	50	$	424,000.00
	$	-			
TOTAL CAPITAL COST	**$**	**1,000,000.00**		$	424,000.00
INTEREST DURING CONSTRUCTION				$	20,000.00
Assumes 1 year interest at 2.5%					
ANNUAL OPERATION AND MAINTENANCE COST					
ANNUAL O, M & R COST (NON-ENERGY)			$ 2,000.00		
PRESENT WORTH OF OM&R COST (NON ENERGY)				$	39,000.00
ANNUAL O, M & R COST (ENERGY)			$ -		
PRESENT WORTH OF OM&R COST (ENERGY)					
PRESENT WORTH				**$**	**483,000.00**
AVERAGE ANNUAL EQUIVALENT COST				**$**	**25,000.00**

Notes:

(1) May 2019 ENR 20 Cities CCI = 11230

(2) Cost is based on a study period of 20 years and a discount rate of 0.2%.
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

2019 SRF Project Plan
Springwater Subdivision Phase IV
5/14/2019

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
1	Mobilization	**LS**	1	$45,000	$45,000
2	Traffic Control	**LS**	1	$8,000	$8,000
3	Erosion Control	**LS**	1	$8,000	$8,000
4	First Flush Sewer, 42"	**LFT**	1,440	$120	$172,800
5	First Flush Sewer, 48"	**LFT**	1,710	$170	$290,700
6	First Flush Manhole, 72"	**Each**	5	$8,000	$40,000
7	Site Restoration	**LS**	1	$20,000	$20,000
	SUBTOTAL				$584,500
	Construction Contingency (20%)				$116,900
	TOTAL CONSTRUCTION COST				$701,400
	Engineering and Construction Services (25%)				$175,400
	Geotechnical Investigation				$5,000
	Geotechnical Services During Construction				$10,000
	Financial and Legal (5%)				$35,100
	ALLOWANCES				
	Easement acquisition costs, if required				$5,000
	Major utility relocation				$8,000
	Permit fees, bonds and inspection fees from permitting agencies.				$10,000
	TOTAL COST				$950,000

Washtenaw County Water Resources Commissioner
2019 SRF Project Plan
Non Point Source Projects

Springwater Subdivision Phase IV
Present Worth Calculations

CAPITAL COST		CAPITAL COST[1]	SERVICE LIFE (YEARS)		PRESENT WORTH[2]
Springwater Subdivision	$	950,000.00	50	$	402,000.00
	$	-			
TOTAL CAPITAL COST	**$**	**950,000.00**		$	402,000.00
INTEREST DURING CONSTRUCTION				$	19,000.00
Assumes 1 year interest at 2.5%					
ANNUAL OPERATION AND MAINTENANCE COST					
ANNUAL O, M & R COST (NON-ENERGY)			$ 5,000.00		
PRESENT WORTH OF OM&R COST (NON ENERGY)				$	98,000.00
ANNUAL O, M & R COST (ENERGY)			$ -		
PRESENT WORTH OF OM&R COST (ENERGY)					
PRESENT WORTH				**$**	**519,000.00**
AVERAGE ANNUAL EQUIVALENT COST				**$**	**26,000.00**

Notes:

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(2) Cost is based on a study period of 20 years and a discount rate of 0.2%.
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

2019 SRF Project Plan
Swift Run MDOT
5/14/2019

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
1	Mobilization	**LS**	1	$40,000	$40,000
2	Traffic Control	**LS**	1	$20,000	$20,000
3	Erosion Control	**LS**	1	$20,000	$20,000
4	Tree Clearing and Grubbing	**LS**	1	$10,000	$10,000
5	Earth Excavation and Embankment	**CYD**	12,000	$20	$240,000
6	Storm Sewer	**LFT**	100	$100	$10,000
7	Weir Structure	**Each**	3	$5,000	$15,000
8	Outlet Control Structure	**Each**	3	$5,000	$15,000
9	Native Plantings	**LS**	1	$35,000	$35,000
10	Site Restoration	**LS**	1	$20,000	$20,000
	SUBTOTAL				$425,000
	Construction Contingency (20%)				$85,000
	TOTAL CONSTRUCTION COST				$510,000
	Engineering and Construction Services (25%)				$127,500
	Geotechnical Investigation				$5,000
	Geotechnical Services During Construction				$10,000
	Financial and Legal (5%)				$25,500
	ALLOWANCES				
	Easement acquisition costs, if required				$5,000
	Major utility relocation				$10,000
	Permit fees, bonds and inspection fees from permitting agencies.				$10,000
	TOTAL COST				$710,000

Washtenaw County Water Resources Commissioner
2019 SRF Project Plan
Non Point Source Projects

Swift Run MDOT
Present Worth Calculations

CAPITAL COST		CAPITAL COST[1]	SERVICE LIFE (YEARS)		PRESENT WORTH[2]
Swift Run MDOT	$	710,000.00	50	$	301,000.00
TOTAL CAPITAL COST	**$**	**710,000.00**		$	301,000.00
INTEREST DURING CONSTRUCTION Assumes 1 year interest at 2.5%				$	14,000.00
ANNUAL OPERATION AND MAINTENANCE COST					
ANNUAL O, M & R COST (NON-ENERGY)			$ 3,500.00		
PRESENT WORTH OF OM&R COST (NON ENERGY)				$	69,000.00
ANNUAL O, M & R COST (ENERGY)			$ -		
PRESENT WORTH OF OM&R COST (ENERGY)					
PRESENT WORTH				**$**	**384,000.00**
AVERAGE ANNUAL EQUIVALENT COST				**$**	**20,000.00**

Notes:

(1) May 2019 ENR 20 Cities CCI = 11230

(2) Cost is based on a study period of 20 years and a discount rate of 0.2%.
Present Worth Costs are based on Straight Line Depreciation and no inflation.

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

Washtenaw County Water Resources Commissioner
2019 SRF Project Plan
Non Point Source Projects

Huron Hills Golf Course
Present Worth Calculations

CAPITAL COST		CAPITAL COST[1]	SERVICE LIFE (YEARS)		PRESENT WORTH[2]
Huron Hills Golf Course	$	1,220,000.00	50	$	517,000.00
TOTAL CAPITAL COST	**$**	**1,220,000.00**		$	517,000.00
INTEREST DURING CONSTRUCTION Assumes 1 year interest at 2.5%				$	24,000.00
ANNUAL OPERATION AND MAINTENANCE COST					
ANNUAL O, M & R COST (NON-ENERGY)			$ 10,000.00		
PRESENT WORTH OF OM&R COST (NON ENERGY)				$	196,000.00
ANNUAL O, M & R COST (ENERGY)			$ -		
PRESENT WORTH OF OM&R COST (ENERGY)					
PRESENT WORTH				**$**	**737,000.00**
AVERAGE ANNUAL EQUIVALENT COST				**$**	**38,000.00**

Notes:

(1) May 2019 ENR 20 Cities CCI = 11230

(2) Cost is based on a study period of 20 years and a discount rate of 0.2%.
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

2019 SRF Project Plan
Lawton Park Stormwater Quality Basin (Underground)
5/14/2019

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
1	Mobilization (5%)	**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	Earth Excavation	**Cu Yd**	15,000	$20	$300,000
5	Underground Storage Basin	**LS**	1	$2,250,000	$2,250,000
6	60" Storm Sewer	**FT**	350	$400	$140,000
7	48" Storm Sewer	**FT**	1,000	$200	$200,000
8	R&R: pavement, sidewalk, curb and gutter	**LS**	1	$300,000	$300,000
9	Site Restoration	**LS**	1	$27,000	$27,000
	SUBTOTAL				$3,272,000
	Construction Contingency (20%)				$654,400
	TOTAL CONSTRUCTION COST				$3,926,400
	Engineering and Construction Services (25%)				$981,600
	Geotechnical Investigation				$5,000
	Geotechnical Services During Construction				$20,000
	Financial and Legal (5%)				$196,300
	ALLOWANCES				
	Easement acquisition costs, if required				$5,000
	Major utility relocation				$10,000
	Permit fees, bonds and inspection fees from permitting agencies.				$10,000
	TOTAL COST				$5,155,000

Washtenaw County Water Resources Commissioner
2019 SRF Project Plan
Non Point Source Projects

Lawton Park Stormwater Quality Basin (Underground)
Present Worth Calculations

CAPITAL COST		CAPITAL COST[1]	SERVICE LIFE (YEARS)		PRESENT WORTH[2]
Lawton Park	$	5,155,000.00	50	$	2,183,000.00
TOTAL CAPITAL COST	**$**	**5,155,000.00**		$	2,183,000.00
INTEREST DURING CONSTRUCTION Assumes 1 year interest at 2.5%				$	103,000.00
ANNUAL OPERATION AND MAINTENANCE COST					
ANNUAL O, M & R COST (NON-ENERGY)			$ 50,000.00		
PRESENT WORTH OF OM&R COST (NON ENERGY)				$	979,000.00
ANNUAL O, M & R COST (ENERGY)			$ -		
PRESENT WORTH OF OM&R COST (ENERGY)					
PRESENT WORTH				**$**	**3,265,000.00**
AVERAGE ANNUAL EQUIVALENT COST				**$**	**167,000.00**

Notes:

(1) May 2019 ENR 20 Cities CCI = 11230

(2) Cost is based on a study period of 20 years and a discount rate of 0.2%.
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

2019 SRF Project Plan
Mallets Creek Phase II Streambank Stabilization
5/14/2019

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	$20,000	$20,000
4	Replacement of 6 culverts	**LS**	1	$500,000	$500,000
5	Streambank Stabilization	**LFT**	5,400	$200	$1,080,000
6	Concrete Removal	**LS**	1	$2,500	$2,500
7	Flex-a-Mat	**Sq Yd**	2,000	$50	$100,000
8	Site Restoration	**LS**	1	$5,000	$5,000
	SUBTOTAL				$1,742,500
	Construction Contingency (20%)				$348,500
	TOTAL CONSTRUCTION COST				$2,091,000
	Engineering and Construction Services (25%)				$522,800
	Geotechnical Investigation				$5,000
	Geotechnical Services During Construction				$20,000
	Financial and Legal (5%)				$104,600
	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				$2,770,000

Washtenaw County Water Resources Commissioner
2019 SRF Project Plan
Non Point Source Projects

Mallets Creek Phase II Streambank Stabilization
Present Worth Calculations

CAPITAL COST		CAPITAL COST[1]	SERVICE LIFE (YEARS)		PRESENT WORTH[2]
Malletts Creek	$	2,770,000.00	50	$	1,173,000.00
TOTAL CAPITAL COST	**$**	**2,770,000.00**		$	1,173,000.00
INTEREST DURING CONSTRUCTION Assumes 1 year interest at 2.5%				$	55,000.00
ANNUAL OPERATION AND MAINTENANCE COST					
ANNUAL O, M & R COST (NON-ENERGY)			$ 1,000.00		
PRESENT WORTH OF OM&R COST (NON ENERGY)				$	20,000.00
ANNUAL O, M & R COST (ENERGY)			$ -		
PRESENT WORTH OF OM&R COST (ENERGY)					
PRESENT WORTH				**$**	**1,248,000.00**
AVERAGE ANNUAL EQUIVALENT COST				**$**	**64,000.00**

Notes:

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(2) Cost is based on a study period of 20 years and a discount rate of 0.2%.
Present Worth Costs are based on Straight Line Depreciation and no inflation.

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

Washtenaw County Water Resources Commissioner
2019 SRF Project Plan
Non Point Source Projects

Miller Drain/Upper Paint Creek Streambank Stabilization
Present Worth Calculations

CAPITAL COST		CAPITAL COST[1]	SERVICE LIFE (YEARS)		PRESENT WORTH[2]
Miller-Paint	$	2,280,000.00	50	$	966,000.00
TOTAL CAPITAL COST	**$**	**2,280,000.00**		$	966,000.00
INTEREST DURING CONSTRUCTION Assumes 1 year interest at 2.5%				$	46,000.00
ANNUAL OPERATION AND MAINTENANCE COST					
ANNUAL O, M & R COST (NON-ENERGY)			$ 1,000.00		
PRESENT WORTH OF OM&R COST (NON ENERGY)				$	20,000.00
ANNUAL O, M & R COST (ENERGY)			$ -		
PRESENT WORTH OF OM&R COST (ENERGY)					
PRESENT WORTH				**$**	**1,032,000.00**
AVERAGE ANNUAL EQUIVALENT COST				**$**	**53,000.00**

Notes:

[1] May 2019 ENR 20 Cities CCI = 11230

[2] Cost is based on a study period of 20 years and a discount rate of 0.2%.
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

2019 SRF Project Plan
Millers Creek - Reach 5 Streambank Restoration
5/14/2019

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
1	Mobilization (5%)	**LS**	1	$15,000	$15,000
2	Traffic Control	**LS**	1	$20,000	$20,000
3	Erosion Control	**LS**	1	$20,000	$20,000
4	Vegetation Management	**LS**	1	$20,000	$20,000
5	Streambank Stabilization	**LFT**	1,250	$200	$250,000
	SUBTOTAL				$325,000
	Construction Contingency (20%)				$65,000
	TOTAL CONSTRUCTION COST				$390,000
	Engineering and Construction Services (25%)				$97,500
	Geotechnical Investigation				$10,000
	Geotechnical Services During Construction				$40,000
	Financial and Legal (5%)				$19,500
	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				$650,000

PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COSTS

2019 SRF Project Plan
Street Tree Planting
5/14/2019

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
1	Mobilization (5%)	**LS**	1	$5,000	$5,000
2	Traffic Control	**LS**	1	$1,000	$1,000
3	Erosion Control	**LS**	1	$1,000	$1,000
4	Street Tree Planting (1000/Year over 5 years)	**EACH**	5,000	$365	$1,825,000
	SUBTOTAL				$1,832,000
	Construction Contingency (10%)				$183,200
	TOTAL CONSTRUCTION COST				$2,015,000
	TOTAL COST				$2,015,000

Washtenaw County Water Resources Commissioner
2019 SRF Project Plan
Non Point Source Projects

Street Tree Planting
Present Worth Calculations

CAPITAL COST		CAPITAL COST[1]	SERVICE LIFE (YEARS)		PRESENT WORTH[2]
Street Tree Planting	$	2,015,000.00	50	$	853,000.00
	$	-			
TOTAL CAPITAL COST	**$**	**2,015,000.00**		$	853,000.00
INTEREST DURING CONSTRUCTION				$	40,000.00
Assumes 1 year interest at 2.5%					
ANNUAL OPERATION AND MAINTENANCE COST					
ANNUAL O, M & R COST (NON-ENERGY)			$ 250.00		
PRESENT WORTH OF OM&R COST (NON ENERGY)				$	5,000.00
ANNUAL O, M & R COST (ENERGY)			$ -		
PRESENT WORTH OF OM&R COST (ENERGY)					
PRESENT WORTH				**$**	**898,000.00**
AVERAGE ANNUAL EQUIVALENT COST				**$**	**46,000.00**

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

2019 SRF Project Plan
Traver Creek Tributary Streambank Stabilization
5/14/2019

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
1	Mobilization (5%)	**LS**	1	$50,000	$50,000
2	Traffic Control	**LS**	1	$10,000	$10,000
3	Erosion Control	**LS**	1	$10,000	$10,000
4	Two-Stage Channel with Wetland Shelf	**FT**	1,800	$200	$360,000
5	Riffle & Pool	**EACH**	3	$5,000	$15,000
6	Control Structure Replacement	**LS**	1	$140,000	$140,000
7	Restoration	**LS**	1	$20,000	$20,000
	SUBTOTAL				$605,000
	Construction Contingency (20%)				$121,000
	TOTAL CONSTRUCTION COST				$726,000
	Engineering and Construction Services (25%)				$181,500
	Geotechnical Investigation				$5,000
	Geotechnical Services During Construction				$20,000
	Financial and Legal (5%)				$36,300
	ALLOWANCES				
	Easement acquisition costs, if required				$10,000
	Major utility relocation				$10,000
	Permit fees, bonds and inspection fees from permitting agencies.				$10,000
	TOTAL COST				$1,000,000

PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COSTS

2019 SRF Project Plan
Carpenter Road Drain
5/14/2019

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
1	Mobilization (5%)	**LS**	1	$60,000	$60,000
2	Erosion Control	**LS**	1	$10,000	$10,000
3	Siphon removal and redirect	**LS**	1	$25,000	$25,000
4	Basin Dredging	**CYD**	10,000	$25	$250,000
5	Disposal	**CYD**	10,000	$20	$200,000
6	Diversion Channel	**LFT**	30	$500	$15,000
7	Weir Structure	**Each**	1	$5,000	$5,000
8	Streambank Stabilization	**LFT**	500	$200	$100,000
9	Outlet Structure Repairs	**Each**	1	$5,000	$5,000
10	Native Plantings	**LS**	1	$25,000	$25,000
11	Restoration	**LS**	1	$30,000	$30,000
	SUBTOTAL				$725,000
	Construction Contingency (20%)				$145,000
	TOTAL CONSTRUCTION COST				$870,000
	Engineering and Construction Services (25%)				$217,500
	Geotechnical Investigation				$5,000
	Geotechnical Services During Construction				$20,000
	Financial and Legal (5%)				$43,500
	ALLOWANCES				
	Easement acquisition costs, if required				$10,000
	Major utility relocation				$10,000
	Permit fees, bonds and inspection fees from permitting agencies.				$20,000
	TOTAL COST				$1,200,000

Washtenaw County Water Resources Commissioner
2019 SRF Project Plan
Non Point Source Projects

Carpener Road Drain
Present Worth Calculations

CAPITAL COST		CAPITAL COST[1]	SERVICE LIFE (YEARS)		PRESENT WORTH[2]
Carpenter Road Drain	$	1,200,000.00	50	$	508,000.00
TOTAL CAPITAL COST	**$**	**1,200,000.00**		$	508,000.00
INTEREST DURING CONSTRUCTION Assumes 1 year interest at 2.5%				$	24,000.00
ANNUAL OPERATION AND MAINTENANCE COST					
ANNUAL O, M & R COST (NON-ENERGY)			$ 3,500.00		
PRESENT WORTH OF OM&R COST (NON ENERGY)				$	69,000.00
ANNUAL O, M & R COST (ENERGY)			$ -		
PRESENT WORTH OF OM&R COST (ENERGY)					
PRESENT WORTH				**$**	**601,000.00**
AVERAGE ANNUAL EQUIVALENT COST				**$**	**31,000.00**

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

2019 SRF Project Plan
Miller Drain and Paint Creek Stabilization
5/14/2019

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL
1	Mobilization (5%)	**LS**	1	$25,000	$25,000
2	Traffic Control	**LS**	1	$20,000	$20,000
3	Erosion Control	**LS**	1	$20,000	$20,000
4	Streambank Stabilization - Miller Drain	**LFT**	1,020	$350	$357,000
5	Streambank Stabilization - Paint Creek	**LFT**	3,340	$250	$835,000
6	Stevens Dr - Repair Crossing	**LS**	1	$10,000	$10,000
7	Native Plantings	**LS**	1	$40,000	$40,000
8	Tree Clearing and Grubbing	**LS**	1	$40,000	$40,000
9	Site Restoration	**LS**	1	$50,000	$50,000
	SUBTOTAL				$1,397,000
	Construction Contingency (20%)				$279,400
	TOTAL CONSTRUCTION COST				$1,676,400
	Engineering and Construction Services (25%)				$419,100
	Geotechnical Investigation				$5,000
	Geotechnical Services During Construction				$20,000
	Financial and Legal (5%)				$83,800
	ALLOWANCES				
	Easement acquisition costs, if required				$50,000
	Major utility relocation				$6,000
	Permit fees, bonds and inspection fees from permitting agencies.				$10,000
	TOTAL COST				$2,280,000

APPENDIX B

PUBLIC HEARING

AD TEXT

Public Notices

Public Hearing Notice Notice is hereby given that the Washtenaw County Water Resources Commissioner (WCWRC) will hold a public hearing on the proposed 2019 State Revolving Fund Project Plan for Washtenaw County for the purpose of receiving comments from interested persons. The hearing will be held from 7-8:30 P.M. on Thursday, June 13, 2019 at the NEW Center, located at 1100 N Main St. Ann Arbor, MI. The purpose of the new proposed project plan is to secure low interest funding for non-point source water quality treatment improvements. The projects described in the project plan will help to reduce storm water pollutants, flooding and flow to rivers and low-lying neighborhoods by retaining, delaying, and infiltrating the storm water runoff. Fourteen sites are being proposed based on the potential storm water management opportunities they provide to the watershed. This project will be funded through loans from Michigan's State Revolving Fund. The fourteen project sites have a combined estimated construction cost of $23,000,000. This equates to $8.17 in 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 13, 2019 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 13, 2019 will be entered into the public hearing record and should be sent to the Washtenaw County Water Resources Office, Attention: Harry Sheehan, 705 N. Zeeb Road, P.O. Box 8645, Ann Arbor, MI, 48107-8645

Related Categories: Notices and Announcements - Legal Notice

APPENDIX C

RESOLUTION

APPENDIX D

MS4 STORMWATER PERMIT

PERMIT NO. MI0059599

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Water Pollution Control Act (33 U.S.C. 1251 ., as amended; the "Federal Act"); Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA); Part 41, Sewerage Systems, of the NREPA; and Michigan Executive Order 2011-1,

Washtenaw County
705 North Zeeb Road
P.O. Box 8645
Ann Arbor, MI 48107

is authorized to discharge from the Municipal Separate Storm Sewer System (MS4)

designated as **Washtenaw Co MS4-Washtenaw**

to surface waters of the state of Michigan in accordance with effluent limitations, monitoring requirements, and other conditions set forth in this permit.

This permit takes effect on December 1, 2017. This permit is based on a complete application submitted on March 21, 2008, as amended through March 22, 2017.

The provisions of this permit are severable. After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked in whole or in part during its term in accordance with applicable laws and rules. On its effective date this permit shall supersede Certificate of Coverage No. MIG610039, issued on December 23, 2003, which is hereby revoked upon the effective date of this permit.

This permit and the authorization to discharge shall expire at midnight, **October 1, 2022.** In order to receive authorization to discharge beyond the date of expiration, the permittee shall submit an application which contains such information, forms, and fees as are required by the Department of Environmental Quality (Department) by **April 4, 2022.**

Issued: November 22, 2017

Original signed by Christine Alexander
Christine Alexander, Manager
Permits Section
Water Resources Division

PERMIT FEE REQUIREMENTS

In accordance with Section 324.3118 of the NREPA, the permittee shall make payment of an annual storm water fee to the Department for each January 1 the permit is in effect regardless of occurrence of discharge. The permittee shall submit the fee in response to the Department's annual notice. The fee shall be postmarked by March 15 for notices mailed by February 1. The fee is due no later than 45 days after receiving the notice for notices mailed after February 1.

Annual Permit Fee Classification: Municipal Storm Water - County

CONTACT INFORMATION

Unless specified otherwise, all contact with the Department required by this permit shall be made to the Jackson District Supervisor of the Water Resources Division. The Jackson District Office is located at 301 East Louis Glick Highway, Jackson, MI, 49201-1535; Telephone: 517-780-7690; Fax: 517-780-7855.

CONTESTED CASE INFORMATION

Any person who is aggrieved by this permit may file a sworn petition with the Michigan Administrative Hearing System within the Michigan Department of Licensing and Regulatory Affairs, c/o the Michigan Department of Environmental Quality, setting forth the conditions of the permit which are being challenged and specifying the grounds for the challenge. The Department of Licensing and Regulatory Affairs may reject any petition filed more than 60 days after issuance as being untimely.

PART I

Section A. Limitations and Monitoring Requirements

1. Authorized Discharges

a. Authorized Outfalls and Points of Discharge
This permit authorizes the discharge of storm water from the permittee's MS4 to the surface waters of the state via the outfalls and points of discharge identified in the permittee's application, including the outfalls and points of discharge in the expanded regulated area based on the 2010 Census, and as modified in accordance with this permit. Such discharges shall be controlled and monitored by the permittee in accordance with this permit.

The permittee shall submit the following information for the outfalls and points of discharge located within the expanded urbanized area based on the 2010 Census on or before October 1, 2018: identification of the type of discharge (i.e., outfall or point of discharge); the outfall or point of discharge identification number; and the surface water of the state receiving the discharge from each outfall or point of discharge. Permittees are encouraged to provide the latitude and longitude for each outfall and point of discharge.

b. Nested MS4 Discharges
This permit authorizes the discharge of storm water to surface waters of the state from a nested MS4 owned or operated by public bodies that include, but are not limited to, public school districts; public universities; airports; or county, state, or federal agencies. The permittee may request to modify permit coverage to add or remove a nested MS4 by submitting a request to the Department for approval. Modifications to the permit coverage may result in a permit modification, after opportunity for public comment.

c. Discharges Authorized Under Other National Pollutant Discharge Elimination System (NPDES) Permits
This permit does not prohibit the use of an MS4 for other discharges authorized under other NPDES permits, or equivalent Department approval under the NREPA or the Federal Act.

d. Water Quality Requirements
Discharges from the permittee's MS4 shall not cause or contribute to an exceedance of water quality standards in the receiving waters. This includes, but is not limited to, the requirement set forth in R 323.1050 of the Water Quality Standards stating that the receiving waters shall not have any of the following unnatural physical properties as a result of the discharge, in quantities which are or may become injurious to any designated use: turbidity, color, oil films, floating solids, foams, settleable solids, suspended solids, or deposits.

1. Outfall or Point of Discharge Identified, Constructed, or Installed After Permit Issuance

a. Outfall or Point of Discharge Within the Permittee's Regulated Area
Authorization from the Department is required to discharge storm water to a surface water of the state from an outfall or point of discharge identified, constructed, or installed after issuance but during the term of this permit and located within the permittee's regulated area as identified in the application. For each outfall or point of discharge identified, constructed, or installed after issuance but during the term of this permit, the permittee shall request authorization to discharge storm water by providing the following to the Department in a written request:

1) whether the discharge is from an outfall or point of discharge;

2) the outfall or point of discharge identification number assigned by the permittee;

3) the surface water of the state receiving the discharge from the outfall or point of discharge;

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Section A. Limitations and Monitoring Requirements

4) a certification statement that the outfall or point of discharge is within the permittee's regulated area as identified in the application;

5) a certification statement that the previously approved Storm Water Management Program (Part I.A.3. of this permit) includes best management practices (BMPs) to comply with the minimum requirements of the permit for the outfall or point of discharge; and

6) a certification statement that the previously approved Storm Water Management Program (Part I.A.3. of this permit) is being implemented in the area served by the outfall or point of discharge, including having available an up-to-date storm sewer system map required in Part I.A.3.d.1) of this permit.

b. Outfall or Point of Discharge Outside the Permittee's Regulated Area
Authorization from the Department is required to discharge storm water to a surface water of the state from an outfall or point of discharge identified, constructed, or installed after issuance but during the term of this permit and located outside the permittee's regulated area as identified in the application (e.g., area served by an expanded MS4 based on the 2010 Census or area previously served by a combined sewer system that is now separated). For each outfall or point of discharge identified, constructed, or installed after issuance but during the term of this permit, the permittee shall request authorization to discharge storm water by providing the following to the Department in a written request:

1) whether the discharge is from an outfall or point of discharge;

2) the outfall or point of discharge identification number assigned by the permittee;

3) the surface water of the state receiving the discharge from the outfall or point of discharge;

4) a map identifying the expanded regulated area based on the 2010 Census served by the permittee's MS4;

5) a certification statement that the previously approved Storm Water Management Program (Part I.A.3. of this permit) includes BMPs to comply with the minimum requirements of the permit for the outfall or point of discharge and expanded regulated area based on the 2010 Census; and

6) a certification statement that the previously approved Storm Water Management Program (Part I.A.3. of this permit) is being implemented in the expanded regulated area based on the 2010 Census served by the outfall or point of discharge, including having available an up-to-date storm sewer system map as required in Part I.A.3.d.1) of this permit.

c. Upon review of the request to authorize the discharge from an outfall or point of discharge identified, constructed, or installed after issuance but during the term of this permit in accordance with Part I.2.a. or Part I.2.b. of this permit, the Department may determine that a permit modification is required, after opportunity for public comment. The Department will notify the permittee if a modification is required.

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Section A. Limitations and Monitoring Requirements

2. Storm Water Management Program (SWMP)

The permittee submitted a SWMP with its application for an NPDES permit. The SWMP is approved as submitted. The permittee shall implement the approved SWMP to comply with the minimum requirements identified in this permit. The SWMP shall cover the area served by, or otherwise contributing to discharges from, the MS4 owned or operated by the permittee identified in the application. The permittee shall implement and enforce the SWMP to reduce the discharge of pollutants from the MS4 to the maximum extent practicable, to protect water quality, and to satisfy the appropriate water quality requirements of the NREPA and the Federal Act. The approved SWMP is an enforceable part of this permit and any Department approved modifications made to the SWMP shall also become enforceable parts of this permit.

a. Enforcement Response Procedure (ERP)
The permittee shall implement the ERP for violations of the permittee's ordinances or regulatory mechanisms identified in the SWMP to the maximum extent practicable. The ERP shall be implemented to compel compliance with the permittee's ordinances and/or regulatory mechanisms and to deter continuing violations.

The permittee shall track and document all enforcement conducted pursuant to the permittee's ERP. At a minimum, the permittee shall track and document the following: the name of the person responsible for violating the permittee's ordinance or regulatory mechanism; the date and location of the violation; a description of the violation; a description of the enforcement response used; a schedule for returning to compliance; and the date the violation was resolved.

b. Public Participation/Involvement Process (PPP)
The permittee shall implement the PPP to encourage public participation/involvement in the implementation and periodic review of the SWMP to the maximum extent practicable. The permittee shall implement the PPP as part of the SWMP. The permittee has chosen to work collaboratively with watershed or regional partners to implement the PPP or part of the PPP, therefore each permittee working collaboratively is responsible for complying with the PPP as described in the SWMP.

The PPP requires implementation of the following minimum requirements:

1) The procedure for making the SWMP available for public inspection and comment, including complying with local public notice requirements, as appropriate; and

2) The procedure for inviting public participation and involvement in the implementation and periodic review of the SWMP.

c. Public Education Program (PEP)
The permittee shall implement the PEP as part of the SWMP to the maximum extent practicable. At the minimum, the PEP shall promote, publicize, and facilitate education for the purpose of encouraging the public to reduce the discharge of pollutants in storm water runoff. The PEP shall be implemented to achieve measurable improvements in the public's understanding of storm water pollution and efforts to reduce the impacts of storm water pollution. The permittee has chosen to work collaboratively with watershed or regional partners to implement the PEP or part of the PEP, therefore each permittee working collaboratively is responsible for complying with the PEP as described in the SWMP.

The permittee shall implement the PEP in accordance with the procedure for prioritizing the following PEP topics based on high-priority, permittee-wide issues and targeted issues to reduce pollutant loads to storm water to the maximum extent practicable.

The PEP requires implementation of the following minimum requirements:

1) BMPs to address the following PEP topics:

(a) Promote public responsibility and stewardship in the permittee's watershed.

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Section A. Limitations and Monitoring Requirements

(b) Inform and educate the public about the connection of the MS4 to area waterbodies and the potential impacts discharges can have on surface waters of the state.

(c) Educate the public on illicit discharges and promote public reporting on illicit discharges and improper disposal of materials into the MS4.

(d) Promote preferred cleaning materials and procedures for car, pavement, and power washing.

(e) Inform and educate the public on proper application and disposal of pesticides, herbicides, and fertilizers.

(f) Promote proper disposal practices for grass clippings, leaf litter, and animal wastes that may enter into the MS4.

(g) Identify and promote the availability, location, and requirements of facilities for collection or disposal of household hazardous wastes, travel trailer sanitary wastes, chemicals, and motor vehicle fluids.

(h) Inform and educate the public on proper septic system care and maintenance, and how to recognize system failure.

(i) Educate the public on, and promote the benefits of, green infrastructure and Low Impact Development.

(j) Identify and educate commercial, industrial, and institutional entities likely to contribute pollutants to storm water runoff.

2) The procedure for determining the overall effectiveness of implementation and the process for modifying the PEP to address ineffective implementation. The Department may determine that a permit modification is required, after opportunity for public comment, based on modifications to the PEP. The Department will notify the permittee if a modification is required.

d. Illicit Discharge Elimination Program (IDEP)
The permittee shall implement and enforce the IDEP to detect and eliminate illicit discharges and connections to the permittee's MS4. The permittee shall implement the IDEP as part of the SWMP to the maximum extent practicable. The permittee has chosen to work collaboratively with watershed or regional partners to implement the IDEP or part of the IDEP, therefore each permittee working collaboratively is responsible for complying with the IDEP as described in the SWMP.

The IDEP requires implementation of the following minimum requirements:

1) An available, up-to-date storm sewer system map identifying the following: the storm sewer system, location of all outfalls and points of discharge the permittee owns or operates in the regulated area, and the names and location of all surface waters of the state that receive discharges from the permittee's MS4. The map shall be retained by the permittee and made available to the Department upon request. The map shall be maintained and updated as outfalls and points of discharge are identified, constructed, and installed in accordance with Part I.A.2. of this permit.

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Section A. Limitations and Monitoring Requirements

2) The plan to detect and eliminate non-storm water discharges to the permittee's MS4, including illegal dumping/spills. The plan includes the following:

a) A procedure for conducting field observations, field screening, and source investigations. The permittee shall conduct a field observation during dry weather in accordance with the procedure. Field screening and source investigation shall be conducted in accordance with the schedule in the procedure.

Field observations, field screening, and source investigations shall include the following:

(1) Field Observation – The permittee shall observe the outfall or point of discharge for the following during dry-weather in accordance with the procedure: presence/absence of flow, water clarity, color, odor, floatable materials, deposits/stains on the discharge structure and bank, vegetation condition, structural condition, and biology (e.g. bacterial sheens, algae, and slimes).

(2) Field Screening – If flow is observed at an outfall or point of discharge, the permittee shall analyze the flow for the indicator parameters identified in the procedure. If the source of an illicit discharge is identified during the field observation, field screening may not be necessary.

(3) Source Investigation – If the source of the illicit discharge was not identified by the field screening, the permittee shall conduct an investigation to identify the source in accordance with the procedure. If the permittee opts to use tracer dyes, the discharge of the dyes shall be authorized in accordance with Part I.A.6. of this permit.

If the permittee is made aware of illegal dumping/spills or complaints received, the permittee shall conduct field observations and follow-up field screening and source investigations as appropriate in accordance with the procedure, including the schedule, in the IDEP. The permittee shall immediately report any release of any polluting material which occurs to the surface waters or groundwaters of the state in accordance with Part II.C.7. of this permit.

b) A procedure for responding to illicit discharges and pursuing enforcement action. The permittee shall implement the procedure to respond and pursue enforcement action once the source of the illicit discharge is identified, including the corrective action required to eliminate the illicit discharge. The permittee shall also implement the procedure to respond to illegal spills/dumping. For each illicit discharge not eliminated within 90 days of its discovery, the permittee shall provide, with the next progress report due, a written certification that the illicit discharge was eliminated or a description of how the illicit discharge will be eliminated.

3) The employee training program, which includes the following:

a) Training on techniques for identifying illicit discharges and connections, including field observations, field screening, and source investigations;

b) Training on procedures for reporting, responding to, and eliminating an illicit discharge or connection and the proper enforcement response; and

c) A schedule and requirement for training at least once during the term of the permit for existing staff and <u>within the first year</u> of hire for new staff.

4) The procedure for IDEP evaluation and determining the overall effectiveness of the IDEP.

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e. Construction Storm Water Runoff Control Program
The permittee shall implement the construction storm water runoff control program to address areas of construction activity that disturb one (1) or more acres, including projects less than one (1) acre that are part of a larger common plan of development or sale. The permittee shall implement the construction storm water runoff control program as part of the SWMP to the maximum extent practicable.

The construction storm water runoff control program requires implementation of the following minimum requirements:

1) The procedure to notify the Part 91 Agency, or appropriate staff (if the permittee is a Part 91 Agency), when soil or sediment is discharged to the permittee's MS4 from a construction activity.

2) The procedure to notify the Department when soil, sediment, or other pollutants are discharged to the permittee's MS4 from a construction activity.

3) The procedure for ensuring that construction activity one (1) acre or greater in total earth disturbance with the potential to discharge to the permittee's MS4 obtains a Part 91 permit or is conducted by an approved Authorized Public Agency, as appropriate.

4) The procedure to advise the landowner or recorded easement holder of the State of Michigan Permit by Rule (R 323.2190 of the Part 21 Rules promulgated pursuant to Part 31 of the NREPA).

a. Post-Construction Storm Water Runoff Program
The permittee shall implement and enforce the program to address post-construction storm water runoff from new development and redevelopment projects that disturb one (1) or more acres, including projects less than one (1) acre that are part of a larger common plan of development or sale, and that discharge into the permittee's MS4. The permittee shall implement and enforce the post-construction storm water control program as part of the SWMP, to the maximum extent practicable and in accordance with the approved ordinance or regulatory mechanism.

1) The permittee shall implement and enforce the ordinance or regulatory mechanism requiring implementation of BMPs to achieve to the maximum extent practicable the following post-construction storm water runoff performance standards at the project site, including projects where the permittee is the project developer:

a) Water Quality Treatment Performance Standard
Treat the runoff generated from 90 percent of all runoff-producing storms. BMPs shall be designed on a site-specific basis to achieve a minimum of 80 percent removal of total suspended solids (TSS) as compared with uncontrolled runoff or a discharge concentration of TSS not to exceed 80 milligrams per liter (mg/l).

a) Channel Protection Performance Standard
The post-construction runoff rate and volume of discharges shall not exceed the pre-development rate and volume for the project site for all storms up to the two-year, 24-hour storm.

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Section A. Limitations and Monitoring Requirements

2) The permittee shall implement and enforce the following site-specific requirements as part of meeting the post-construction storm water runoff performance standards set forth in a) and b), above:

a) The procedure for reviewing the use of infiltration BMPs to achieve the performance standards in areas of soil or groundwater contamination in a manner that does not exacerbate existing conditions.

The ordinance or regulatory mechanism requiring BMPs to address the associated pollutants in potential hot spots as part of meeting the performance standards. Hot spots include areas with the potential for significant pollutant loading including, but not limited to, the following: gas stations; vehicle maintenance and repair; auto recyclers; recycling centers and scrap yards; landfills; solid waste facilities; and railroads. Hot spots also include areas with the potential for contaminating public water supply intakes.

3) All structural and vegetative BMPs installed and implemented to meet the performance standards shall be operated and maintained in perpetuity. The permittee shall implement and enforce the ordinance or regulatory mechanism program to ensure long-term operation and maintenance of BMPs.

4) The permittee shall implement and enforce the ordinance or regulatory mechanism and procedures for site plan review and approval for projects that disturb one (1) or more acres, including projects less than one (1) acre that are part of a larger common plan of development or sale, and discharge to the permittee's MS4, including projects where the permittee is the developer. The site plan review and approval shall demonstrate compliance with the performance standards and long-term operation and maintenance requirements of this permit.

b. Pollution Prevention and Good Housekeeping Activities for Municipal Operations
The permittee shall implement the pollution prevention and good housekeeping program with the goal of preventing or reducing pollutant runoff from municipal facilities and operations that discharge storm water to surface waters of the state. The permittee shall implement the program as part of the SWMP to the maximum extent practicable.

1) Municipal Facility and Structural Storm Water Control Inventory
The permittee shall make available to the Department upon request an up-to-date map or maps of the facilities and structural storm water controls owned or operated by the permittee with a discharge to surface waters of the state in the regulated area. In accordance with the procedure for updating and revising the permittee's facility inventory and map(s), the permittee shall submit to the Department the type and location for any new facility obtained or constructed during this permit term with a discharge of storm water to surface waters of the state and the information requested in Parts I.A.2. of the permit.

2) Facility-Specific Storm Water Management

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Section A. Limitations and Monitoring Requirements

The permittee shall implement the BMPs identified in the procedure to prevent or reduce pollutant runoff at each facility the permittee identified as having the medium or low potential to discharge pollutants to surface waters of the state. The permittee shall assess new facilities for the potential to discharge pollutants to surface waters of the state in accordance with the procedure to determine a priority level. High-priority facilities shall include permittee-owned or operated fleet maintenance and storage yards unless a demonstration is submitted and approved by the Department demonstrating how the permittee's fleet maintenance or storage yard has the low potential to discharge pollutants to surface waters of the state. The assessment shall be submitted in writing to the Department for approval within 30 days of ownership or operation of the new facility. The permittee shall certify in writing to the Department that a facility-specific standard operating procedure (SOP) is being implemented within 90 days of ownership or operation of a new high-priority facility. Within 90 days of ownership or operation, the permittee shall certify in writing to the Department that BMPs are being implemented in accordance with the procedure developed to prevent or reduce pollutant runoff at each new medium- or low-priority facility. For new facilities, the Department may determine that a permit modification is required, after opportunity for public comment. The Department will notify the permittee if a modification is required. The permittee shall document all other changes to the facility assessment as part of the progress report and as an update to the procedure.

The facility-specific SOP shall be kept at the site described in the SOP and made available upon request by the Department. The facility-specific SOP for each high-priority facility shall include implementation of the following.

a) Structural and non-structural storm water controls to prevent or reduce the discharge of pollutants to surface waters of the state.

b) Up-to-date list of significant materials stored on-site that could pollute storm water with a description of the handling and storage requirements and potential to discharge for each significant material.

c) Good housekeeping practices including, but not limited to, maintaining a clean and orderly facility, properly storing and covering materials, and minimizing pollutant sources to prevent or reduce pollutant runoff.

d) Routine maintenance and inspections of storm water management and control devices to ensure materials and equipment are clean and orderly and prevent or reduce pollutant runoff. The written report of the inspection and corrective actions shall be retained in accordance with Part II.B.5. of this permit.

e) Comprehensive site inspections at least once every six (6) months. The comprehensive site inspection shall include an inspection of all structural storm water controls and a review of non-structural storm water controls to prevent or reduce pollutant runoff. A written report of the inspection and corrective actions shall be retained in accordance with Part II.B.5. of this permit.

3) Structural Storm water Control Operation and Maintenance Activities

a) The permittee shall implement the procedures for inspecting, cleaning, and maintaining permittee-owned or operated catch basins in the regulated area using the priority level assigned to each catch basin. The permittee shall document changes to the priority level for a catch basin as part of the progress report and as an update to the procedure.

The permittee shall also implement the procedure for dewatering and disposal of materials extracted from the catch basins in accordance with Part 111 (Hazardous Waste), Part 115 (Solid Waste), and Part 121 (Liquid Industrial Waste) of the NREPA.

b) The permittee shall implement the procedure for inspecting and maintaining permittee-owned or operated structural storm water controls other than catch basins in the

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regulated area. The permittee shall document changes to the procedure as part of the progress report and as an update to the procedure.

c) The permittee shall implement the procedure requiring that new permittee-owned or operated facilities or structural storm water controls to address water quantity be designed and implemented in accordance with the post-construction storm water runoff performance standards and long-term operation and maintenance requirements in Part I.A.3.f. of this permit.

4) Municipal Operations and Maintenance Activities
The permittee shall implement the procedure, including the BMPs identified, to prevent or reduce pollutant runoff from the permittee's operation and maintenance activities identified in the SWMP. The permittee shall document changes to the assessment of operation and maintenance activities for the potential to discharge pollutants to surface waters of the state as part of the progress report and as an update to the procedure.

5) Managing Vegetated Properties
The permittee shall implement the procedure requiring the permittee's pesticide applicator to be certified by the State of Michigan as an applicator in the applicable category, to prevent or reduce pollutant runoff from vegetated land.

6) Employee Training
The permittee shall implement the employee training program to train employees involved in implementing pollution prevention and good housekeeping activities. At a minimum, existing staff shall be trained once during the permit cycle and new hire employees <u>within the first year</u> of their hire date.

7) Contractor Requirements and Oversight
The permittee shall implement the procedure requiring contractors hired by the permittee to perform municipal operation and maintenance activities that comply with the permittee's pollution prevention and good housekeeping program and contractor oversight to ensure compliance.

c. Total Maximum Daily Load (TMDL) Implementation Plan
The permittee shall implement the TMDL Implementation Plan to reduce the discharge of pollutants from the permittee's MS4 to make progress in meeting Water Quality Standards. The permittee shall implement the TMDL Implementation Plan as part of the SWMP. The permittee has chosen to work collaboratively with watershed or regional partners to implement this plan or part of the plan, therefore each permittee is responsible for complying with the plan as described in the SWMP.

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The following TMDLs are applicable to the discharge from the permittee's MS4:

Name of TMDL	Pollutant of Concern
Ford and Bellville Lakes	Total Phosphorus
Geddes Pond (Huron River)	
Honey Creek	
Mallets Creek	Biota
Paint Creek	Dissolved Oxygen, Biota
Rouge River	Biota
Swift Run Creek	Biota

The permittee shall implement the prioritized BMPs included in the TMDL Implementation Plan during the permit cycle to make progress in achieving the pollutant load reduction requirement in the TMDL. The permittee shall review, update, and revise the list of BMPs implemented as part of the TMDL Implementation Plan in accordance with the procedure included in the SWMP. The Department may determine that a permit modification is required, after opportunity for public comment, based on modifications to the TMDL Implementation Plan. The Department will notify the permittee if a modification is required.

The permittee shall implement the monitoring plan included in the TMDL Implementation Plan for assessing the effectiveness of the BMPs implemented in making progress toward achieving the TMDL pollutant load reduction. Available monitoring data shall be submitted with each progress report.

4. SWMP Modifications

a. SWMP Modifications Requested by the Permittee
Modifications to the previously approved SWMP may be requested by the permittee as follows:

1) Modifications adding BMPs (but not replacing, subtracting, or affecting the level of implementation of any other BMP) to the previously approved SWMP may be made by the permittee at any time upon written notification to the Department. Notification shall include a description of the modification, which may include a description of a new BMP with a corresponding measurable goal. Upon notification to the Department, the modification is considered an enforceable part of the approved SWMP.

2) Modifications replacing an ineffective or unfeasible BMP identified in the previously approved SWMP with an alternative BMP may be requested at any time by written notification to the Department. The ineffective or unfeasible BMP identified shall not be replaced in the previously approved SWMP unless the replacement is approved by the Department. Modifications to the previously approved SWMP may result in a permit modification after opportunity for public comment. Such requests shall include the following:

a) an analysis of why the BMP is ineffective or unfeasible (including cost-prohibitive);

b) a measurable goal for the replacement BMP; and

c) an analysis of why the replacement BMP is expected to achieve the intent of the BMP to be replaced.

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3) Modifications subtracting an ineffective or unfeasible BMP identified in the previously approved SWMP may be requested by written notification to the Department. The identified BMP shall not be subtracted from the previously approved SWMP unless the subtraction is approved by the Department. Modifications to the previously approved SWMP may result in a permit modification after opportunity for public comment. Such requests shall include the following:

a) an analysis of why the BMP is ineffective or unfeasible (including cost prohibitive); and

b) a determination of why the removal of the BMP will not change the permittee's ability to comply with the permit requirements.

b. Modifications Required by the Department
The Department may require the permittee to modify the SWMP as needed to:

1) address contributions from the permittee's MS4 discharge that impair receiving water quality;

2) include more stringent requirements necessary to comply with new state or federal statutory or regulatory requirements; and/or

3) include such other conditions deemed necessary by the Department to comply with the goals and requirements of the Federal Act or the NREPA, including the requirement to reduce the discharge of pollutants from the MS4 to the maximum extent practicable.

3. Request for Discharge of Water Treatment Additives

Prior to discharge of any water treatment additive, written approval shall be obtained by the permittee. Requests for such approval shall be submitted via the Department's MiWaters system. Instructions for submitting such a request may be obtained via the Internet (http://www.michigan.gov/deqnpdes; then near the bottom of the page, click on one or both of the links located under the Water Treatment Additives banner). Additional monitoring and reporting may be required as a condition for the approval to discharge the additive.

A request to discharge water treatment additives shall include all of the following usage and discharge information for each water treatment additive proposed to be discharged:

a. Safety Data Sheet (formerly known as Material Safety Data Sheet);

b. the proposed water treatment additive discharge concentration with supporting calculations;

c. the discharge frequency (i.e., number of hours per day and number of days per year);

d. the monitoring point from which the product is to be discharged;

e. the type of removal treatment, if any, that the water treatment additive receives prior to discharge;

f. product function (i.e. microbiocide, flocculant, etc.);

g. a 48-hour LC_{50} or EC_{50} for a North American freshwater planktonic crustacean (either .); and

h. the results of a toxicity test for one (1) other North American freshwater aquatic species (other than a planktonic crustacean) that meets a minimum requirement of R 323.1057(2) of the Water Quality Standards.

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Section A. Limitations and Monitoring Requirements

6. Tracer Dye Discharges

The permittee is authorized to apply tracer dye(s) to surface waters of the state in accordance with the following conditions:

a. Tracer dye discharge authorization is restricted to the tracer dye(s), active ingredient Chemical Abstract Service (CAS) number(s), and concentration(s) identified in the permittee's Notice of Intent (NOI), dated January 13, 2016.

b. The application of tracer dye(s) shall be conducted in accordance with all pertinent product label instructions.

c. The extent of the tracer dye plume(s) in waters of the state shall be minimized to the fullest extent practicable.

d. The permittee shall notify the following agencies at least 48 hours prior to each tracer dye application:
   Local Municipality (city, township, village, etc.)
   Local County Health Department
   Downstream Health Departments if they could be potentially affected
   Local Area Emergency Coordinator

e. The permittee shall notify the Department at least 48 hours prior to each application of tracer dye(s) directly to surface waters of the state. In the event that indirect application of tracer dye results in visible discharges of tracer dye(s) observed in the surface waters of the state, the permittee shall notify the Department immediately after making the observation. During normal working hours, such notification shall be made in accordance with Contact Information on Page 2 of this permit; if after hours or on weekends or holidays, the permittee shall contact the Pollution Emergency Alert System (PEAS) at 800-292-4706.

f. The permittee shall retain records identifying all treatment locations, dates of treatment, and names of applicators, and name, CAS number, and concentration of all active ingredient(s) applied at each location. Records shall be retained for a minimum of three (3) years from the date of application.

g. In the event that any of the above conditions in this section are or may not be met, the permittee shall immediately notify the Department.

7. Storm Water Program Manager (Facility Contact)

The "Facility Contact" was specified in the application. The permittee may replace the facility contact at any time, and shall notify the Department in writing <u>within 10 days</u> after replacement (including the name, address and telephone number of the new facility contact).

a. The facility contact shall be (or a duly authorized representative of this person):
   for a corporation, a principal executive officer of at least the level of vice president; or a designated representative if the representative is responsible for the overall operation of the facility from which the discharge originates, as described in the permit application or other NPDES form,
   for a partnership, a general partner,
   for a sole proprietorship, the proprietor, or
   for a municipal, state, or other public facility, either a principal executive officer, the mayor, village president, city or village manager or other duly authorized employee.

PART I

Section A. Limitations and Monitoring Requirements

b. A person is a duly authorized representative only if:

the authorization is made in writing to the Department by a person described in paragraph a. of this section; and

the authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the facility (a duly authorized representative may thus be either a named individual or any individual occupying a named position).

Nothing in this section obviates the permittee from properly submitting reports and forms as required by law.

PART I

Section B. Program Assessment and Reporting

1. Progress Reports

The permittee shall submit progress reports to the Department during the term of the permit. Progress reports shall be submitted on or before April 1, 2020 and on April 1 every two (2) years following. The Department may approve alternate dates for progress report submittal if requested and adequately justified by the permittee. Each progress report shall contain the following information for the entire period that has elapsed since the last progress report submittal (i.e., the reporting cycle):

a. Compliance Assessment
The permittee shall describe the status of compliance with the approved SWMP identified in Part I.A.3 of this permit. The permittee shall assess and describe the appropriateness of the BMPs identified in the SWMP. The report shall describe the progress made towards achieving the identified measurable goals for each of the BMPs, and specific evaluation criteria as follows:

1) For the PEP, provide a summary of the evaluation of the overall effectiveness of the PEP, using the evaluation methods described in the PEP.

2) For the IDEP, provide a summary of the evaluation and determination of the overall effectiveness of the IDEP, using the evaluation methods described in the IDEP. For each illicit discharge that was not eliminated within 90 days of its discovery the permittee shall provide a written certification that the illicit discharge was eliminated or a description of how the illicit discharge will be eliminated.

3) If applicable, the permittee shall submit to the Department any new outfall or point of discharge information as required in Part I.A.2. of this permit.

4) For the TMDL Implementation Plan, if monitoring data is available in accordance with the monitoring plan, provide an assessment of progress made toward achieving the TMDL pollutant load reduction requirement.

b. Data and Results
The permittee shall provide a summary of all of the information collected and analyzed, including monitoring data, if any, during the reporting cycle.

c. Upcoming Activities
The permittee shall provide a summary of the BMPs to be implemented during the next reporting cycle.

d. Changes to BMPs and Measurable Goals
The permittee shall describe any changes to BMPs or measurable goals in the approved SWMP. In accordance with the permit, these changes will be reviewed to determine if a permit modification is necessary. The Department will notify the permittee if a permit modification is required.

e. Notice of Changes in Nested Jurisdiction Agreements
The permittee shall identify any nested jurisdictions that enter into or terminate permit agreements with the permittee which were not identified in the SWMP. The permittee may request to modify the permit coverage to add or remove a nested MS4 by submitting a request to the Department for approval in accordance with Part I.A.1.b. of this permit. Modifications to the permit coverage may result in a permit modification, after opportunity for public comment.

f. Required Signatures
All reports required by this permit, and other information requested by the Department, shall be signed by either a principal executive officer or ranking elected official, or by a duly authorized representative of that person in accordance with 40 CFR 122.22(b).

PART II

Part II may include terms and /or conditions not applicable to discharges covered under this permit.

Section A. Definitions

Acute toxic unit (TU_A) means $100/LC_{50}$ where the LC_{50} is determined from a whole effluent toxicity (WET) test which produces a result that is statistically or graphically estimated to be lethal to 50% of the test organisms.

Annual monitoring frequency refers to a calendar year beginning on January 1 and ending on December 31. When required by this permit, an analytical result, reading, value or observation shall be reported for that period if a discharge occurs during that period.

Authorized public agency means a state, local, or county agency that is designated pursuant to the provisions of section 9110 of Part 91 of the NREPA to implement soil erosion and sedimentation control requirements with regard to construction activities undertaken by that agency.

Best management practices (BMPs) means structural devices or nonstructural practices that are designed to prevent pollutants from entering into storm water, to direct the flow of storm water, or to treat polluted storm water.

Bioaccumulative chemical of concern (BCC) means a chemical which, upon entering the surface waters, by itself or as its toxic transformation product, accumulates in aquatic organisms by a human health bioaccumulation factor of more than 1000 after considering metabolism and other physiochemical properties that might enhance or inhibit bioaccumulation. The human health bioaccumulation factor shall be derived according to R 323.1057(5). Chemicals with half-lives of less than 8 weeks in the water column, sediment, and biota are not BCCs. The minimum bioaccumulation concentration factor (BAF) information needed to define an organic chemical as a BCC is either a field-measured BAF or a BAF derived using the biota-sediment accumulation factor (BSAF) methodology. The minimum BAF information needed to define an inorganic chemical as a BCC, including an organometal, is either a field-measured BAF or a laboratory-measured bioconcentration factor (BCF). The BCCs to which these rules apply are identified in Table 5 of R 323.1057 of the Water Quality Standards.

Biosolids are the solid, semisolid, or liquid residues generated during the treatment of sanitary sewage or domestic sewage in a treatment works. This includes, but is not limited to, scum or solids removed in primary, secondary, or advanced wastewater treatment processes and a derivative of the removed scum or solids.

Bulk biosolids means biosolids that are not sold or given away in a bag or other container for application to a lawn or home garden.

Certificate of Coverage (COC) is a document, issued by the Department, which authorizes a discharge under a general permit.

Chronic toxic unit (TU_C) means 100/MATC or $100/IC_{25}$, where the maximum acceptable toxicant concentration (MATC) and IC_{25} are expressed as a percent effluent in the test medium.

Class B biosolids refers to material that has met the Class B pathogen reduction requirements or equivalent treatment by a Process to Significantly Reduce Pathogens (PSRP) in accordance with the Part 24 Rules. Processes include aerobic digestion, composting, anaerobic digestion, lime stabilization and air drying.

Combined sewer system is a sewer system in which storm water runoff is combined with sanitary wastes.

PART II

Section A. Definitions

Daily concentration is the sum of the concentrations of the individual samples of a parameter divided by the number of samples taken during any calendar day. If the parameter concentration in any sample is less than the quantification limit, regard that value as zero when calculating the daily concentration. The daily concentration will be used to determine compliance with any maximum and minimum daily concentration limitations (except for pH and dissolved oxygen). When required by the permit, report the maximum calculated daily concentration for the month in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the Discharge Monitoring Reports (DMRs).

For pH, report the maximum value of any sample taken during the month in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs and the minimum value of any sample taken during the month in the "MINIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs. For dissolved oxygen, report the minimum concentration of any sample in the "MINIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs.

Daily loading is the total discharge by weight of a parameter discharged during any calendar day. This value is calculated by multiplying the daily concentration by the total daily flow and by the appropriate conversion factor. The daily loading will be used to determine compliance with any maximum daily loading limitations. When required by the permit, report the maximum calculated daily loading for the month in the "MAXIMUM" column under "QUANTITY OR LOADING" on the DMRs.

Daily monitoring frequency refers to a 24-hour day. When required by this permit, an analytical result, reading, value or observation shall be reported for that period if a discharge occurs during that period.

Department means the Michigan Department of Environmental Quality.

Detection level means the lowest concentration or amount of the target analyte that can be determined to be different from zero by a single measurement at a stated level of probability.

Discharge means the addition of any waste, waste effluent, wastewater, pollutant, or any combination thereof to any surface water of the state.

EC_{50} means a statistically or graphically estimated concentration that is expected to cause 1 or more specified effects in 50% of a group of organisms under specified conditions.

Fecal coliform bacteria monthly
FOR WWSLs THAT COLLECT AND STORE WASTEWATER AND ARE AUTHORIZED TO DISCHARGE ONLY IN THE SPRING AND/OR FALL ON AN INTERMITTENT BASIS – Fecal coliform bacteria monthly is the geometric mean of all daily concentrations determined during a discharge event. Days on which no daily concentration is determined shall not be used to determine the calculated monthly value. The calculated monthly value will be used to determine compliance with the maximum monthly fecal coliform bacteria limitations. When required by the permit, report the calculated monthly value in the "AVERAGE" column under "QUALITY OR CONCENTRATION" on the DMR. If the period in which the discharge event occurred was partially in each of two months, the calculated monthly value shall be reported on the DMR of the month in which the last day of discharge occurred.

FOR ALL OTHER DISCHARGES – Fecal coliform bacteria monthly is the geometric mean of all daily concentrations determined during a reporting month. Days on which no daily concentration is determined shall not be used to determine the calculated monthly value. The calculated monthly value will be used to determine compliance with the maximum monthly fecal coliform bacteria limitations. When required by the permit, report the calculated monthly value in the "AVERAGE" column under "QUALITY OR CONCENTRATION" on the DMR.

PART II

Section A. Definitions

Fecal coliform bacteria 7-day
FOR WWSLs THAT COLLECT AND STORE WASTEWATER AND ARE AUTHORIZED TO DISCHARGE ONLY IN THE SPRING AND/OR FALL ON AN INTERMITTENT BASIS – Fecal coliform bacteria 7-day is the geometric mean of the daily concentrations determined during any 7 consecutive days of discharge during a discharge event. If the number of daily concentrations determined during the discharge event is less than 7 days, the number of actual daily concentrations determined shall be used for the calculation. Days on which no daily concentration is determined shall not be used to determine the value. The calculated 7-day value will be used to determine compliance with the maximum 7-day fecal coliform bacteria limitations. When required by the permit, report the maximum calculated 7-day geometric mean value for the month in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs. If the 7-day period was partially in each of two months, the value shall be reported on the DMR of the month in which the last day of discharge occurred.

FOR ALL OTHER DISCHARGES – Fecal coliform bacteria 7-day is the geometric mean of the daily concentrations determined during any 7 consecutive days in a reporting month. If the number of daily concentrations determined is less than 7, the actual number of daily concentrations determined shall be used for the calculation. Days on which no daily concentration is determined shall not be used to determine the value. The calculated 7-day value will be used to determine compliance with the maximum 7-day fecal coliform bacteria limitations. When required by the permit, report the maximum calculated 7-day geometric mean for the month in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs. The first calculation shall be made on day 7 of the reporting month, and the last calculation shall be made on the last day of the reporting month.

Flow-proportioned sample is a composite sample with the sample volume proportional to the effluent flow.

General permit means a National Pollutant Discharge Elimination System permit issued authorizing a category of similar discharges.

Geometric mean is the average of the logarithmic values of a base 10 data set, converted back to a base 10 number.

Grab sample is a single sample taken at neither a set time nor flow.

IC_{25} means the toxicant concentration that would cause a 25% reduction in a nonquantal biological measurement for the test population.

Illicit connection means a physical connection to a municipal separate storm sewer system that primarily conveys non-storm water discharges other than uncontaminated groundwater into the storm sewer; or a physical connection not authorized or permitted by the local authority, where a local authority requires authorization or a permit for physical connections.

Illicit discharge means any discharge to, or seepage into, a municipal separate storm sewer system that is not composed entirely of storm water or uncontaminated groundwater. Illicit discharges include non-storm water discharges through pipes or other physical connections; dumping of motor vehicle fluids, household hazardous wastes, domestic animal wastes, or litter; collection and intentional dumping of grass clippings or leaf litter; or unauthorized discharges of sewage, industrial waste, restaurant wastes, or any other non-storm water waste directly into a separate storm sewer.

Individual permit means a site-specific NPDES permit.

Inlet means a catch basin, roof drain, conduit, drain tile, retention pond riser pipe, sump pump, or other point where storm water or wastewater enters into a closed conveyance system prior to discharge off site or into waters of the state.

PART II

Section A. Definitions

Interference is a discharge which, alone or in conjunction with a discharge or discharges from other sources, both: 1) inhibits or disrupts the POTW, its treatment processes or operations, or its sludge processes, use or disposal; and 2) therefore, is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation) or, of the prevention of sewage sludge use or disposal in compliance with the following statutory provisions and regulations or permits issued thereunder (or more stringent state or local regulations): Section 405 of the Clean Water Act, the Solid Waste Disposal Act (SWDA) (including Title II, more commonly referred to as the Resource Conservation and Recovery Act (RCRA), and including state regulations contained in any state sludge management plan prepared pursuant to Subtitle D of the SWDA), the Clean Air Act, the Toxic Substances Control Act, and the Marine Protection, Research and Sanctuaries Act. [This definition does not apply to sample matrix interference].

Land application means spraying or spreading biosolids or a biosolids derivative onto the land surface, injecting below the land surface, or incorporating into the soil so that the biosolids or biosolids derivative can either condition the soil or fertilize crops or vegetation grown in the soil.

LC_{50} means a statistically or graphically estimated concentration that is expected to be lethal to 50% of a group of organisms under specified conditions.

Maximum acceptable toxicant concentration (MATC) means the concentration obtained by calculating the geometric mean of the lower and upper chronic limits from a chronic test. A lower chronic limit is the highest tested concentration that did not cause the occurrence of a specific adverse effect. An upper chronic limit is the lowest tested concentration which did cause the occurrence of a specific adverse effect and above which all tested concentrations caused such an occurrence.

Maximum extent practicable means implementation of best management practices by a public body to comply with an approved storm water management program as required by a national permit for a municipal separate storm sewer system, in a manner that is environmentally beneficial, technically feasible, and within the public body's legal authority.

MGD means million gallons per day.

Monthly concentration is the sum of the daily concentrations determined during a reporting period divided by the number of daily concentrations determined. The calculated monthly concentration will be used to determine compliance with any maximum monthly concentration limitations. Days with no discharge shall not be used to determine the value. When required by the permit, report the calculated monthly concentration in the "AVERAGE" column under "QUALITY OR CONCENTRATION" on the DMR.

For minimum percent removal requirements, the monthly influent concentration and the monthly effluent concentration shall be determined. The calculated monthly percent removal, which is equal to 100 times the quantity [1 minus the quantity (monthly effluent concentration divided by the monthly influent concentration)], shall be reported in the "MINIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs.

Monthly loading is the sum of the daily loadings of a parameter divided by the number of daily loadings determined during a reporting period. The calculated monthly loading will be used to determine compliance with any maximum monthly loading limitations. Days with no discharge shall not be used to determine the value. When required by the permit, report the calculated monthly loading in the "AVERAGE" column under "QUANTITY OR LOADING" on the DMR.

Monthly monitoring frequency refers to a calendar month. When required by this permit, an analytical result, reading, value or observation shall be reported for that period if a discharge occurs during that period.

Municipal separate storm sewer means a conveyance or system of conveyances designed or used for collecting or conveying storm water which is not a combined sewer and which is not part of a publicly-owned treatment works as defined in the Code of Federal Regulations at 40 CFR 122.2.

PART II

Section A. Definitions

Municipal separate storm sewer system (MS4) means all separate storm sewers that are owned or operated by the United States, a state, city, village, township, county, district, association, or other public body created by or pursuant to state law, having jurisdiction over disposal of sewage, industrial wastes, storm water, or other wastes, including special districts under state law, such as a sewer district, flood control district, or drainage district, or similar entity, or a designated or approved management agency under Section 208 of the Federal Act that discharges to the waters of the state. This term includes systems similar to separate storm sewer systems in municipalities, such as systems at military bases, large hospital or prison complexes, and highways and other thoroughfares. The term does not include separate storm sewers in very discrete areas, such as individual buildings.

National Pretreatment Standards are the regulations promulgated by or to be promulgated by the Federal Environmental Protection Agency pursuant to Section 307(b) and (c) of the Federal Act. The standards establish nationwide limits for specific industrial categories for discharge to a POTW.

No observed adverse effect level (NOAEL) means the highest tested dose or concentration of a substance which results in no observed adverse effect in exposed test organisms where higher doses or concentrations result in an adverse effect.

Noncontact cooling water is water used for cooling which does not come into direct contact with any raw material, intermediate product, by-product, waste product or finished product.

Nondomestic user is any discharger to a POTW that discharges wastes other than or in addition to water-carried wastes from toilet, kitchen, laundry, bathing or other facilities used for household purposes.

Outfall is the location at which a point source discharge enters the surface waters of the state.

Part 91 agency means an agency that is designated by a county board of commissioners pursuant to the provisions of section 9105 of Part 91 of the NREPA; an agency that is designated by a city, village, or township in accordance with the provisions of section 9106 of Part 91 of the NREPA; or the Department for soil erosion and sedimentation activities under Part 615, Part 631, or Part 632 pursuant to the provisions of section 9115 of Part 91 of the NREPA.

Part 91 permit means a soil erosion and sedimentation control permit issued by a Part 91 agency pursuant to the provisions of Part 91 of the NREPA.

Partially treated sewage is any sewage, sewage and storm water, or sewage and wastewater, from domestic or industrial sources that is treated to a level less than that required by the permittee's National Pollutant Discharge Elimination System permit, or that is not treated to national secondary treatment standards for wastewater, including discharges to surface waters from retention treatment facilities.

Point of discharge is the location of a point source discharge where storm water is discharged directly into a separate storm sewer system.

Point source discharge means a discharge from any discernible, confined, discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, or rolling stock. Changing the surface of land or establishing grading patterns on land will result in a point source discharge where the runoff from the site is ultimately discharged to waters of the state.

Polluting material means any material, in solid or liquid form, identified as a polluting material under the Part 5 Rules (R 324.2001 through R 324.2009 of the Michigan Administrative Code).

POTW is a publicly owned treatment work.

Predevelopment means at a minimum, predevelopment is the last land use prior to the planned new development or redevelopment.

PART II

Section A. Definitions

Pretreatment is reducing the amount of pollutants, eliminating pollutants, or altering the nature of pollutant properties to a less harmful state prior to discharge into a public sewer. The reduction or alteration can be by physical, chemical, or biological processes, process changes, or by other means. Dilution is not considered pretreatment unless expressly authorized by an applicable National Pretreatment Standard for a particular industrial category.

Public (as used in the MS4 individual permit) means all persons who potentially could affect the authorized storm water discharges, including, but not limited to, residents, visitors to the area, public employees, businesses, industries, and construction contractors and developers.

Public body means the United States; the state of Michigan; a city, village, township, county, school district, public college or university, or single-purpose governmental agency; or any other body which is created by federal or state statute or law.

Qualified Personnel means an individual who meets qualifications acceptable to the Department and who is authorized by an Industrial Storm Water Certified Operator to collect the storm water sample.

Qualifying storm event means a storm event causing greater than 0.1 inch of rainfall and occurring at least 72 hours after the previous measurable storm event that also caused greater than 0.1 inch of rainfall. Upon request, the Department may approve an alternate definition meeting the condition of a qualifying storm event.

Quantification level means the measurement of the concentration of a contaminant obtained by using a specified laboratory procedure calculated at a specified concentration above the detection level. It is considered the lowest concentration at which a particular contaminant can be quantitatively measured using a specified laboratory procedure for monitoring of the contaminant.

Quarterly monitoring frequency refers to a three month period, defined as January through March, April through June, July through September, and October through December. When required by this permit, an analytical result, reading, value or observation shall be reported for that period if a discharge occurs during that period.

Regional Administrator is the Region 5 Administrator, U.S. EPA, located at R-19J, 77 W. Jackson Blvd., Chicago, Illinois 60604.

Regulated area means the permittee's urbanized area, where urbanized area is defined as a place and its adjacent densely-populated territory that together have a minimum population of 50,000 people as defined by the United States Bureau of the Census and as determined by the latest available decennial census.

Secondary containment structure means a unit, other than the primary container, in which significant materials are packaged or held, which is required by State or Federal law to prevent the escape of significant materials by gravity into sewers, drains, or otherwise directly or indirectly into any sewer system or to the surface or ground waters of this state.

Separate storm sewer system means a system of drainage, including, but not limited to, roads, catch basins, curbs, gutters, parking lots, ditches, conduits, pumping devices, or man-made channels, which is not a combined sewer where storm water mixes with sanitary wastes, and is not part of a POTW.

Significant industrial user is a nondomestic user that: 1) is subject to Categorical Pretreatment Standards under 40 CFR 403.6 and 40 CFR Chapter I, Subchapter N; or 2) discharges an average of 25,000 gallons per day or more of process wastewater to a POTW (excluding sanitary, noncontact cooling and boiler blowdown wastewater); contributes a process waste stream which makes up five (5) percent or more of the average dry weather hydraulic or organic capacity of the POTW treatment plant; or is designated as such by the permittee as defined in 40 CFR 403.12(a) on the basis that the industrial user has a reasonable potential for adversely affecting the POTW's treatment plant operation or violating any pretreatment standard or requirement (in accordance with 40 CFR 403.8(f)(6)).

PART II

Section A. Definitions

Significant materials Significant Materials means any material which could degrade or impair water quality, including but not limited to: raw materials; fuels; solvents, detergents, and plastic pellets; finished materials such as metallic products; hazardous substances designated under Section 101(14) of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (see 40 CFR 372.65); any chemical the facility is required to report pursuant to Section 313 of Emergency Planning and Community Right-to-Know Act (EPCRA); polluting materials as identified under the Part 5 Rules (R 324.2001 through R 324.2009 of the Michigan Administrative Code); Hazardous Wastes as defined in Part 111 of the NREPA; fertilizers; pesticides; and waste products such as ashes, slag, and sludge that have the potential to be released with storm water discharges.

Significant spills and significant leaks means any release of a polluting material reportable under the Part 5 Rules (R 324.2001 through R 324.2009 of the Michigan Administrative Code).

Special-use area means secondary containment structures required by state or federal law; lands on Michigan's List of Sites of Environmental Contamination pursuant to Part 201, Environmental Remediation, of the NREPA; and/or areas with other activities that may contribute pollutants to the storm water for which the Department determines monitoring is needed.

Stoichiometric means the quantity of a reagent calculated to be necessary and sufficient for a given chemical reaction.

Storm water means storm water runoff, snow melt runoff, surface runoff and drainage, and non-storm water included under the conditions of this permit.

Storm water discharge point is the location where the point source discharge of storm water is directed to surface waters of the state or to a separate storm sewer. It includes the location of all point source discharges where storm water exits the facility, including which discharge directly to surface waters of the state, and which discharge directly into separate storm sewer systems.

SWPPP means the Storm Water Pollution Prevention Plan prepared in accordance with this permit.

Tier I value means a value for aquatic life, human health or wildlife calculated under R 323.1057 of the Water Quality Standards using a tier I toxicity database.

Tier II value means a value for aquatic life, human health or wildlife calculated under R 323.1057 of the Water Quality Standards using a tier II toxicity database.

Total maximum daily loads (TMDLs)

Toxicity reduction evaluation (TRE) means a site-specific study conducted in a stepwise process designed to identify the causative agents of effluent toxicity, isolate the sources of toxicity, evaluate the effectiveness of toxicity control options, and then confirm the reduction in effluent toxicity.

Water Quality Standards means the Part 4 Water Quality Standards promulgated pursuant to Part 31 of the NREPA, being R 323.1041 through R 323.1117 of the Michigan Administrative Code.

Weekly monitoring frequency refers to a calendar week which begins on Sunday and ends on Saturday. When required by this permit, an analytical result, reading, value or observation shall be reported for that period if a discharge occurs during that period.

WWSL is a wastewater stabilization lagoon.

WWSL discharge event is a discrete occurrence during which effluent is discharged to the surface water up to 10 days of a consecutive 14 day period.

PART II

Section A. Definitions

3-portion composite sample is a sample consisting of three equal-volume grab samples collected at equal intervals over an 8-hour period.

7-day concentration
FOR WWSLs THAT COLLECT AND STORE WASTEWATER AND ARE AUTHORIZED TO DISCHARGE ONLY IN THE SPRING AND/OR FALL ON AN INTERMITTENT BASIS – The 7-day concentration is the sum of the daily concentrations determined during any 7 consecutive days of discharge during a WWSL discharge event divided by the number of daily concentrations determined. If the number of daily concentrations determined during the WWSL discharge event is less than 7 days, the number of actual daily concentrations determined shall be used for the calculation. The calculated 7-day concentration will be used to determine compliance with any maximum 7-day concentration limitations. When required by the permit, report the maximum calculated 7-day concentration for the WWSL discharge event in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the DMR. If the WWSL discharge event was partially in each of two months, the value shall be reported on the DMR of the month in which the last day of discharge occurred.

FOR ALL OTHER DISCHARGES – The 7-day concentration is the sum of the daily concentrations determined during any 7 consecutive days in a reporting month divided by the number of daily concentrations determined. If the number of daily concentrations determined is less than 7, the actual number of daily concentrations determined shall be used for the calculation. The calculated 7-day concentration will be used to determine compliance with any maximum 7-day concentration limitations in the reporting month. When required by the permit, report the maximum calculated 7-day concentration for the month in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the DMR. The first 7-day calculation shall be made on day 7 of the reporting month, and the last calculation shall be made on the last day of the reporting month.

7-day loading
FOR WWSLs THAT COLLECT AND STORE WASTEWATER AND ARE AUTHORIZED TO DISCHARGE ONLY IN THE SPRING AND/OR FALL ON AN INTERMITTENT BASIS – The 7-day loading is the sum of the daily loadings determined during any 7 consecutive days of discharge during a WWSL discharge event divided by the number of daily loadings determined. If the number of daily loadings determined during the WWSL discharge event is less than 7 days, the number of actual daily loadings determined shall be used for the calculation. The calculated 7-day loading will be used to determine compliance with any maximum 7-day loading limitations. When required by the permit, report the maximum calculated 7-day loading for the WWSL discharge event in the "MAXIMUM" column under "QUANTITY OR LOADING" on the DMR. If the WWSL discharge event was partially in each of two months, the value shall be reported on the DMR of the month in which the last day of discharge occurred

FOR ALL OTHER DISCHARGES – The 7-day loading is the sum of the daily loadings determined during any 7 consecutive days in a reporting month divided by the number of daily loadings determined. If the number of daily loadings determined is less than 7, the actual number of daily loadings determined shall be used for the calculation. The calculated 7-day loading will be used to determine compliance with any maximum 7-day loading limitations in the reporting month. When required by the permit, report the maximum calculated 7-day loading for the month in the "MAXIMUM" column under "QUANTITY OR LOADING" on the DMR. The first 7-day calculation shall be made on day 7 of the reporting month, and the last calculation shall be made on the last day of the reporting month.

24-hour composite sample is a flow-proportioned composite sample consisting of hourly or more frequent portions that are taken over a 24-hour period. A time-proportioned composite sample may be used upon approval of the Department if the permittee demonstrates it is representative of the discharge.

PART II

Section B. Monitoring Procedures

1. Representative Samples

Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge.

2. Test Procedures

Test procedures for the analysis of pollutants shall conform to regulations promulgated pursuant to Section 304(h) of the Federal Act (40 CFR Part 136 – Guidelines Establishing Test Procedures for the Analysis of Pollutants), unless specified otherwise in this permit. **Test procedures used shall be sufficiently sensitive to determine compliance with applicable effluent limitations**. Requests to use test procedures not promulgated under 40 CFR Part 136 for pollutant monitoring required by this permit shall be made in accordance with the Alternate Test Procedures regulations specified in 40 CFR 136.4. These requests shall be submitted to the Manager of the Permits Section, Water Resources Division, Michigan Department of Environmental Quality, P.O. Box 30458, Lansing, Michigan, 48909-7958. The permittee may use such procedures upon approval.

The permittee shall periodically calibrate and perform maintenance procedures on all analytical instrumentation at intervals to ensure accuracy of measurements. The calibration and maintenance shall be performed as part of the permittee's laboratory Quality Control/Quality Assurance program.

3. Instrumentation

The permittee shall periodically calibrate and perform maintenance procedures on all monitoring instrumentation at intervals to ensure accuracy of measurements.

4. Recording Results

For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information: 1) the exact place, date, and time of measurement or sampling; 2) the person(s) who performed the measurement or sample collection; 3) the dates the analyses were performed; 4) the person(s) who performed the analyses; 5) the analytical techniques or methods used; 6) the date of and person responsible for equipment calibration; and 7) the results of all required analyses.

5. Records Retention

All records and information resulting from the monitoring activities required by this permit including all records of analyses performed and calibration and maintenance of instrumentation and recordings from continuous monitoring instrumentation shall be retained for a minimum of three (3) years, or longer if requested by the Regional Administrator or the Department.

PART II

Section C. Reporting Requirements

1. Start-up Notification

If the permittee will not discharge during the first 60 days following the effective date of this permit, the permittee shall notify the Department within 14 days following the effective date of this permit, and then 60 days prior to the commencement of the discharge.

2. Submittal Requirements for Self-Monitoring Data

Part 31 of the NREPA (specifically Section 324.3110(7)); and R 323.2155(2) of Part 21, Wastewater Discharge Permits, promulgated under Part 31 of the NREPA, allow the Department to specify the forms to be utilized for reporting the required self-monitoring data. Unless instructed on the effluent limitations page to conduct "Retained Self-Monitoring" the permittee shall submit self-monitoring data via the Department's MiWaters system.

The permittee shall utilize the information provided on the MiWaters website at https://miwaters.deq.state.mi.us to access and submit the electronic forms. Both monthly summary and daily data shall be submitted to the Department no later than the 20th day of the month following each month of the authorized discharge period(s). The permittee may be allowed to submit the electronic forms after this date if the Department has granted an extension to the submittal date.

3. Retained Self-Monitoring Requirements

If instructed on the effluent limits page (or otherwise authorized by the Department in accordance with the provisions of this permit) to conduct retained self-monitoring, the permittee shall maintain a year-to-date log of retained self-monitoring results and, upon request, provide such log for inspection to the staff of the Department. Retained self-monitoring results are public information and shall be promptly provided to the public upon request.

The permittee shall certify, in writing, to the Department, on or before January 10th (April 1st for animal feeding operation facilities) of each year, that: 1) all retained self-monitoring requirements have been complied with and a year-to-date log has been maintained; and 2) the application on which this permit is based still accurately describes the discharge. With this annual certification, the permittee shall submit a summary of the previous year's monitoring data. The summary shall include maximum values for samples to be reported as daily maximums and/or monthly maximums and minimum values for any daily minimum samples.

Retained self-monitoring may be denied to a permittee by notification in writing from the Department. In such cases, the permittee shall submit self-monitoring data in accordance with Part II.C.2., above. Such a denial may be rescinded by the Department upon written notification to the permittee. Reissuance or modification of this permit or reissuance or modification of an individual permittee's authorization to discharge shall not affect previous approval or denial for retained self-monitoring unless the Department provides notification in writing to the permittee.

4. Additional Monitoring by Permittee

If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved analytical methods as specified above, the results of such monitoring shall be included in the calculation and reporting of the values required in the Discharge Monitoring Report. Such increased frequency shall also be indicated.

Monitoring required pursuant to Part 41 of the NREPA or Rule 35 of the Mobile Home Park Commission Act (Act 96 of the Public Acts of 1987) for assurance of proper facility operation shall be submitted as required by the Department.

PART II

Section C. Reporting Requirements

5. Compliance Dates Notification

Within 14 days of every compliance date specified in this permit, the permittee shall submit a notification to the Department indicating whether or not the particular requirement was accomplished. If the requirement was not accomplished, the notification shall include an explanation of the failure to accomplish the requirement, actions taken or planned by the permittee to correct the situation, and an estimate of when the requirement will be accomplished. If a written report is required to be submitted by a specified date and the permittee accomplishes this, a separate written notification is not required.

6. Noncompliance Notification

Compliance with all applicable requirements set forth in the Federal Act, Parts 31 and 41 of the NREPA, and related regulations and rules is required. All instances of noncompliance shall be reported as follows:

a. 24-Hour Reporting
Any noncompliance which may endanger health or the environment (including maximum and/or minimum daily concentration discharge limitation exceedances) shall be reported, verbally, within 24 hours from the time the permittee becomes aware of the noncompliance. A written submission shall also be provided within five (5) days.

b. Other Reporting
The permittee shall report, in writing, all other instances of noncompliance not described in a. above at the time monitoring reports are submitted; or, in the case of retained self-monitoring, within five (5) days from the time the permittee becomes aware of the noncompliance.

Written reporting shall include: 1) a description of the discharge and cause of noncompliance; and 2) the period of noncompliance, including exact dates and times, or, if not yet corrected, the anticipated time the noncompliance is expected to continue, and the steps taken to reduce, eliminate and prevent recurrence of the noncomplying discharge.

7. Spill Notification

The permittee shall immediately report any release of any polluting material which occurs to the surface waters or groundwaters of the state, unless the permittee has determined that the release is not in excess of the threshold reporting quantities specified in the Part 5 Rules (R 324.2001 through R 324.2009 of the Michigan Administrative Code), by calling the Department at the number indicated on the second page of this permit (or, if this is a general permit, on the COC); or, if the notice is provided after regular working hours, call the Department's 24-hour Pollution Emergency Alerting System telephone number, 1-800-292-4706 (calls from **out-of-state** dial 1-517-373-7660).

Within ten (10) days of the release, the permittee shall submit to the Department a full written explanation as to the cause of the release, the discovery of the release, response (clean-up and/or recovery) measures taken, and preventative measures taken or a schedule for completion of measures to be taken to prevent reoccurrence of similar releases.

PART II

Section C. Reporting Requirements

8. Upset Noncompliance Notification

If a process "upset" (defined as an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee) has occurred, the permittee who wishes to establish the affirmative defense of upset, shall notify the Department by telephone within 24 hours of becoming aware of such conditions; and within five (5) days, provide in writing, the following information:

a. that an upset occurred and that the permittee can identify the specific cause(s) of the upset;

b. that the permitted wastewater treatment facility was, at the time, being properly operated and maintained (note that an upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation); and

c. that the permittee has specified and taken action on all responsible steps to minimize or correct any adverse impact in the environment resulting from noncompliance with this permit.

No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

In any enforcement proceedings, the permittee, seeking to establish the occurrence of an upset, has the burden of proof.

9. Bypass Prohibition and Notification

a. Bypass Prohibition
Bypass is prohibited, and the Department may take an enforcement action, unless:

1) bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

2) there were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate backup equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass; and

3) the permittee submitted notices as required under 9.b. or 9.c. below.

b. Notice of Anticipated Bypass
If the permittee knows in advance of the need for a bypass, it shall submit prior notice to the Department, if possible at least ten (10) days before the date of the bypass, and provide information about the anticipated bypass as required by the Department. The Department may approve an anticipated bypass, after considering its adverse effects, if it will meet the three (3) conditions listed in 9.a. above.

c. Notice of Unanticipated Bypass
The permittee shall submit notice to the Department of an unanticipated bypass by calling the Department at the number indicated on the second page of this permit (if the notice is provided after regular working hours, use the following number: 1-800-292-4706) as soon as possible, but no later than 24 hours from the time the permittee becomes aware of the circumstances.

PART II

Section C. Reporting Requirements

d. Written Report of Bypass
A written submission shall be provided within five (5) working days of commencing any bypass to the Department, and at additional times as directed by the Department. The written submission shall contain a description of the bypass and its cause; the period of bypass, including exact dates and times, and if the bypass has not been corrected, the anticipated time it is expected to continue; steps taken or planned to reduce, eliminate, and prevent reoccurrence of the bypass; and other information as required by the Department.

e. Bypass Not Exceeding Limitations
The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to ensure efficient operation. These bypasses are not subject to the provisions of 9.a., 9.b., 9.c., and 9.d., above. This provision does not relieve the permittee of any notification responsibilities under Part II.C.11. of this permit.

f. Definitions

1) Bypass means the intentional diversion of waste streams from any portion of a treatment facility.

2) Severe property damage means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

10. Bioaccumulative Chemicals of Concern (BCC)

Consistent with the requirements of R 323.1098 and R 323.1215 of the Michigan Administrative Code, the permittee is prohibited from undertaking any action that would result in a lowering of water quality from an increased loading of a BCC unless an increased use request and antidegradation demonstration have been submitted and approved by the Department.

11. Notification of Changes in Discharge

The permittee shall notify the Department, in writing, as soon as possible but no later than 10 days of knowing, or having reason to believe, that any activity or change has occurred or will occur which would result in the discharge of: 1) detectable levels of chemicals on the current Michigan Critical Materials Register, priority pollutants or hazardous substances set forth in 40 CFR 122.21, Appendix D, or the Pollutants of Initial Focus in the Great Lakes Water Quality Initiative specified in 40 CFR 132.6, Table 6, which were not acknowledged in the application or listed in the application at less than detectable levels; 2) detectable levels of any other chemical not listed in the application or listed at less than detection, for which the application specifically requested information; or 3) any chemical at levels greater than five times the average level reported in the complete application (see the first page of this permit, for the date(s) the complete application was submitted). Any other monitoring results obtained as a requirement of this permit shall be reported in accordance with the compliance schedules.

PART II

Section C. Reporting Requirements

12. Changes in Facility Operations

Any anticipated action or activity, including but not limited to facility expansion, production increases, or process modification, which will result in new or increased loadings of pollutants to the receiving waters must be reported to the Department by a) submission of an increased use request (application) and all information required under R 323.1098 (Antidegradation) of the Water Quality Standards or b) by notice if the following conditions are met: 1) the action or activity will not result in a change in the types of wastewater discharged or result in a greater quantity of wastewater than currently authorized by this permit; 2) the action or activity will not result in violations of the effluent limitations specified in this permit; 3) the action or activity is not prohibited by the requirements of Part II.C.10.; and 4) the action or activity will not require notification pursuant to Part II.C.11. Following such notice, the permit or, if applicable, the facility's COC may be modified according to applicable laws and rules to specify and limit any pollutant not previously limited.

13. Transfer of Ownership or Control

In the event of any change in control or ownership of facilities from which the authorized discharge emanates, the permittee shall submit to the Department 30 days prior to the actual transfer of ownership or control a written agreement between the current permittee and the new permittee containing: 1) the legal name and address of the new owner; 2) a specific date for the effective transfer of permit responsibility, coverage and liability; and 3) a certification of the continuity of or any changes in operations, wastewater discharge, or wastewater treatment.

If the new permittee is proposing changes in operations, wastewater discharge, or wastewater treatment, the Department may propose modification of this permit in accordance with applicable laws and rules.

14. Operations and Maintenance Manual

For wastewater treatment facilities that serve the public (and are thus subject to Part 41 of the NREPA), Section 4104 of Part 41 and associated Rule 2957 of the Michigan Administrative Code allow the Department to require an Operations and Maintenance (O&M) Manual from the facility. An up-to-date copy of the O&M Manual shall be kept at the facility and shall be provided to the Department upon request. The Department may review the O&M Manual in whole or in part at its discretion and require modifications to it if portions are determined to be inadequate.

At a minimum, the O&M Manual shall include the following information: permit standards; descriptions and operation information for all equipment; staffing information; laboratory requirements; record keeping requirements; a maintenance plan for equipment; an emergency operating plan; safety program information; and copies of all pertinent forms, as-built plans, and manufacturer's manuals.

Certification of the existence and accuracy of the O&M Manual shall be submitted to the Department at least sixty days prior to start-up of a new wastewater treatment facility. Recertification shall be submitted sixty days prior to start-up of any substantial improvements or modifications made to an existing wastewater treatment facility.

PART II

Section C. Reporting Requirements

15. Signatory Requirements

All applications, reports, or information submitted to the Department in accordance with the conditions of this permit and that require a signature shall be signed and certified as described in the Federal Act and the NREPA.

The Federal Act provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance, shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

The NREPA (Section 3115(2)) provides that a person who at the time of the violation knew or should have known that he or she discharged a substance contrary to this part, or contrary to a permit, COC, or order issued or rule promulgated under this part, or who intentionally makes a false statement, representation, or certification in an application for or form pertaining to a permit or COC or in a notice or report required by the terms and conditions of an issued permit or COC, or who intentionally renders inaccurate a monitoring device or record required to be maintained by the Department, is guilty of a felony and shall be fined not less than $2,500.00 or more than $25,000.00 for each violation. The court may impose an additional fine of not more than $25,000.00 for each day during which the unlawful discharge occurred. If the conviction is for a violation committed after a first conviction of the person under this subsection, the court shall impose a fine of not less than $25,000.00 per day and not more than $50,000.00 per day of violation. Upon conviction, in addition to a fine, the court in its discretion may sentence the defendant to imprisonment for not more than 2 years or impose probation upon a person for a violation of this part. With the exception of the issuance of criminal complaints, issuance of warrants, and the holding of an arraignment, the circuit court for the county in which the violation occurred has exclusive jurisdiction. However, the person shall not be subject to the penalties of this subsection if the discharge of the effluent is in conformance with and obedient to a rule, order, permit, or COC of the Department. In addition to a fine, the attorney general may file a civil suit in a court of competent jurisdiction to recover the full value of the injuries done to the natural resources of the state and the costs of surveillance and enforcement by the state resulting from the violation.

16. Electronic Reporting

Upon notice by the Department that electronic reporting tools are available for specific reports or notifications, the permittee shall submit electronically all such reports or notifications as required by this permit.

PART II

Section D. Management Responsibilities

1. Duty to Comply

All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant identified in this permit, more frequently than, or at a level in excess of, that authorized, shall constitute a violation of the permit.

It is the duty of the permittee to comply with all the terms and conditions of this permit. Any noncompliance with the Effluent Limitations, Special Conditions, or terms of this permit constitutes a violation of the NREPA and/or the Federal Act and constitutes grounds for enforcement action; for permit or Certificate of Coverage (COC) termination, revocation and reissuance, or modification; or denial of an application for permit or COC renewal.

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

2. Operator Certification

The permittee shall have the waste treatment facilities under direct supervision of an operator certified at the appropriate level for the facility certification by the Department, as required by Sections 3110 and 4104 of the NREPA. Permittees authorized to discharge storm water shall have the storm water treatment and/or control measures under direct supervision of a storm water operator certified by the Department, as required by Section 3110 of the NREPA.

3. Facilities Operation

The permittee shall, at all times, properly operate and maintain all treatment or control facilities or systems installed or used by the permittee to achieve compliance with the terms and conditions of this permit. Proper operation and maintenance includes adequate laboratory controls and appropriate quality assurance procedures.

4. Power Failures

In order to maintain compliance with the effluent limitations of this permit and prevent unauthorized discharges, the permittee shall either:

a. provide an alternative power source sufficient to operate facilities utilized by the permittee to maintain compliance with the effluent limitations and conditions of this permit; or

b. upon the reduction, loss, or failure of one or more of the primary sources of power to facilities utilized by the permittee to maintain compliance with the effluent limitations and conditions of this permit, the permittee shall halt, reduce or otherwise control production and/or all discharge in order to maintain compliance with the effluent limitations and conditions of this permit.

5. Adverse Impact

The permittee shall take all reasonable steps to minimize or prevent any adverse impact to the surface waters or groundwaters of the state resulting from noncompliance with any effluent limitation specified in this permit including, but not limited to, such accelerated or additional monitoring as necessary to determine the nature and impact of the discharge in noncompliance.

PART II

Section D. Management Responsibilities

6. Containment Facilities

The permittee shall provide facilities for containment of any accidental losses of polluting materials in accordance with the requirements of the Part 5 Rules (R 324.2001 through R 324.2009 of the Michigan Administrative Code). For a Publicly Owned Treatment Work (POTW), these facilities shall be approved under Part 41 of the NREPA.

7. Waste Treatment Residues

Residuals (i.e. solids, sludges, biosolids, filter backwash, scrubber water, ash, grit, or other pollutants or wastes) removed from or resulting from treatment or control of wastewaters, including those that are generated during treatment or left over after treatment or control has ceased, shall be disposed of in an environmentally compatible manner and according to applicable laws and rules. These laws may include, but are not limited to, the NREPA, Part 31 for protection of water resources, Part 55 for air pollution control, Part 111 for hazardous waste management, Part 115 for solid waste management, Part 121 for liquid industrial wastes, Part 301 for protection of inland lakes and streams, and Part 303 for wetlands protection. Such disposal shall not result in any unlawful pollution of the air, surface waters or groundwaters of the state.

8. Right of Entry

The permittee shall allow the Department, any agent appointed by the Department, or the Regional Administrator, upon the presentation of credentials and, for animal feeding operation facilities, following appropriate biosecurity protocols:

a. to enter upon the permittee's premises where an effluent source is located or any place in which records are required to be kept under the terms and conditions of this permit; and

b. at reasonable times to have access to and copy any records required to be kept under the terms and conditions of this permit; to inspect process facilities, treatment works, monitoring methods and equipment regulated or required under this permit; and to sample any discharge of pollutants.

9. Availability of Reports

Except for data determined to be confidential under Section 308 of the Federal Act and Rule 2128 (R 323.2128 of the Michigan Administrative Code), all reports prepared in accordance with the terms of this permit, shall be available for public inspection at the offices of the Department and the Regional Administrator. As required by the Federal Act, effluent data shall not be considered confidential. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in Section 309 of the Federal Act and Sections 3112, 3115, 4106 and 4110 of the NREPA.

10. Duty to Provide Information

The permittee shall furnish to the Department, <u>within a reasonable time</u>, any information which the Department may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or the facility's COC, or to determine compliance with this permit. The permittee shall also furnish to the Department, upon request, copies of records required to be kept by this permit.

Where the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Department, it shall promptly submit such facts or information.

PART II

Section E. Activities Not Authorized by This Permit

1. Discharge to the Groundwaters

This permit does not authorize any discharge to the groundwaters. Such discharge may be authorized by a groundwater discharge permit issued pursuant to the NREPA.

2. POTW Construction

This permit does not authorize or approve the construction or modification of any physical structures or facilities at a POTW. Approval for the construction or modification of any physical structures or facilities at a POTW shall be by permit issued under Part 41 of the NREPA.

3. Civil and Criminal Liability

Except as provided in permit conditions on "Bypass" (Part II.C.9. pursuant to 40 CFR 122.41(m)), nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance, whether or not such noncompliance is due to factors beyond the permittee's control, such as accidents, equipment breakdowns, or labor disputes.

4. Oil and Hazardous Substance Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee may be subject under Section 311 of the Federal Act except as are exempted by federal regulations.

5. State Laws

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable state law or regulation under authority preserved by Section 510 of the Federal Act.

6. Property Rights

The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize violation of any federal, state or local laws or regulations, nor does it obviate the necessity of obtaining such permits, including any other Department of Environmental Quality permits, or approvals from other units of government as may be required by law.

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APPENDIX E

TMDLs

APPENDIX E

TMDLs

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
WATER DIVISION
SEPTEMBER 2004

TOTAL MAXIMUM DAILY LOAD FOR PHOSPHORUS IN FORD AND BELLEVILLE LAKES

Location:

Ford and Belleville Lakes are impoundments of the Huron River, located in Washtenaw and Wayne Counties (see Figure 2 in Kosek, 1996 [attached]; and Figure 4 in Brenner and Rentschler, 1996 [attached]).

Pollutant:

Total Phosphorus.

Summary:

These lakes receive high nutrient loadings, causing severe water quality problems, most notably nuisance algae blooms. In 1991, Ford Lake suffered a September algae bloom so severe that a hazardous material response team was summoned to investigate the "green paint spill." At the September 1987 meeting of the Water Resources Commission, the state of Michigan established a goal of 30 micrograms per liter (µg/L) phosphorus concentration for Belleville Lake as part of an effort to restore designated uses of the lake. The Michigan Department of Environmental Quality (MDEQ) has determined that a 50 µg/L phosphorus concentration must be met going into Ford Lake during the period of April-September (the algae growing season) in order to achieve the 30 µg/L goal for Belleville Lake. Other impoundments along this section of the Huron River watershed are expected to benefit from the reduced phosphorus as well.

The MDEQ has developed the loading capacity for both lakes based on the phosphorus concentration goal established for Belleville Lake (Kosek, 1996). This loading capacity will be used to determine the Total Maximum Daily Load (TMDL) and associated National Pollutant Discharge Elimination System (NPDES) permit limits for all involved point source dischargers, and also to determine the magnitude of the phosphorus reductions necessary from other sources. As part of a watershed 104(b)(3) grant from the United States Environmental Protection Agency (USEPA), the local communities have been involved in the process of developing an implementation plan for these reductions (Brenner and Rentschler, 1996).

TMDL Development:

The phosphorus concentration is the critical variable in this system, since it is the limiting nutrient for algae growth in these short retention time lakes. If the total phosphorus concentration going into Ford Lake can be kept at or below 50 µg/L in April-September, then the lakes should respond by decreasing the algae growth to nonnuisance levels and Belleville Lake should meet its 30 µg/L goal. Therefore, the loading capacity is expressed as a phosphorus concentration of 50 µg/L at the Michigan Avenue bridge on the Huron River (just upstream of Ford Lake) for the months of April through September (see Table 13 in Kosek, 1996).

Phosphorus load, though related to the concentration, will vary with flow. Figure 1 shows graphically how the load varies with flow, with the monthly average loads indicated on the line. In order to decrease present loadings (represented by 1995 data in Figures 1 and 2) to the

loading capacity levels, it will be necessary to reduce phosphorus loads from both point and nonpoint sources. The wasteload allocations (WLAs) and load allocations (LAs) were calculated for each month (Table 1).

Table 1. WLAs and LAs for the Ford and Belleville Lakes TMDL for Phosphorus.

	WLA/LA by Month (lb/d)					
	APR	MAY	JUN	JUL	AUG	SEP
TMDL	304	214	139	88	74	103
Ann Arbor WWTP	150	60	60	50	50	60
Chelsea WWTP	9.5	2.2	2.2	1.8	1.8	2.2
Dexter WWTP	3.0	0.9	0.9	0.8	0.8	0.9
Loch Alpine WWTP	1.5	0.6	0.6	0.5	0.5	0.6
Chrysler-Chelsea	0.5	0.3	0.3	0.3	0.3	0.3
Other Point Sources[a]	1.5	1.7	1.7	1.7	1.7	1.7
Total Point Source WLA	166	66	66	55	55	66
Nonpoint Source LA	91	100	61	29	19	37
Remaining	47	48	12	4	0	0

[a]There are 12 minor point source dischargers in the watershed area of interest. For more details, see Brenner and Rentschler, 1996.

TMDL implementation consists of reducing point and nonpoint source loads to the levels presented in Table 1. Communities would gradually implement phosphorus reduction activities over a five-year period. A Section 319 grant proposal has been submitted to provide funding for the implementation of a local information and education campaign, which has been developed. Lake and river sampling will continue in order to monitor how well the reductions are being achieved.

Calculations:

LA:

Due to the highly variable nature of nonpoint source loads, the development of the LA was complex. The general concept used to develop the LA for the nonpoint sources was to subtract the amount of reduction from watershed-specific best management practices from the current nonpoint source loads. A detailed land use study was performed to determine the maximum reductions possible through extensive use of best management practices tailored to the land uses in the middle Huron River watershed. Best management practices based on the specific area and type of land use in each subwatershed basin would reduce the nonpoint source load by as much as 58% (Brenner and Rentschler, 1996). The maximum usage of the most effective best management practices is recommended.

Since the TMDL corresponds to a constant concentration at various flows, allowable loads are best expressed as a linear equation (Figure 1). The average flows for the period of record for each month were used to calculate the TMDL loads by month. Several of the critical months in 1995 deviated from the average flows for the period of record. Rather than use the unusually high or low loadings that were calculated for these months in 1995, "expected" nonpoint source

loads under current point and nonpoint source management practices were calculated for each month (except April) based on the average flow for the period of record. These calculations were based on a linear regression of the measured loads and flow conditions for each month in 1995 (Figure 2). A summary of the nonpoint source load calculations is presented in Table 2. Current "expected" conditions are highlighted in bold in Table 2.

The nonpoint source load allocations are equal to a 57% reduction from current "expected" nonpoint source loads in April and a 58% reduction from current "expected" nonpoint source loads in May-September.

WLA:

Phosphorus load restrictions are not needed to protect these lakes during the months of October through March, since algae growth does not occur at those times and the water will be flushed out of the lakes before the algae growing season starts. The limit of 1 milligram per liter (mg/L) would be retained in the point source permits during the months of October through March for the purposes of Great Lakes protection.

The critical algae growing season begins in May. Therefore, allowing some time of passage and cycling of phosphorus through the system, reductions in the phosphorus loadings need to begin in April. The point sources will be expected to operate in such a manner so as not to exceed the allocated waste loads. Options to meeting the allocated waste loads will include permit requirements to 1) meet the individual WLA in Table 1; 2) meet the aggregate total point source WLA in Table 1; or 3) enter into a Cooperative Agreement to meet the point source WLA in Table 1 for phosphorus. It is left to each facility to determine the exact dynamics of the concentration and flow rates used to meet these loadings at the respective plants.

Late snowmelt and spring rains usually cause high flow conditions in April, so the phosphorus concentrations remain relatively low despite higher loading rates. Therefore, the point source WLA for April incorporates larger loadings (166 lb/d) and serves as a transitional period between the unrestricted winter loads and the stringent summer loads. The loading rate of 166 lb/d approximates concentrations of 0.6 mg/L phosphorus at the design flows of the point sources. For the months of May, June, and September, the WLA among the point sources drops to 66 lb/d (Table 2), which approximates concentrations of 0.4 mg/L phosphorus at the current flows of the wastewater treatment plants. For the months of July and August, the WLA among the point sources is reduced to 55 lb/d (Table 2). Please note that the loads for July and August are less than those proposed in the phosphorus reduction strategy developed by the local stakeholders (see Table 14 in Brenner and Rentschler, 1996).

Table 2. Information Used to Calculate WLAs and LAs.

	LA by Month (lb/d)					
	APR	MAY	JUN	JUL	AUG	SEP
TMDL	304	214	139	88	74	103
1995 Total Load	246	319	244	211	331	85
"Expected" Load	304	336	223	145	123	168
1995 Point Sources	92	97	77	78	86	80
Ann Arbor WWTP	150	60	60	50	50	60
Chelsea WWTP	9.5	2.2	2.2	1.8	1.8	2.2
Dexter WWTP	3.0	0.9	0.9	0.8	0.8	0.9
Loch Alpine WWTP	1.5	0.6	0.6	0.5	0.5	0.6
Chrysler-Chelsea	0.5	0.3	0.3	0.3	0.3	0.3
Other Point Sources[a]	1.5	1.7	1.7	1.7	1.7	1.7
Total Point Source WLA	166	66	66	55	55	66
1995 Nonpoint Sources	155	223	159	99	122	46
"Expected" Nonpoint Sources[b]	212	239	146	68	46	87
Nonpoint Source LA	91	100	61	29	19	38
Remaining	47	48	12	4	0	0

[a]There are 12 minor dischargers in the watershed area of interest. For more details, see Brenner and Rentschler, 1996.

[b]For April-June, using respective 1995 point source loads. For July-September, using 77 lb/d point source load. For all months, using "expected" loads as totals.

References:

Kosek, S. 1996. A Phosphorus Loading Analysis and Proposed TMDL for Ford and Belleville Lakes, Washtenaw and Wayne Counties, December 1994-November 1995. MDEQ Report No. MI/DEQ/SWQ-96/005.

Brenner, A. and P. Rentschler. 1996. The Middle Huron Initiative: A Total Maximum Daily Load Analysis for the Middle Portion of the Huron River Watershed. Huron River Watershed Council.

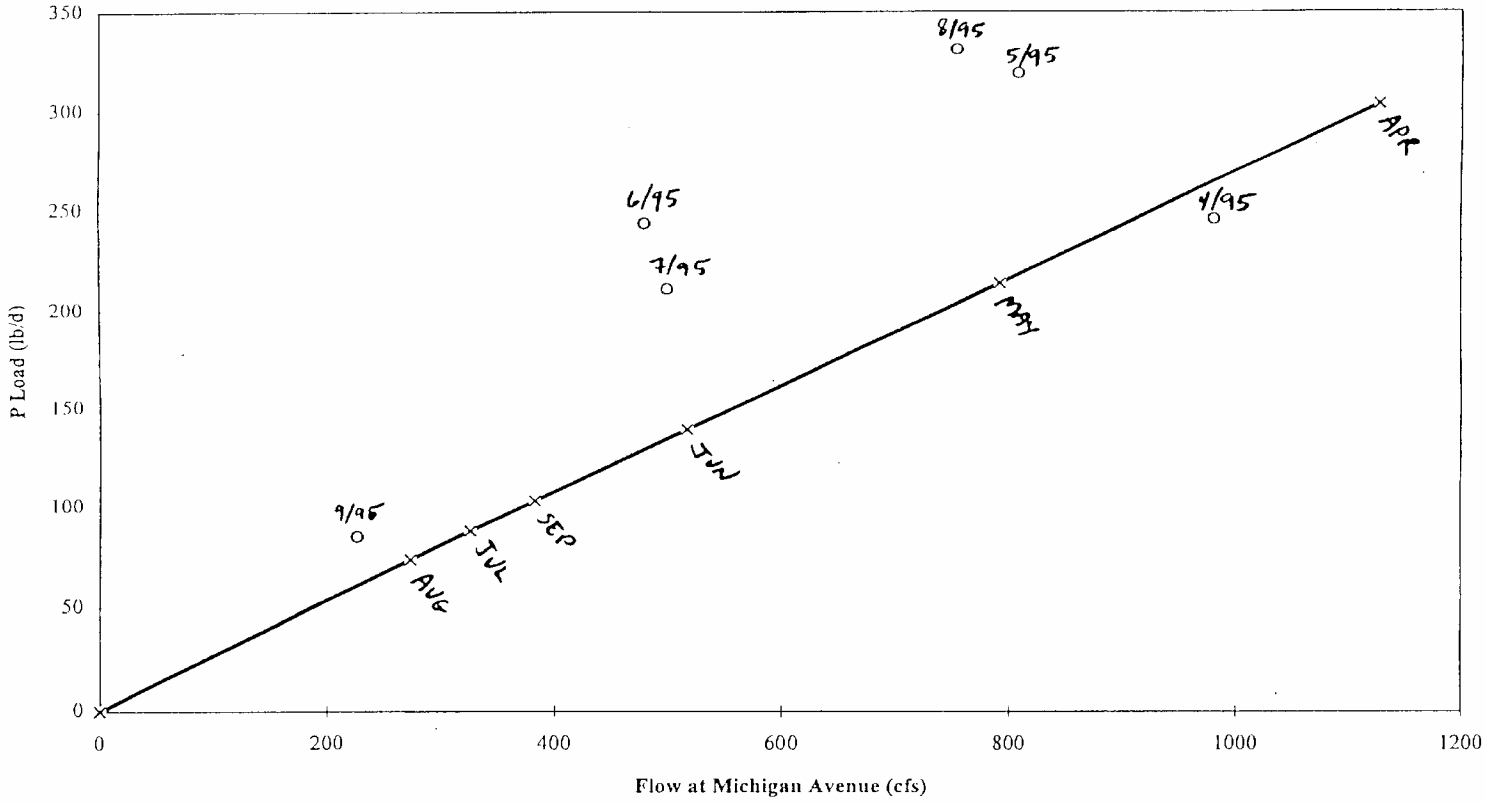

Figure 1: HRWI TMDL and 1995 data relative to average flow.

HRWILOAD.XLS

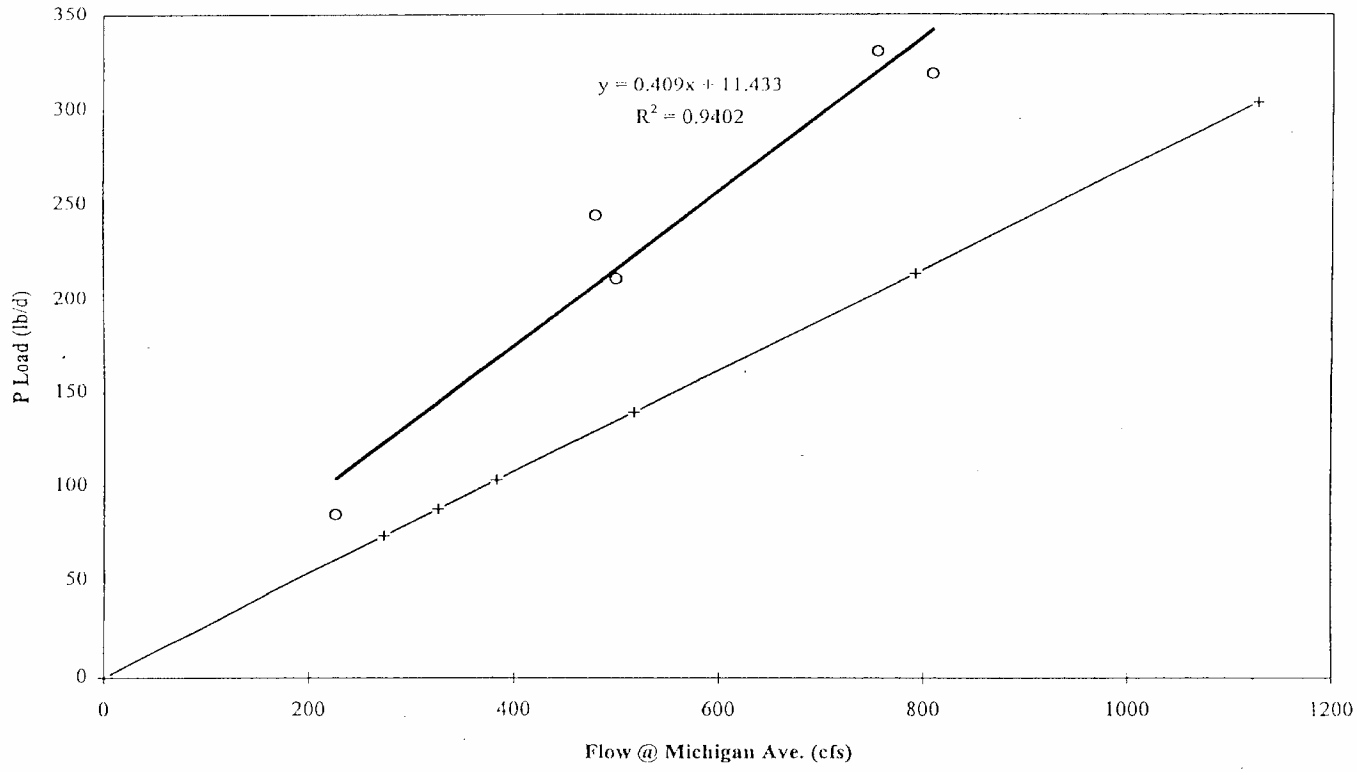

Figure 2: Huron River TMDL and 1995 data relative to average flow. Linear regression line and equation for calculation of "expected" total load.

TMDL 1 (50 ug/L) | 1995 | Linear (1995)

HRWILOAD.XLS

Michigan Department of Environmental Quality
Surface Water Quality Division
August 2001

Total Maximum Daily Load for *Escherichia Coli* in Geddes Pond, Huron River, Washtenaw County

INTRODUCTION

Section 303(d) of the federal Clean Water Act and the United States Environmental Protection Agency's (USEPA's) Water Quality Planning and Management Regulations (40 Code of Federal Regulations Part 130) require states to develop Total Maximum Daily Loads (TMDLs) for waterbodies that are not meeting Water Quality Standards (WQS). The TMDL process establishes the allowable loadings of pollutants for a water body based on the relationship between pollution sources and in-stream water quality conditions. TMDLs provide states a basis for determining the pollutant reductions necessary from both point and nonpoint sources to restore then maintain the quality of their water resources. This TMDL follows the phased approach due to inherent uncertainties in estimating loading from nonpoint sources. Under the phased approach, load allocations and wasteload allocations are calculated using the best available data and information, recognizing the need for additional monitoring data to determine if the load reductions required by the TMDL lead to attainment of WQS. The phased approach provides for the implementation of the TMDL while additional data are collected to reduce uncertainty.

As part of the TMDL development, a support document was developed (Limno-Tech, Inc., 2000). This document contains background information about the listed waterbody, known water quality data, and source assessment. The TMDL was developed based on this support document and additional information, including a site visit by the Michigan Department of Environmental Quality (MDEQ) in December 2000 (Thelen, 2001).

PROBLEM STATEMENT

This TMDL addresses approximately five miles of the Huron River near Ann Arbor where recreational uses are impaired by elevated levels of pathogens. Michigan's Section 303(d) list (Creal and Wuycheck, 2000) cites the upstream terminus as Geddes Avenue and the downstream terminus as the Geddes Dam at Dixboro Road. However, based on a December 19, 2000 site visit by the MDEQ (Thelen, 2001), the upstream boundary was extended to Argo Dam (Figure 1) for TMDL development to include an important recreational area at the confluence of Allen Creek with the Huron River. The TMDL reach is on the Section 303(d) list as:

Waterbody: **Huron River (Geddes Pond)** WBID#: **061203B**
County: Washtenaw RF3RchID: 4090005 9 Size: 2 M
Location: Geddes Pond Dam u/s to Geddes Avenue.
Status: **2** Problem: **Pathogens (Rule 100).**
TMDL YEAR(s): 2000

The Huron River (Geddes Pond) was placed on the Section 303(d) list due to impairment of recreational uses by the presence of elevated levels of pathogens. Most of the data collection efforts in the listed reach were made in the early to middle 1980s. More than 500 samples were collected in Lower Geddes Pond for fecal coliform analysis in the1980s, but less than 100 samples were collected in the 1990s. Samples for *Escherichia coli (E. coli)*, the pathogen of concern, were collected in the 1980s, but not in the 1990s. Despite the sparse data available,

some general trends in bacterial concentration can be made over time. Lower Geddes Pond has consistently exhibited the highest bacteria concentrations among all Huron River reaches in the Ann Arbor area. Historical exceedances of state standards and high bacteria counts were common in the 1970s, 1980s, and 1990s, although improvements have been made since the peaks of the 1980s (Limno-Tech, Inc., 2000).

NUMERIC TARGETS

The impaired designated use for the Huron River at this location is total body contact. Rule 100 of the Michigan WQS requires that this waterbody be protected for total body contact recreation from May 1 to October 31. The target levels for this designated use are the ambient *E. coli* standards established in Rule 62 of the WQS as follows:

> R 323.1062 Microorganisms.
> Rule 62. (1) All waters of the state protected for total body contact recreation shall not contain more than 130 *Escherichia coli (E. coli)* per 100 milliliters, as a 30-day geometric mean. Compliance shall be based on the geometric mean of all individual samples taken during 5 or more sampling events representatively spread over a 30-day period. Each sampling event shall consist of 3 or more samples taken at representative locations within a defined sampling area. At no time shall the waters of the state protected for total body contact recreation contain more than a maximum of 300 *E. coli* per 100 milliliters. Compliance shall be based on the geometric mean of 3 or more samples taken during the same sampling event at representative locations within a defined sampling area.

For this TMDL, the WQS of 130 per 100 milliliters (ml) as a 30-day geometric mean is the target level for the TMDL reach from May 1 to October 31. Wet and dry weather geometric mean concentrations from the 1980s show *E. coli* concentrations higher for Geddes Pond than for any part of the Huron River immediately upstream. Wet weather fecal coliform data for three decades of sampling in Geddes Pond showed the geometric mean concentration at 436 per 100 ml in the 1980s, with an observed maximum of 110,000 per 100 ml. For dry weather, the fecal coliform geometric mean peaked at 104 per 100 ml, with an observed maximum of 120,000 per 100 ml. Geddes Pond is also the receiving water for three direct tributaries (Millers Creek, Malletts Creek and Swift Run Creek), plus Traver Creek and Allen Drain immediately upstream. Observed fecal coliform counts in these tributaries in the 1980s ranged from 1,515 per 100 ml to 19,840 per 100 ml as a wet weather geometric mean. Maximum wet weather counts in the 1980s for Malletts Creek were 740,000 per 100 ml (Limno-Tech, Inc., 2000).

SOURCE ASSESSMENT

Potential pathogen sources for this waterbody include sources typically associated with urban and suburban runoff because the immediate watershed is primarily comprised of these land types.

Municipalities in the Huron River watershed include the city of Ann Arbor, the University of Michigan (U-M), Ann Arbor Township, Northfield Township, Pittsfield Township, Lodi Township, Scio Township, Ypsilanti Township, and Superior Township. Table 1 shows the distribution of land for each subwatershed in the listed reach of the Huron River.

Table 1. Distribution of land for each subwatershed in the listed reach of the Huron River.

	Subwatershed Area (sq. mi)	Percentage of Land Area in Subwatershed	Percentage of Immediate Watershed
Allen Creek			
City of Ann Arbor	4.0	90	
University of Michigan	0.43	10	
Total area	4.43	100	13
Traver Creek			
City of Ann Arbor	3.3	45	
University of Michigan	0.072	1	
Ann Arbor Township	3.8	52	
Northfield Township	0.17	2	
Total area	7.342	100	22
Millers Creek			
City of Ann Arbor	2.4	67	
University of Michigan	1.2	33	
Ann Arbor Township	0.0028	0.0007	
Total area	3.6028	100	11
Mallets Creek			
City of Ann Arbor	7.6	68	
University of Michigan	0.42	3.7	
Pittsfield Township	2.5	23	
Ann Arbor Township	0.017	0.2	
Lodi Township	0.43	3.8	
Scio Township	0.1403	1.3	
Total area	11.1073	100	32
Swift Run			
City of Ann Arbor	1.9	35	
Pittsfield Township	2.7	50	
Ann Arbor Township	0.69	13	
Superior Township	0.09	1.6	
Ypsilanti Township	0.021	0.4	
Total area	5.401	100	16
Direct Drainage			
City of Ann Arbor	1.8	82	
University of Michigan	0.39	18	
Total area	2.19	100	6
TOTAL	**34.0731**		**100**

Further source evaluation indicates that bacteria loads from a large part of Ann Arbor enter Geddes Pond via the storm water system. Bacteria loads are also delivered to Geddes Pond by tributaries that drain a large portion of Ann Arbor. Other potential pathogen sources for Geddes Pond include upstream inputs, illicit sewer connections, pet and wildlife feces, and a small number of on-site wastewater treatment systems (septic systems) (Limno-Tech, Inc., 2000).

LINKAGE ANALYSIS

The link between the *E. coli* concentration in the Huron River and the identified sources on the tributaries is the basis for the development of the TMDL. The linkage is defined as the cause and effect relationship between the selected indicators and the identified sources. This provides the basis for estimating the total assimilative capacity of the river and any needed load reductions. For this TMDL, the primary loading of pathogens enters the Huron River directly through the tributaries and storm sewers within the listed reach. Given the low level of *E. coli* in the Huron River upstream of the listed reach, the guiding water quality management principle used to develop the TMDL was that compliance with the numeric pathogen target in the Huron River depended on pathogen control in the tributaries and storm sewers. If the pathogen inputs to the tributaries and storm sewers could be controlled, then total body contact recreation in the Huron River would be protected.

TMDL DEVELOPMENT

The TMDL represents the maximum loading that can be assimilated by the waterbody while still achieving WQS. As indicated in the Numeric Targets section, the target for this pathogen TMDL is the WQS of 130 *E. coli* per 100 ml. Concurrent with the selection of a numeric concentration endpoint, TMDL development also defines the environmental conditions that will be used when defining allowable levels. Many TMDLs are designed around the concept of a "critical condition." The critical condition is defined as the set of environmental conditions that, if controls are designed to protect, will ensure attainment of objectives for all other conditions. For example, the critical conditions for the control of point sources in Michigan are given in R 323.1090. In general, the lowest monthly 95% exceedance flow is used to address aquatic life concerns. However, bacteria sources to the Huron River in the listed reach arise from a mixture of dry and wet weather-driven sources, and there is no single critical condition that is protective for all other conditions. In addition, for most pollutants, TMDLs are expressed on a mass loading basis (e.g., pounds per day). For *E. coli* indicators, however, mass is not an appropriate measure, and the USEPA allows pathogen TMDLs to be expressed in terms of organism counts (or resulting concentration). Therefore, this pathogen TMDL is concentration-based consistent with R 323.1062 and the TMDL is equal to the target concentration of 130 *E. coli* per 100 ml.

The majority of the land (67%) in the Geddes Pond watershed falls under the jurisdictions of the city of Ann Arbor and the University of Michigan (U-M) (Table 2). These entities now have National Pollutant Discharge Elimination System (NPDES) required storm water permits. Other municipalities in the watershed will soon be considered to have permits in Phase 2 of the storm water permitting program. These storm water permits provide a mechanism for controlling bacterial loads to Geddes Pond and a structure for source characterization efforts. Therefore, this TMDL categorizes allowable loads by subwatershed and storm water permit holders, where applicable.

Table 2. Distribution of land in immediate Geddes Pond Watershed by Government Entity.

Government Entity	Number of Sq. Miles	Percent of Total Watershed
Ann Arbor	21	62.0
Pittsfield Township	5.2	15.3
Ann Arbor Township	4.5	13.3
University of Michigan	2.5	7.4
Lodi Township	0.43	1.3
Scio Township	0.14	0.4
Superior Township	0.09	0.2
Ypsilanti Township	0.021	0.1
TOTAL	**33.881**	**100.0**

Because bacteria loads originate from a number of different locations, there is not a single unique loading capacity that will ensure compliance with WQS. Rather, there are a large number of different allowable levels that will all ensure compliance, as long as they are distributed properly throughout space.

For this TMDL, an allocation strategy has been selected that assumes equal bacteria loads per unit area for all lands within the watershed. The allocation process for each month of the recreational season (May through October) is outlined below.

1. This TMDL is concentration-based so the TMDL is equal to the pathogen WQS of 130 *E. coli* per 100 ml.

2. All surface tributaries (not enclosed) are required to comply with the WQS of 130 *E. coli* per 100 milliliter (ml) as a monthly average. This requirement applies to Traver Creek, Millers Creek, Malletts Creek, and Swift Run Creek.

3. For the enclosed tributaries, the daily maximum WQS of 300 *E. coli* per 100 ml shall apply as a monthly average. The enclosed tributaries of the watershed are Allen Creek and the direct drainage area. Based on a December 19, 2000 MDEQ site visit (Thelen, 2001), it was determined that the confluence of Allen Creek with the Huron River represents an important recreational area. By maintaining the concentration of 300 *E. coli* per 100 ml in Allen Creek, any area of WQS exceedance in the Huron River will be minimized.

4. The average *E. coli* concentration in Barton Pond was determined to be 10 *E. coli* per 100 ml and was used as background. To confirm the background concentration, a sampling station was added upstream of Argo Dam. This station is downstream of Barton Pond, but upstream of the listed reach of the Huron River.

5. If surface tributaries meet the monthly average of 130 *E. coli* per 100 ml, the enclosed tributaries meet a monthly average of 300 *E. coli* per 100 ml and background levels do not significantly increase, then total body contact recreation for the Huron River will be met.

Consistent with the allocation strategy, Table 3 shows the allowable concentrations for each of the subwatersheds of the listed reach of the Huron River.

Table 3. Allowable *E. coli* Concentrations for the Subwatersheds of the Huron River.

	May	June	July	August	September	October
	Monthly Average *E. coli* Concentration (per 100 ml)					
Allen Creek	300	300	300	300	300	300
Traver Creek	130	130	130	130	130	130
Millers Creek	130	130	130	130	130	130
Malletts Creek	130	130	130	130	130	130
Swift Run Creek	130	130	130	130	130	130
Direct drainage	300	300	300	300	300	300

ALLOCATIONS

TMDLs are comprised of the sum of individual wasteload allocations (WLAs) for point sources, and load allocations (LAs) for nonpoint sources and natural background levels. In addition, the TMDL must include a margin of safety (MOS), either implicitly or explicitly, that accounts for uncertainty in the relation between pollutant loads and the quality of the receiving water body. Conceptually, this definition is denoted by the equation:

$$TMDL = \sum WLAs + \sum LAs + MOS$$

The term TMDL represents the maximum loading that can be assimilated by the receiving water while still achieving WQS. The overall loading capacity is subsequently allocated into the TMDL components of WLAs for point sources, LAs for nonpoint sources, and the MOS. As previously indicated, this pathogen TMDL will not be expressed on a mass loading basis and is concentration-based consistent with EPA regulations at 40 CFR 130.2(1).

WLAs

There are about 10 permitted non-storm water point source discharges within the listed reach. However, none of these have applied for or reported discharges of *E. coli.* Therefore, the WLA for this TMDL is equal to zero.

LAs

The primary sources of bacteria in the watershed consist of urban runoff from lands under the jurisdiction of two entities that have municipal storm water permits, the city of Ann Arbor and the U-M (see Figure 1 and Table 2). Runoff from lands in Pittsfield Township is also included and the township will soon be required to have a permit in Phase 2 of the storm water permitting program. While runoff from these entities is or will be covered by NPDES permits, it was still considered under the LA category because of the diffuse nature of the sources.

A small portion of land in the watershed does not fall under the jurisdiction of existing (or soon to be developed) storm water permits. This includes lands in Ann Arbor, Northfield, Lodi, Scio, Superior, and Ypsilanti Townships. Runoff from these lands is also included in the LA category.

Because this TMDL is concentration-based, the determination of individual LAs will be based on the assumption of equal bacteria loads per unit area for all lands within the watershed. Therefore, the relative responsibility for achieving the necessary reductions of bacteria and maintaining acceptable conditions in the subwatersheds will be determined by the amount of land under the jurisdiction of the various local units of governments within each of the subwatersheds. Table 1 gives the relative LAs by subwatershed for each of the local entities. The percentage of land within the subwatersheds for each of the local units of government gives a clear indication of the relative amount of effort that will be required by each entity to restore and maintain the total body contact designated use to this reach of the Huron River.

The government entity with the largest percent land area in the Geddes Pond watershed is Ann Arbor. The City of Ann Arbor makes up a majority of the Allen Creek, Millers Creek, Malletts Creek and Direct Drainage subwatersheds and is the second largest government entity in the Traver Creek subwatershed next to Ann Arbor Township. Pittsfield Township contains the largest percentage of land area in the Swift Run Creek subwatershed (see Tables 1 and 2).

The upstream sources of *E. coli* entering the listed reach must also be included in the LA category. Measurements of *E. coli* have been made in Barton Pond. The average concentration determined from these measurements was 10 *E. coli* per 100 ml. The TMDL assumes that the upstream boundary concentration will remain consistent at all river flows.

MOS

This section addresses the incorporation of a MOS in the TMDL analysis. The MOS accounts for any uncertainty or lack of knowledge concerning the relationship between pollutant loading, water quality and knowledge of continuous point sources of *E. coli*. The MOS can be either implicit (i.e., incorporated into the TMDL analysis thorough conservative assumptions) or explicit (i.e., expressed in the TMDL as a portion of the loadings). This TMDL uses an implicit MOS through the establishment of a substantial reserved allocation in the Huron River. Conservative assumptions in the development of the TMDL included the surface tributaries meeting the monthly average WQS of 130 *E. coli* per 100 ml; the enclosed tributaries meeting a monthly average of 300 *E. coli* per 100 ml; and the background conditions equaling 10 *E. coli* per 100 ml. Given these assumptions and the much larger flow in the Huron River compared to the tributaries, the pathogen WQS will be met in the listed reach with a substantial MOS or reserved allocation. The example loading assessment, given below, demonstrates that the magnitude of the MOS can also be estimated under any chosen flow scenario.

Example Loading Assessment

Although this TMDL is concentration-based, an example calculation using counts per day was used to simulate a loading assessment. The TMDL, on a loading basis, can be calculated as a function of stream flow using the following equation:

$$TMDL = Q_{riv,x} \times C_{WQS}$$

Where:

TMDL = Loading capacity in the river (counts per time).
$Q_{riv,x}$ = River flow (volume of water per time).
C_{WQS} = WQS concentration (counts per volume of water).

The loading capacity defined in the above equation applies to all river flows for which WQS apply. It must be noted that the loading capacity in the TMDL reach is directly dependent upon the upstream loads (because they directly affect C_x).

The monthly average flows for the Huron River and tributaries from May through October are given in Table 4 and were used to demonstrate the relative magnitude of allowable loads from the various units of government for one flow scenario.

Table 4. Huron River and Tributary Average Flows (cfs) Used to Calculate Loading.

Waterbody	May	June	July	August	September	October
Huron River	606	403	243	183	216	268
Allen Creek	4.45	3.49	1.78	1.34	1.58	1.97
Traver Creek	1.87	1.25	0.75	0.57	0.67	0.83
Millers Creek	2.92	1.94	1.17	0.88	1.04	1.29
Mallets Creek	6.55	4.35	2.62	1.98	2.33	2.89
Swift Run Creek	1.01	0.67	0.4	0.31	0.36	0.45
direct drainage	1.31	1.15	0.53	0.4	0.47	0.58

Using the previously stated conditions from the allocation strategy, the allocations based on average flow conditions were determined using the following process:

1. For the Huron River and each tributary, the allowable concentrations were converted to allowable loads.

2. LAs were determined for each local entity based on the relative areas of jurisdiction within each subwatershed. These results are given in Table 5.

3. The background levels of *E. coli* for the Huron River were converted to loads and are given in Table 6.

4. The Huron River flows used in the calculations were based on United States Geological Survey gage data of statistical monthly means for the years 1915-1997. The gage is located 4.2 miles upstream of Geddes Dam on the Huron River at Wall Street in Ann Arbor, Michigan.

The results of the loading assessment for the listed reach of the Huron River under average flow conditions are given in Table 7. The assessment shows that if the LAs are met, the TMDL will not be exceeded in the Huron River for each month of the recreational season. It also demonstrates the relative magnitude of the reserved allocation or MOS for each month.

Table 5. Load Allocations for Huron River Tributaries for Average Flow (relative loading units*)

	Watershed Area (sq. mi)	May	June	July	August	September	October
****Allen Creek**							
City of Ann Arbor	4.0	29.7	23.4	11.7	8.9	10.4	13.0
University of Michigan	0.43	3.3	2.6	1.3	1.0	1.2	1.4
Total LA	4.43	33.0	26.0	13.0	9.8	11.6	14.4
Traver Creek							
City of Ann Arbor	3.3	2.65	1.80	1.08	0.81	0.94	1.17
University of Michigan	0.072	0.06	0.04	0.02	0.02	0.02	0.03
Ann Arbor Township	3.8	3.05	2.07	1.24	0.93	1.09	1.35
Northfield Township	0.17	0.14	0.09	0.06	0.04	0.05	0.06
Total LA	7.342	5.9	4.0	2.4	1.8	2.1	2.6
Millers Creek							
City of Ann Arbor	2.4	6.20	4.13	2.46	1.86	2.19	2.73
University of Michigan	1.2	3.10	2.06	1.23	0.93	1.10	1.36
Ann Arbor Township	0.0028	0.01	0.01	0.01	0.01	0.01	0.01
Total LA	3.6028	9.3	6.2	3.7	2.8	3.3	4.1
Mallets Creek							
City of Ann Arbor	7.6	14.23	9.44	5.68	4.31	5.06	6.29
University of Michigan	0.42	0.79	0.52	0.31	0.24	0.28	0.35
Pittsfield Township	2.5	4.68	3.11	1.87	1.42	1.67	2.07
Ann Arbor Township	0.017	0.03	0.02	0.01	0.01	0.01	0.01
Lodi Township	0.43	0.81	0.53	0.32	0.24	0.29	0.36
Scio Township	0.1403	0.26	0.17	0.10	0.08	0.09	0.12
Total LA	11.1073	20.8	13.8	8.3	6.3	7.4	9.2
Swift Run							
City of Ann Arbor	1.9	1.13	0.74	0.46	0.35	0.39	0.49
Pittsfield Township	2.7	1.60	1.05	0.65	0.50	0.54	0.70
Ann Arbor Township	0.69	0.41	0.27	0.17	0.13	0.14	0.18
Superior Township	0.09	0.05	0.03	0.02	0.01	0.02	0.02
Ypsilanti Township	0.021	0.01	0.01	0.01	0.01	0.01	0.01
Total LA	5.401	3.2	2.1	1.3	1.0	1.1	1.4
****Direct Drainage**							
City of Ann Arbor	1.8	7.89	6.90	3.21	2.38	2.79	3.53
University of Michigan	0.39	1.71	1.50	0.69	0.52	0.61	0.77
Total LA	2.19	9.6	8.4	3.9	2.9	3.4	4.3
TOTAL LA		**81.8**	**60.5**	**32.6**	**24.6**	**28.9**	**36.0**

* Relative Loading Units = *E. coli* concentration (130 counts/100 ml) x River flow (cfs) x (10 x .646 x 3.785) / 10^3
** Allen creek and Direct Drainage use *E. coli* concentration of 300 counts/100 ml

Table 6. Background Loads of *E. coli* for the Huron River (relative loading units)*.

May	June	July	August	September	October
150	99	59	45	53	66

*relative loading unit = *E. coli* concentration (10 cts/100ml) x River flow (cfs) x (10 x .646 x 3.785)/10^3

Table 7. TMDL including LAs, WLAs, and MOS for the Huron River, May to October 31 (relative loading units).*

	May	June	July	August	September	October
WLA	0	0	0	0	0	0
LA	231.8	159.5	91.6	69.6	81.9	102
MOS (reserved allocation)	1694.2	1121.5	680.4	512.4	605.1	750
TOTAL LOAD	1926	1281	772	582	687	852

*relative loading unit = *E. coli* concentration (130 cts/100ml) x River flow (cfs) x (10 x .646 x 3.785)/10^3

SEASONALITY

Seasonality in the TMDL is addressed by expressing the TMDL in terms of a total body contact recreation season that is defined as May 1 through October 31 by Rule 100 of the WQS. There is no total body contact during the remainder of the year primarily due to cold weather. In addition, because this is a concentration based TMDL, WQS will be met regardless of flow conditions in the applicable season.

MONITORING

As previously discussed, this TMDL was developed following a phased approach. First, needed reductions of pollutant loads were estimated. Next, water quality will be monitored to determine the effectiveness of reductions. Recommended monitoring includes sample collection from all five tributaries (Swift Run Creek, Mallets Creek, Millers Creek, Traver Creek, and Allen Creek) at stations 1, 2, 3, 5, and 6 (Figure 1). One upstream location (station 7, Figure 1), as well as one location in Geddes Pond (station 4, Figure 1) will be sampled. Sampling will also include one wet and dry weather event. Initially, in May 2001 each station will be sampled five times. Subsequent sampling from June through September will be based on data collected in May. If sampling in May 2001 indicates WQS are exceeded, sampling will be oriented toward source identification. If sampling indicates WQS are met, sampling frequency will be increased to determine if WQS are met.

In future years, assuming WQS are not met immediately, sampling frequency will be once per month from May through September at all seven locations. Sampling will be adjusted as needed to assist in continued source identification and elimination. When these results indicate that the waterbody may be meeting WQS, sampling will be conducted at the appropriate frequency to determine if the 30-day geometric mean value of 130 *E. coli* per 100 ml is being met.

REASONABLE ASSURANCE ACTIVITIES

Urban storm water runoff is likely the dominant source of *E. coli* to Geddes Pond. Implementation activities to meet the TMDL require measures to reduce *E. coli* sources and loads. These measures will include activities that are already required of the NPDES municipal storm water permitees within the watershed. These permits have been in place since 1996, allowing the permittees several years to initiate quality programs. Currently, the city of Ann Arbor, Michigan Department of Transportation, and the U-M hold NPDES municipal storm water permits.

The city of Ann Arbor's NPDES municipal storm water permit contains several general requirements that, when implemented, could help reduce the delivery of pathogens to Geddes Pond. The permit requires a plan for effective elimination of illicit discharges and prohibition of illicit discharges. The permit requires that all catch basins be mapped and regularly cleaned. Effective storm water management in areas of redevelopment and new development is required. A public education program on storm water management and impacts of storm water pollution is also required.

The city of Ann Arbor is actively pursuing all of the above requirements and has an ongoing storm drain examination program that includes cross-connection searches. Some ordinances have been changed to require more storm water management in new developments. They have an active public education program that has been developed in cooperation with the Huron River Watershed Council.

The Ann Arbor campus of U-M also has an NPDES storm water permit. The U-M has developed the required storm water management program that contains several elements that could help reduce the delivery of pathogens to local waters and eventually to Geddes Pond on the Huron River. The U-M's permit essentially requires the same management activities as the city of Ann Arbor's NPDES permit, including illicit discharge elimination, pollution prevention, and public education.he U-M is actively meeting the permit requirements. For example, for illicit connections, the U-M campus is divided into a grid system and each grid is routinely tested for illicit connections.

When the Phase 2 storm water requirements are applicable, other municipalities in the watershed will also be considered for an NPDES municipal storm water permit. These permits will likely require activities that reduce pathogen inputs, similar to those in the city of Ann Arbor and U-M storm water permits.

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August 10, 2001

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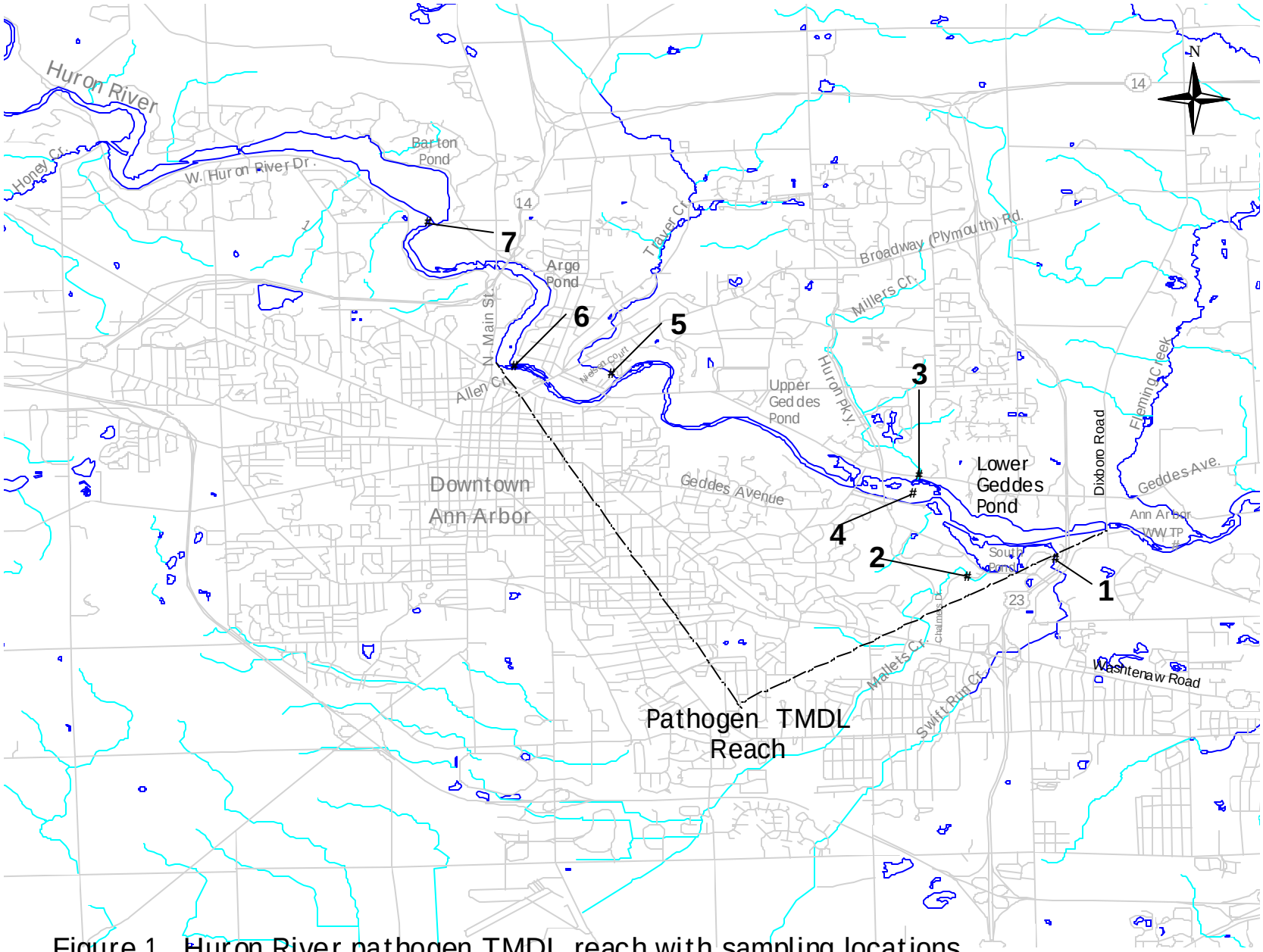
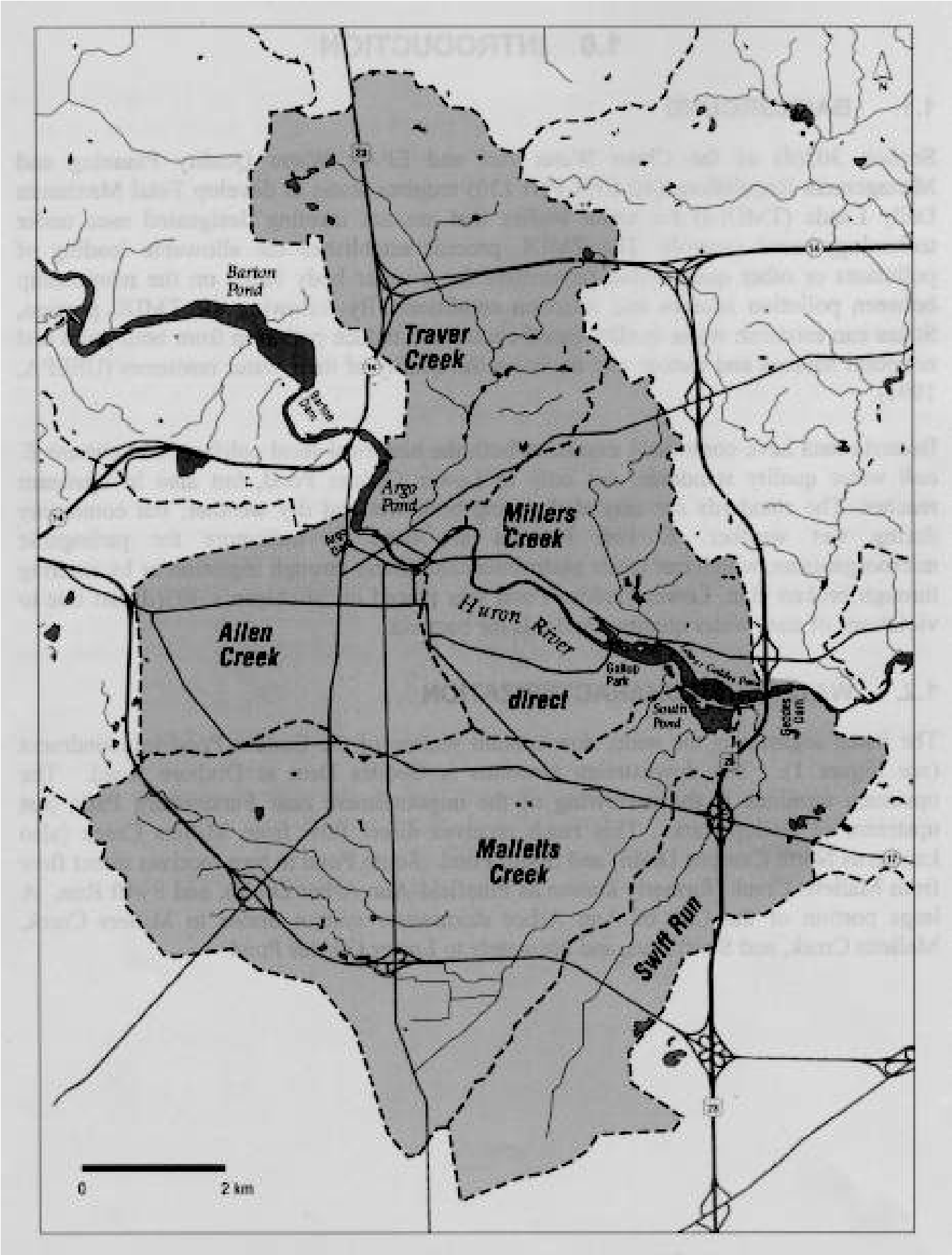


Figure 1. Huron River pathogen TMDL reach with sampling locations.

Figure 2. Subwatersheds in the Huron River TMDL listed reach.



Michigan Department of Environmental Quality

Water Division

August 2004

Total Maximum Daily Load for Biota for Malletts Creek

Washtenaw County

INTRODUCTION

Section 303(d) of the federal Clean Water Act (CWA) and the United States Environmental Protection Agency's (USEPA's) Water Quality Planning and Management Regulations (Title 40 of the Code of Federal Regulations, Part 130) require states to develop Total Maximum Daily Loads (TMDLs) for water bodies that are not meeting Michigan's Water Quality Standards (WQS). The TMDL process establishes the allowable loads of a pollutant to a water body based on the relationship between pollutant sources and in-stream water quality conditions. TMDLs provide states a basis for determining the pollutant reduction necessary from both point and nonpoint sources (NPS) to restore and maintain the quality of their water resources. The purpose of this TMDL is to identify appropriate actions to achieve the fish and macroinvertebrate community targets and habitat quality targets, specifically a reduction in sediment loadings from sources in the Malletts Creek watershed that will result in WQS attainment. This TMDL follows the phased approach, due to inherent uncertainties in deriving numeric targets and estimating loading from NPS. Under the phased approach, load allocations (LAs) and waste load allocations (WLAs) are calculated using the best available data and information, recognizing the need for additional monitoring data to determine if the load reductions required by the TMDL lead to attainment of the WQS. The phased approach provides for the implementation of the TMDL while additional data are collected to reduce uncertainty.

PROBLEM STATEMENT

The TMDL reach of Malletts Creek, a warmwater designated water body tributary to the Huron River at South Pond Park, is located in Washtenaw County in the vicinity of Ann Arbor (Figure 1). The impaired designated uses (Rule 100 of the Michigan WQS) include the lack of support of acceptable communities of warmwater fish and other aquatic life (macroinvertebrate) communities. This condition served as the basis for placing Malletts Creek on Michigan's Section 303(d) list of impaired water bodies requiring the development of a TMDL. The TMDL reach is about two miles in length and is identified on the Section 303(d) list (Creal and Wuycheck, 2002) as follows:

MALLETTS CREEK WBID#: **061203I**
County: WASHTENAW HUC: 04090005 Size: 2 M
Location: Huron River confluence u/s to Packard Road.
Problem: **Fish and macroinvertebrate communities rated poor.**
TMDL YEAR(s): 2004 RF3RchID: 4090005 499

This document represents the basis for the development of a biota TMDL that focuses on the

restoration of the biological communities of the impacted perennial reach of Malletts Creek in order to meet Michigan's WQS.

The headwater reach of Malletts Creek upstream of the Brown Park Pond dam is classified by the United States Geological Survey (USGS) as intermittent. Malletts Creek is classified by the USGS as perennial from Brown Park Pond Dam downstream to the Huron River confluence. Within the two-mile biota TMDL reach, habitat impairment is attributed to unstable flow regimes, reduced bank stability, bank erosion, sedimentation, and reduced stream quality due to excessive runoff/washoff throughout this highly urbanized watershed.

The TMDL reach was based on the August 1997, Michigan Department of Environmental Quality's (MDEQ's) Procedure 51, biological community assessment findings for Malletts Creek (Wuycheck, 2003). The Procedure 51 fish community assessments involve the evaluation of ten metrics with a score and rating system as follows: a score range of 5 to 10 is rated excellent; a score range of 4 to -4 is rated acceptable; and a score range of -5 to -10 is rated poor. The macroinvertebrate community assessments involve the evaluation of nine metrics with a score and rating system as follows: a score range of 5 to 9 is rated excellent; a score range of 4 to -4 is rated acceptable; and a score range of -5 to -9 is rated poor. A poor-rated macroinvertebrate community characterized the stream at Packard Road and a poor-rated fish community characterized the community upstream of Chalmers Road (Figure 1). The fish community was rated acceptable (-2) at East Eisenhower Parkway in the headwaters of the watershed, but poor (-7) at Chalmers Road located approximately 0.1 mile upstream of the Huron River confluence at South Pond Park. Additional Procedure 51 macroinvertebrate community assessments conducted in August 2002 and September 2003, at Scheffler Park (located between Platt Road and Washtenaw Road off Edgewood Drive) and Chalmers Road, indicated acceptable macroinvertebrate community scores of -3 and -1; and -3 and -2, respectively.

Procedure 51 habitat quality assessments involve the evaluation of ten metrics with a scoring and rating system as follows: a habitat score less than 56 is rated poor, 56 to 104 is rated marginal, 105 to 154 is rated good and a score greater than 154 (with a maximum of 200 points) is rated excellent. Habitats at two stations (Packard Road and Chalmers Road) in August 1997, were rated good (slightly impaired) based on scores of 83 and 93, respectively, based on the 1997 version of Procedure 51. The August 2002 and September 2003, habitat scores and ratings, using the May 2002, updated Procedure 51 habitat assessment protocol for sites at Scheffler Park (Edgewood Drive) and Chalmers Road were 141 and 150 in 2002; and 131 and 135 in 2003, respectively. This indicates that, overall, the habitats assessed were rated good. However, scores for the individual metric categories of flow stability and bank stability were generally 50 percent or less than their maximum potential scores indicating unstable habitat conditions in Malletts Creek. Similar scores were recorded for these same metrics during the August 2002, biological assessments of Malletts Creek at Scheffler Park (downstream of Platt Road) and Chalmers Road.

Biological community assessments by the Huron River Watershed Council (HRWC) volunteers characterized the macroinvertebrate communities at Scheffler Park and Chalmers Road as poor in the spring of 2003 (HRWC, 2003). The differences between the MDEQ and HRWC biological community assessment results may be attributed to assessment procedure used and/or seasonal differences.

Total suspended solids (TSS) monitoring in the Malletts Creek watershed was conducted during

the months of June, July, and August 2003, by Limno-Tech, Incorporated (LTI), as part of a Clean Michigan Initiative (CMI)-funded monitoring program. The assessment was prompted by MDEQ staff concern about the impact of excessive sedimentation on habitat quality and, therefore, the biological community. The project, requested by the MDEQ, required monitoring at least twice during the survey period to characterize background TSS concentrations during dry weather, stable flow conditions and to monitor at least three wet weather runoff events to assess increases in stream TSS during these events. Effort was directed towards sampling TSS during the rise and fall of the Malletts Creek hydrograph in response to a rainfall/runoff event of 0.1 inches or greater. Survey results (LTI, 2003b) indicated average background, stable, base flow TSS concentrations at Chalmers Road of 5 to 10 milligrams per liter (mg/l). Precipitation events of 1.22, 0.61, and 1.02 inches on June 21, August 1 through August 2, and August 12, 2003, resulted in maximum (average) in-stream TSS concentrations of 460 mg/l (257mg/l), 130 mg/l (95 mg/l), and 1276 mg/l (572 mg/l), respectively. This information indicates that precipitation runoff/washoff events in the watershed substantially increase the amount of TSS in transport in Malletts Creek. In-stream flows measured at the USGS gage (#04174518) during the three wet weather event monitoring dates show increases from 1.6 to 178 cubic feet per second (cfs); 1.7 to 60 cfs, and 2 to 205 cfs, respectively, demonstrating substantial flow responses to precipitation events observed.

Municipal and commercial site storm water runoff/washoff associated with the numerous storm water outfalls within the Malletts Creek watershed are considered the most probable sources of unstable habitat conditions and associated impacts to aquatic life. The primary contributors to poor stream quality include excessive runoff/washoff, stream bank erosion, elevated runoff volumes, flow extremes (both lows and highs), and runoff rates from substantial areas of impervious surfaces in this highly urbanized/commercialized watershed that cause flashy, unstable flow conditions. These factors result in severe stream bank erosion; sediment induced erosivity of both habitat and colonizing organisms; and siltation and sedimentation of biologically important and desirable habitat. Reductions in storm sewer runoff rates and solids loads from both commercial and municipal storm water runoff sites, along with reduced stream bank erosion through more stable flow management are necessary to reduce impacts on the aquatic life.

NUMERIC TARGETS

The impaired designated use for Malletts Creek is aquatic life. Michigan's WQS require, as a minimum, the protection of a variety of designated uses, including aquatic life (Rule 100(1)(f)). The fish and macroinvertebrate communities of Malletts Creek are impacted due to habitat impairment and instability due to excessive bank erosion, sedimentation, and unstable flow extremes. Achievement of WQS for the aquatic life designated use is to be demonstrated via assessments of the integrity of the fish and macroinvertebrate community and habitat quality.

The primary numeric targets involve the use of Michigan's biological community and habitat quality assessment Procedure 51 (MDEQ, 1997 and 1998). The biota TMDL target is to establish both a fish community and macroinvertebrate community with acceptable, reproducible scores, each equal to or greater than -4 (acceptable). Both fish and macroinvertebrate communities will be evaluated based on a minimum of two Procedure 51 biological assessments to be conducted in successive years. The assessments would follow the implementation of Best Management Practices (BMPs) intended to stabilize flow extremes, bank erosion, and sediment loadings to the subject TMDL reach.

The Procedure 51 stream habitat quality assessment procedure has been revised and will also be used (MDEQ, 2002). A target habitat score equal to or greater than 130 is provided to assure protection of habitat conditions and minimized impairment to habitat. This is consistent with current acceptable scores for the habitats assessed at Scheffler Park and Chalmers Road. This level of conservation is appropriately high enough to minimize both temporal and spatial variability within the watershed and provide a buffer for the variability within the macroinvertebrate and habitat assessment protocol.

A secondary numeric target established to improve habitat conditions is for TSS. TSS measurements will be used to further assess improvements in Malletts Creek. The secondary goal is represented by a mean annual, in-stream TSS concentration target of 80 mg/l to characterize wet weather runoff/washoff events. This secondary numeric target may be overridden by achievement of the biological and habitat numeric targets. However, if the TSS numeric target is achieved, but the biota or habitat numeric targets are not achieved, then the TSS target may have to be reevaluated. Achievement of the secondary numeric target will help guide proper control over NPS of excessive suspended solids loads from runoff, as well as the runoff discharge rates and instantaneous runoff volumes that affect increased stream flow instability, stream bank erosion, and increased suspended solids concentrations.

The mean annual target concentration of 80 mg/l TSS is based on a review of existing conditions and published literature on the effects of TSS. Vohs et al., (1993) indicated that chemically inert TSS of 100 mg/l appears to separate those streams with a fish population from those without. The European Inland Fisheries Advisory Commission stated that in the absence of other pollution, a fishery would not be harmed at suspended solids concentrations less than 25 mg/l. Good to moderate fisheries can be found at 25 to 80 mg/l TSS; good fisheries were unlikely to be found at 80 to 400 mg/l, while only poor fisheries are typically found at 400 mg/l (Alabaster, 1972). Decreases were demonstrated in the standing crop of both fishes and macroinvertebrates in an area receiving suspended solids loadings of no more than 40 mg/l (Gammon, 1970).

Water quality for suspended solids (finely divided solids) may be represented by the following categories:

Optimum	= $\leq$25 mg/l
Good to Moderate	= >25 to 80 mg/l
Less than Moderate	= >80 to 400 mg/l
Poor	= >400 mg/l

Since the TMDL purpose is to restore the biological community to an acceptable condition and attain WQS, a value of 80 mg/l as a mean annual TSS target for wet weather events was chosen for Malletts Creek.

Overall, the secondary target of 80 mg/l TSS (as a mean annual value) is intended to evaluate solids loading influences and assist in orienting and focusing corrective actions for source reductions. Additional TSS targets based on flow related considerations may be developed as additional data on Malletts Creek become available.

The Washtenaw County Drain Commissioner's office has focused on reducing total phosphorus loads, including those from Malletts Creek, to the Huron River in response to the Huron River nutrient TMDLs for Ford and Belleville Lakes (Kosek, 1996). Current, local pollutant reduction and implementation plans for Malletts Creek involve the phosphorus TMDL to reduce the

occurrence of nuisance algal blooms in both Ford and Belleville Lakes. The Malletts Creek Restoration Plan targets a 50% reduction in total phosphorus, which is characterized as "…functionally equivalent to the mean TSS concentration of 80 mg/l…" (Malletts Creek Restoration Plan, 2000). Therefore, adherence to either the 80 mg/l TSS secondary target and/or the 50% total phosphorus reduction target will, presumably, equally effect desired reductions in both the TSS and/or total phosphorus loads, the latter targeted in the existing Malletts Creek Restoration Plan.

SOURCE ASSESSMENT

From the Huron River confluence upstream, land use in the watershed is dominated by residential, commercial, and industrial development. The estimated impervious surface area in the Malletts Creek watershed is 37% or 2478 acres (Malletts Creek Restoration Plan, 2000). Increasing the percent of impervious surface within a watershed can severely affect the extremes in a stream's hydrologic and hydraulic characteristics. Such increases cause rapid precipitation runoff and washoff of suspended solids and contaminant loads to the receiving waters (Fonger and Fulcher, 2001; Schueler and Holland, 2000). Substantial reductions in vegetative riparian zones and pervious areas throughout the watershed of Malletts Creek and the extensive use of structural features, including paved impervious surface areas (e.g., roads and parking lots), curb and gutter, and numerous direct storm sewer discharges, dominate the landscape and serve to increase the rate of precipitation runoff to Malletts Creek.

Existing stream flow conditions of Malletts Creek can best be described as unstable and flashy in response to storm events as characterized by the flow extremes recorded at the USGS Malletts Creek (#04174518) stream flow gage (Figure 2). Note in this August 2003 example, the extremes in flow fluctuation from low flows of 2 cfs to highs of over 400 cfs occurred within a three to six-hour period. The hydrograph demonstrates the very flashy and unstable stream flow conditions that occur during wet weather runoff/washoff events. This condition results in excessive stream bank erosion, sedimentation, and erosivity of otherwise stable, inhabitable substrate suitable for macroinvertebrate colonization and fish community development. Therefore, the sources of sediment loadings to Malletts Creek are primarily attributable to periodic erosion and storm water runoff/washoff from impervious surfaces associated with residential, industrial, and commercial-dominated land uses in the watershed.

There are five National Pollutant Discharge Elimination System (NPDES) permitted dischargers in the Malletts Creek watershed that have general permits (Table 1 and Figure 3). Two facilities discharge treated groundwater and the other three discharge non-contact cooling water. Collectively, none of the five NPDES permitted point source facilities is required to monitor TSS in its effluent discharged to Malletts Creek since TSS limits are not commonly required or needed for these types of discharges. The combined maximum design discharge total of 1.673 million gallons/day or 610 million gallons/year applies to the five dischargers. Therefore, a worst-case estimate of TSS load for each of these five facilities was made assuming a TSS monthly average concentration of 25 mg/l; a typical monthly average permit limit provided in NPDES permits. The estimated TSS load from the five general permitted facilities is 349 pounds/day or 127,396 pounds/year.

There are at least 161 storm water outfalls to Malletts Creek watershed covered by the NPDES Phase I MS4 storm water runoff permit program (Figure 4). These outfalls are overseen by the city of Ann Arbor (137 outfalls), University of Michigan (11 outfalls), and Michigan Department of Transportation (2 outfalls - from Business Route 23 to Malletts Creek). Washtenaw County has at least 11 identified outfalls that are covered under the Phase II MS4 program.

The derivation of current annual TSS loads to the Malletts Creek watershed from the various land use categories, involved estimates of the acres of each land use category (LTI, 2003a), a mean annual rainfall of 34 inches, and the use of the USEPA's Simple Method model approach (USEPA, 2001). The estimated current, annual TSS load from the NPDES permitted storm water sources (WLA component) versus the remaining NPS land use categories (LA component) in the Malletts Creek watershed is approximately 1,173,788 pounds and 102,662 pounds, respectively (Table 2). The overall total estimated annual TSS load to the Malletts Creek from NPDES point sources, NPDES storm water, and NPS is approximately 1,403,846 pounds, representing 9%, 84%, and 7% of the total load, respectively.

In summary, excessive sedimentation and flashy flow conditions in Malletts Creek occur due to elevated wet weather event runoff/washoff volumes, associated TSS loads from the impervious urban areas in the watershed, and in-stream bank erosion and resuspension. The presence of substantial areas of impervious surfaces in the watershed has disrupted the natural hydrology of Malletts Creek, especially during wet weather runoff/washoff events. These alterations to the Malletts Creek watershed have destabilized stream banks, increased solids loads, shortened the runoff/washoff rate of delivery to the stream, modified extremes in stream flows (both high and low flows), and reduced or eliminated desirable fish and macroinvertebrate habitat. Approximately 2478 acres or 37% of the Malletts Creek watershed (6696 acres) is estimated to be impervious (Malletts Creek Restoration Plan, 2000). Stream degradation has been demonstrated to occur in watersheds containing as little as 10% to 20% impervious surface areas because of associated direct runoff discharges to a water body (Center for Watershed Protection, 1994). However, local studies within the Huron River watershed indicate a threshold range for impairment of 8% to 10% (Wiley and Martin, 1999).

LINKAGE ANALYSIS

A suitable method used to develop a TMDL that addresses the severity of the impacts of sedimentation to a biological community is to measure sediment impacts on stable, colonizable substrates in the stream channel and the associated changes in the biological community.

Increased siltation and embeddedness of colonizable substrates resulting from excessive bank erosion and sedimentation has been demonstrated to impair the biological integrity of rivers (Waters, 1995) by obscuring or reducing the suitability of colonizable or useable substrate by stream biota. With improved habitat through the reduction in sedimentation, both fish and macroinvertebrate communities respond with an increase in species diversity and an increase in the number of individuals of each species. As a result, the Procedure 51 assessment scores and ratings for quality of the fish and macroinvertebrate communities and habitat are expected to increase as sedimentation rates decline, embeddedness decreases, and habitat diversity increases. These latter characteristics will serve to demonstrate improvement in habitat conditions, WQS attainment, and overall stream quality as expressed through an acceptably rated biological community.

TMDL DEVELOPMENT

The TMDL represents the maximum loading that can be assimilated by a water body while still achieving WQS. The Malletts Creek biotic community has been impaired by unstable flow conditions, bank erosion, and excessive sedimentation. Therefore, this TMDL is focused on reducing sediment loads throughout the watershed to a level that supports a biological community that meets WQS. Using the metrics from Procedure 51, a numeric score of -4 for

both fish and macroinvertebrate communities and a habitat score of 130 or greater, will serve as primary targets for this biota TMDL.

Concurrent with the selection of numeric endpoints, this TMDL also defines the environmental conditions that will be used when defining allowable levels. Some TMDLs are designed around the concept of critical condition. A critical condition is defined as the set of environmental conditions that, if controls are designed to protect, will ensure attainment of objectives for all other important conditions. For example, the critical conditions for the control of point sources in Michigan are provided in Rules 323.1082 and 323.1090 of Michigan's WQS. In general, the lowest monthly 95% exceedance flow for a stream is used to establish effluent limits for point sources. However, the primary sediment inputs to Malletts Creek are attributable to wet weather-driven discharges and resulting in-stream conditions. As such, there is no single condition that is protective for all conditions, but efforts are directed towards wet weather runoff/washoff events.

The target of 80 mg/l TSS is used to develop a secondary TMDL loading goal for TSS during wet weather runoff/washoff events, especially from storm water discharges from the area (3875 acres) of urban/industrial/built-up land use category that represents about 58% of the land use area in the Malletts Creek watershed.

ALLOCATIONS

TMDLs are comprised of the sum of individual WLAs for point sources, LAs for NPS, and natural background levels. The TMDL must include a margin of safety (MOS), either implicitly within the WLA and/or LA, or explicitly, that accounts for uncertainty in the relation between pollutant loads and the quality of the receiving water body. This definition is denoted by the equation:

$$TMDL = \Sigma^{WLAs} + \Sigma^{LAs} + MOS$$

The TMDL represents a maximum load of a pollutant or stressor that can be discharged to a receiving water and still meet WQS. The overall TMDL load capacity is allocated among the three TMDL components: WLA for NPDES permitted point sources, LA for NPS and background loads, and the MOS.

WLAs

Presently, the estimated total annual TSS load from all point sources is approximately 1,301,184 pounds. The combined individual/general NPDES permitted point source TSS load to Malletts Creek is estimated at 127,396 pounds/year (Table 1). Based on land use category TSS export coefficients (Cave et al., 1994), a total annual TSS load estimate of approximately 1,173,788 pounds is attributable to NPDES permitted storm water runoff/washoff discharges to the Malletts Creek watershed associated with the urban/industrial/built-up sources (Table 2). The projected annual TSS load (127,396 pounds) from the individual/general NPDES permitted point sources is considered acceptable. However, the combined effect on Malletts Creek by runoff/washoff loads of TSS from the urban/industrial/built-up storm water source should be reduced in order to achieve an in-stream mean annual wet weather TSS concentration goal of 80 mg/l or less by reducing runoff/washoff delivery rates to Malletts Creek. If the goal of 80 mg/l TSS were achieved, this would represent a 16% reduction in TSS load to Malletts Creek, resulting in a projected annual WLA of 1,113,249 pounds of TSS. Reduced runoff/washoff

delivery rates to Malletts Creek will play an important role in achieving the 80 mg/l goal by reducing TSS loads from upland sources, stream bank erosion, and re-suspension of in-place TSS.

For developing water quality-based effluent limits for the individual/general NPDES permitted point source discharges, the receiving stream design flow equals the lowest 95% exceedance flow. However, it is proposed that any TSS limits in NPDES point source permits be established at the target of 25 mg/l or less, as a monthly maximum average, which then makes it unnecessary to consider mixing zone scenarios. The point source contributions to the WLA are considered controllable through the existing NPDES individual/general permit requirements and storm water through the Phase I and Phase II MS4 storm water program requirements.

LAs

The LA component defines the load capacity for a pollutant that is nonpoint in origin that includes the following land use categories: agriculture, forested/shrub/open land, wetland, and water bodies (Table 2). An estimated annual TSS load of 102,662 pounds is attributed to these land use categories of NPS in the watershed. All but the agricultural land use are considered as background load sources. Therefore, the only targeted TSS load reduction source is from agricultural sources. A 45% annual reduction (from 53,822 to 29,695 pounds) from cropland areas in the watershed is recommended, resulting in the annual LA, TSS load target of 78,535 pounds, based on achieving the 80 mg/l TSS target concentration during wet weather runoff/washoff events.

In summary, the proposed reduction in the total annual TSS load to Malletts Creek (WLA + LA) to meet the annual average target of 80 mg/l is 1,191,784 pounds/year, an overall 15% reduction. Eleven percent (127,396 pounds/year) is allocated to the general NPDES permitted point source component of the WLA, along with 83% (985,853 pounds/year) to the NPDES permitted industrial and municipal storm water outfalls covered under the Phase I and Phase II MS4 storm water program, and the remainder of 7% (78,535 pounds/year) is attributed to the LA. To achieve the WLA, a reduction in the storm water runoff/washoff of the TSS load is recommended, especially, in the urban/industrial/built-up land use categories. The percent reduction in the TSS load is based on the reduction of wet weather runoff event TSS loads with a goal of an annual average in-stream target of 80 mg/l TSS during wet weather runoff/washoff events.

MOS

The MOS in a TMDL is used, in part, to account for variability of source inputs to the system and is either implicit or explicit. An MOS is implicit for a biota TMDL because the quality of the biological community, its integrity, and overall composition represent an integration of the effects of the spatial and temporal variability in sediment loadings to the aquatic environment.

The habitat target score of 130 or greater will be used, so as to maintain habitat conditions and demonstrate acceptable stream quality conditions that provide adequate control of anthropogenic sediment sources to assure improved habitat quality and the biological communities. This targeted score is closely associated with macroinvertebrate community scores of -3 or greater, potentially providing better results than a minimally acceptable value of -4.

For comparison of survey assessment results from 1997, 2002, and 2003, follow-up biological and habitat quality assessments will be conducted during stable flow conditions within the months of June through September. The results will best reflect an MOS that is implicit and express an integration of the effects of the variability in sediment loads in the aquatic environment and minimize seasonal variability.

SEASONALITY

Seasonality is addressed in the TMDL in terms of sampling periods for fish and macroinvertebrate communities. To minimize temporal variability in the biological community, sampling will be conducted during June through September of each year during stable flow conditions. For assessing TSS loads to Malletts Creek, seasonal event monitoring will be conducted to define and characterize both hydraulic and TSS loads from the Malletts Creek watershed that influences the biota TMDL reach.

MONITORING PLAN

Monitoring will be conducted by the MDEQ to assess progress towards meeting the biota TMDL targets, following implementation of applicable BMPs and control measures. Subsequently, annual sampling of the macroinvertebrate community and habitat quality at locations in the vicinity of Chalmers Road, Washtenaw Road, Packard Road, and immediately downstream of the Brown Park Pond dam, as a minimum, will be conducted until assessment results from two consecutive years, demonstrate attainment of TMDL targets at these sites. For best comparative purposes, follow-up biological and habitat assessments will be conducted in a June to August time frame during stable flow conditions. Every effort will be made to sample during similar stream conditions and assess the same sampling locations.

In-stream monitoring of TSS, stream flow, and representative land use runoff/washoff characteristics for a variety of stable flow and wet weather events will be necessary to refine the TSS loadings estimates for the Malletts Creek watershed. This information will further define the level of TSS load reduction necessary; seasonally, climatologically, and annually.

Once the BMPs are in place to minimize the effects of runoff and flashy conditions that exist in Malletts Creek, stream flow and TSS sampling can be implemented so as to measure progress towards the secondary numeric target of 80 mg/l as a mean annual TSS value during wet weather runoff events. Multiple sampling during critical high flow events, as well as low flow events, needs to be assessed to estimate future TSS loads in Malletts Creek.

REASONABLE ASSURANCE

The focus of the actions to protect Malletts Creek is directed towards installing BMPs and other control measures to reduce and minimize solids loads and excessive runoff/washoff discharge rates to the TMDL reach. The former action is to reduce sedimentation impacts, the latter to minimize stream bank erosion associated with the erosive effects of flashy flow extremes. Overall, control measures include: NPDES individual/general and storm water permit limits and approved BMPs for areas currently not under any permit.

For the WLA, existing general NPDES permit requirements for these sources will be adequate to meet the target.

NPDES storm water permits are issued to the various dischargers within a watershed. The permittees are required to collectively develop a watershed management plan that includes the detailing of short- and long-term goals and attainment actions, public education plans, illicit discharge elimination plans, and the development (by each local unit of government within the Malletts Creek watershed) of their individual storm water prevention plans.

The MDEQ district staff will continue to work with and assist interest groups in the Malletts Creek watershed. The purpose is to assist in defining and designing approvable actions and programs that assess, develop, plan, and implement BMPs and control measures that best minimize or prevent soil erosion and excessive runoff rates to the Malletts Creek watershed.

- Upgrade and maintain the current vegetative riparian zone to reduce soil erosion and loadings to the Malletts Creek from sources within the watershed. BMPs need to be employed within the riparian zone adjacent to the urbanized, residential, industrialized, and commercial areas to minimize the loss through erosion and direct runoff/washoff, thereby minimizing habitat impairment of the Malletts Creek.

- Implementation of BMPs in the storm water permits program that reduces sediment loadings and moderate runoff release rates and excessive runoff/washoff to the Malletts Creek watershed are expected to improve and protect designated use support throughout the watershed. The goals are for reduced solids loadings and greater flow stability throughout the watershed so that WQS are restored and protected. Available guidance regarding runoff detention and stream protection is provided by Fongers and Fulcher, 2001; Schueler and Holland, 2000; and Purdue, 2003.

The MDEQ approval of BMPs and implementation plans is required prior to implementation of proposed structural improvements.

A Quality Assurance Project Plan (QAPP) is being designed for the Washtenaw County Drain Commissioner, for a Malletts Creek Regional Detention Facility site, involving the Brown Park Pond area (CDM, 2003). The facility is intended to help stabilize stream conditions due to wet weather runoff/washoff events. This QAPP may well enhance and reduce current impacts to the hydrology of Malletts Creek and foster improved habitat and biological communities.

Also, the Ann Arbor City Planning Commission's resolution regarding development in the Malletts Creek watershed requires the incorporation of the following BMPs into any proposal for development:

- Minimize impervious surfaces by efficient parking and drive design, shared parking, parking deferral, and use of multiple-story building design wherever possible.
- Provide detention facilities that meet or exceed the Washtenaw County Drain Commissioner's rules.
- In the case of redevelopment sites, provide detention for all added impervious surfaces and, if feasible, as much of the existing development as possible.
- Incorporate techniques from the MDEQ's "Guidebook of Best Management Practices for Michigan Watersheds (Peterson et al., 1993)."
- Avoid placing detention facilities in the Malletts Creek floodplain.

Since the inception of the Malletts Creek Restoration Plan (2000), the city of Ann Arbor and the Washtenaw County Drain Commissioner have partnered with the MDEQ to implement illicit

connection discharge elimination and retrofit regional detention within the basin using CMI and USEPA Section 319 Grant funding (Bobrin, 2003). Also, the 2000 plan indicates that updates of local ordinances and development standards affecting physical, biological, and chemical integrity of Malletts Creek have been made. To date, the total local public commitment for plan implementation exceeds $2 million.

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Michigan Department of Environmental Quality
August 6, 2004

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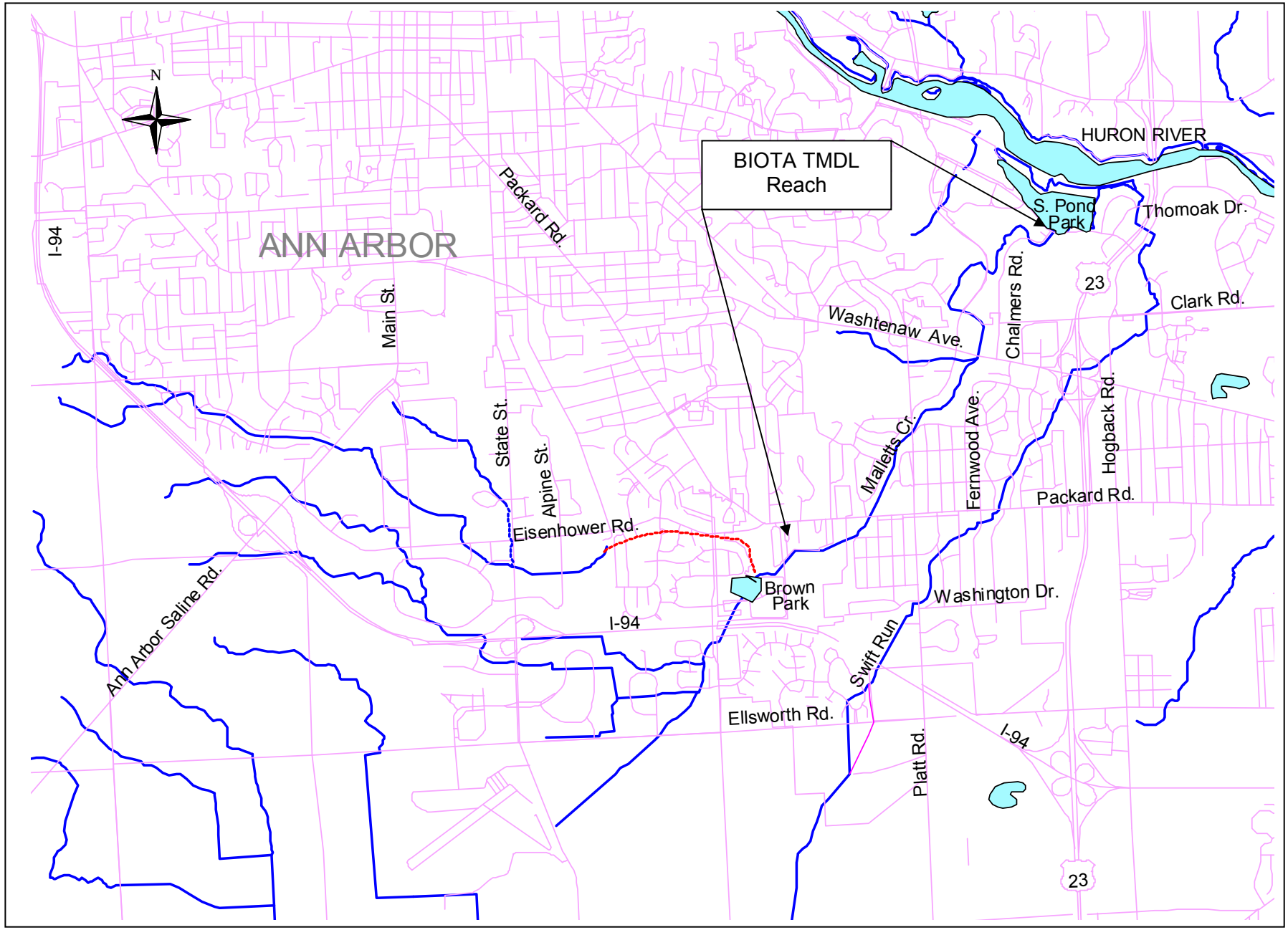
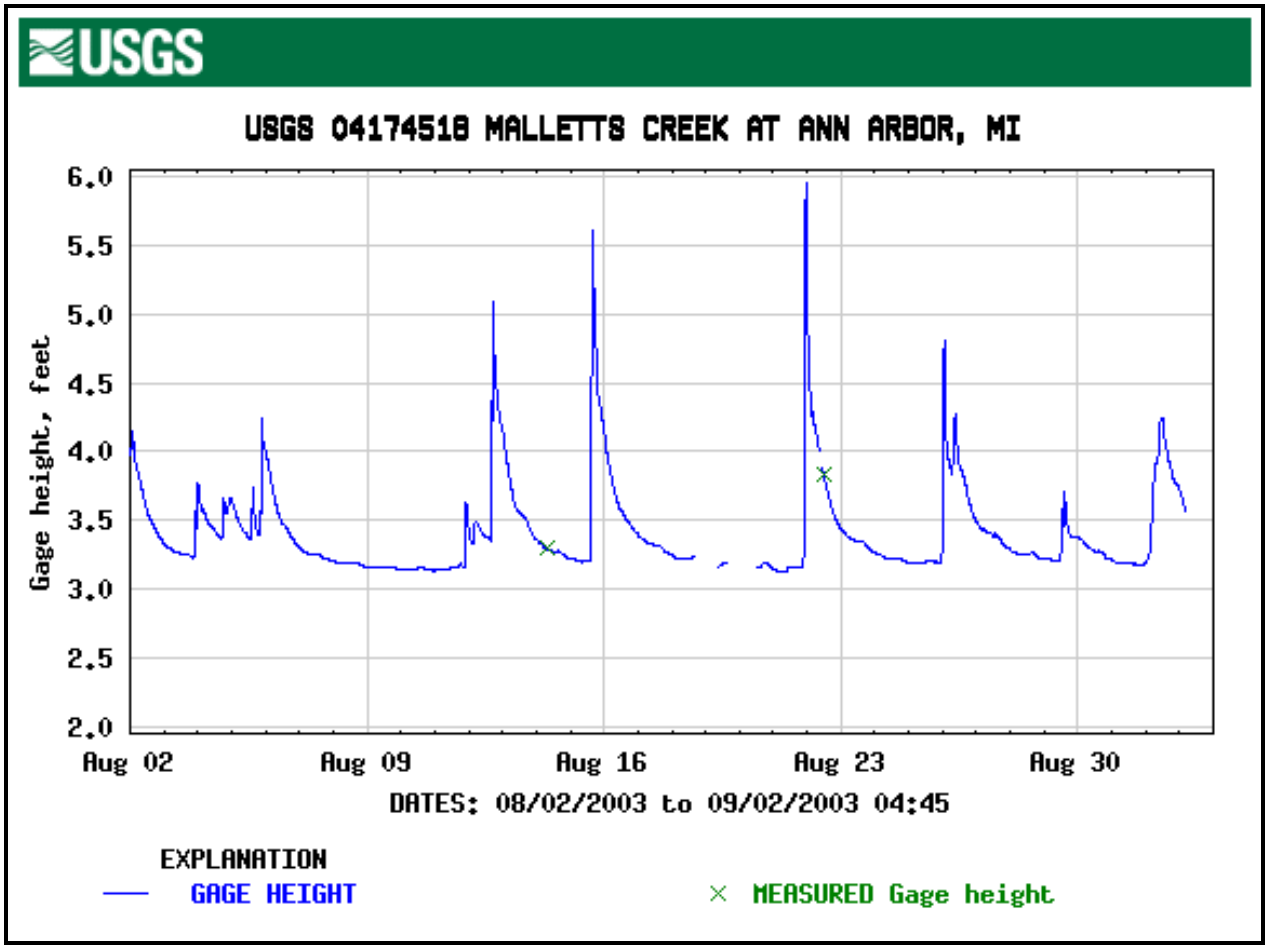


Figure 1. Malletts Creek biota TMDL reach, Washtenaw County, Michigan.



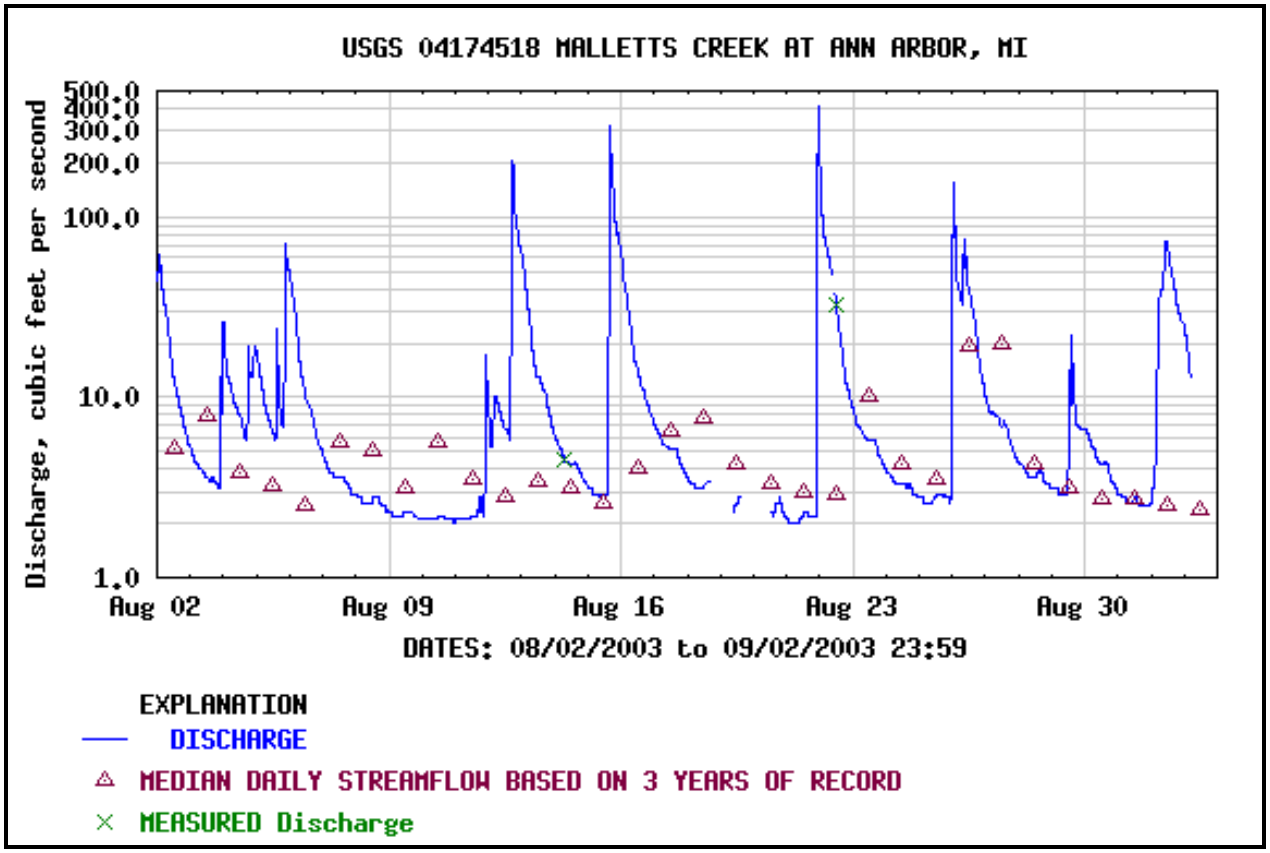


Figure 2. Malletts Creek storm event response in height and flow at the USGS gage.

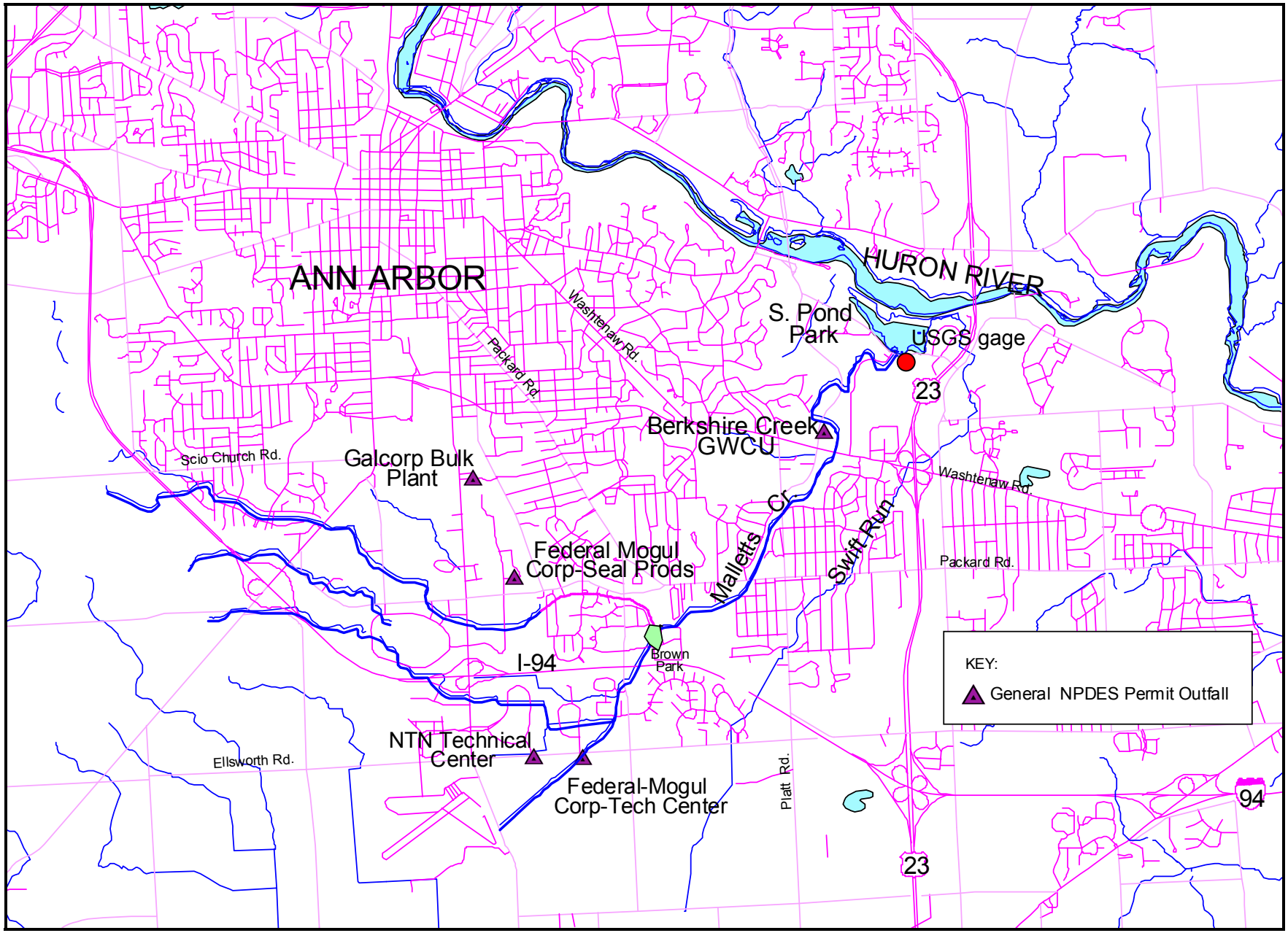


Figure 3. NPDES permitted (individual, general, and industrial storm water) facility outfalls to Malletts Creek watershed, Washtenaw County, Michigan.

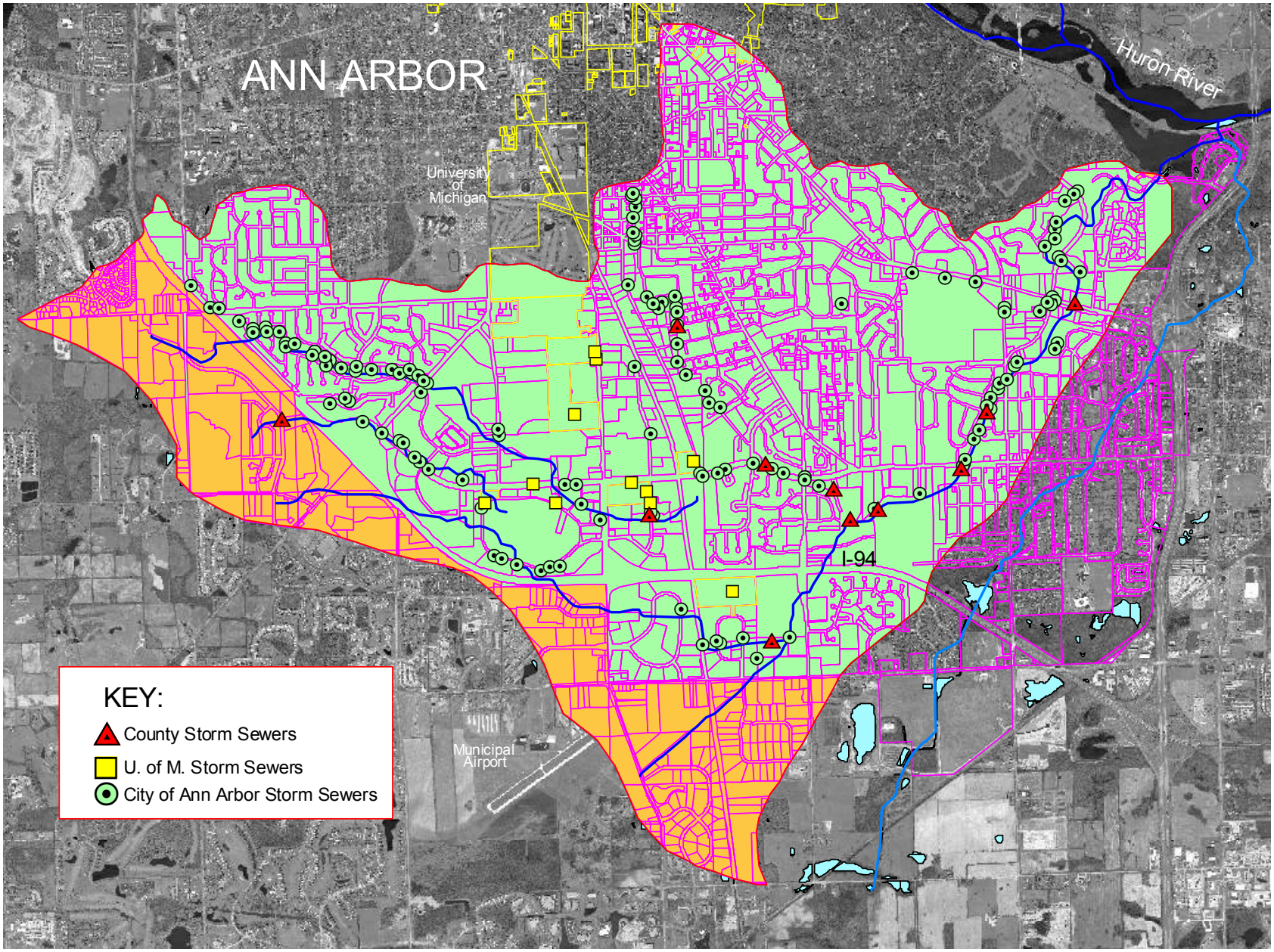


Figure 4. Washtenaw County Phase I and II storm sewer outfalls in the Malletts Creek watershed managed by the city of Ann Arbor, University of Michigan, and Washtenaw County. Source: Scott Wade – (LTI, 2003).

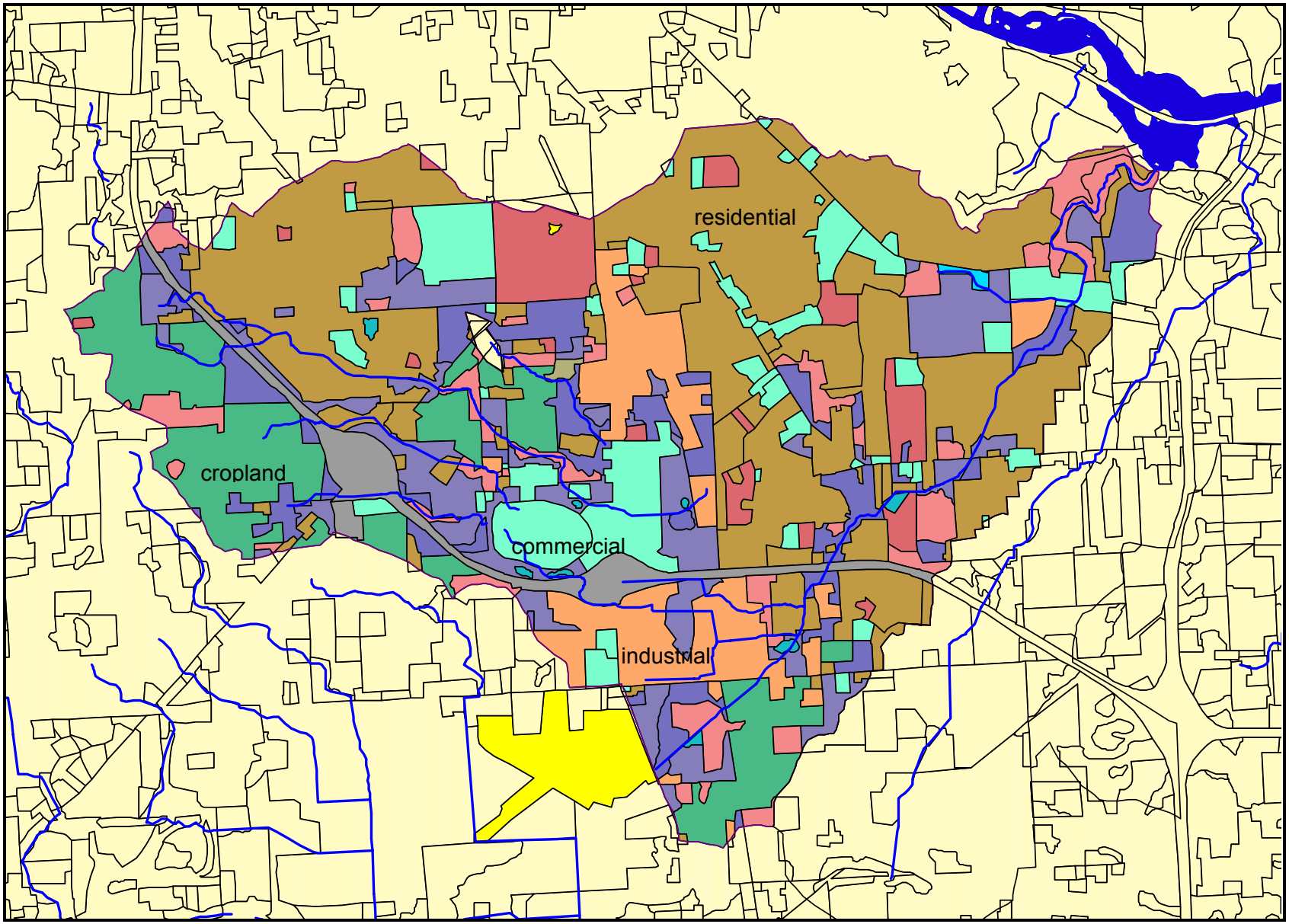


Figure 5. Land use categories in the Malletts Creek watershed, Washtenaw County, Michigan.
(Source: Scott Wade – (LTI, 2003 using 2002 (Ann Arbor) and 1998 (township) land use coverages).

Table 1. Individual, general, and industrial storm water NPDES permitted outfalls tributary to the Malletts Creek watershed and estimated TSS loads for non-storm water outfalls. (Source: MDEQ/WD NPDES permit Management System. *mgd = million gallons per day.

PERMIT NUMBER	FACILITY	DESIGN FLOW (mgd*)	Latitude (decimal degrees)	Longitude (decimal degrees)	Annual TSS Load at 25 mg/l (pounds)
General NPDES Permits:					
MIG080756	Galcorp Bulk Plant	0.043	42.255	-83.73855	3,274
MIG081010	Berkshire Creek GWCU	0.01	42.258333	-83.695	761
MIG250419	NTN Technical Center	0.33	42.22944	-83.73167	25,129
MIG250420	Federal-Mogul Corp-Tech. Center	0.09	42.917	-83.72556	6,853
MIG250421	Federal-Mogul Corp-SealProducts	1.2	42.245833	-83.73333	91,378
	Total Daily Design Flow (mgd):	**1.673**			**127,396**
Storm Water NPDES Permits (Phase I – MS4 Program):					
MI0053856	City of Ann Arbor				
MI0053902	University of Michigan				
MI0053911	Michigan Depart. of Transportation				
Storm Water NPDES Permits (Phase II – MS4 Program):					
(eleven outfalls)	Washtenaw County				

Table 2. Annual TSS loads based on NPDES permitted point sources and various land use categories in the Malletts Creek watershed. Estimated annual TSS loads and recommended TSS reductions (WLA and LA) are derived.

Source Category	Acres	Estimated Current TSS (Pounds/Year)*	TMDL TSS Target Load TSS (Pounds/Year)
WLA Components:			
NPDES Individual/General Permitted Point Source TSS Load:		127,396	127,396
NPDES Permitted Storm Water TSS Load:			
Residential	2422	496,343	
Industrial	535	202,971	
Commercial and Service	686	405,831	
Transportation/Comm/Util.	232	68,643	
Subtotal:		1,173,788	985,853 (16% reduction)
WLA Total:	3875	1,301,184	1,113,249 (**WLA)**
LA Components:			
Agricultural Land			
Cropland	787	53,822	29,695 (45% reduction)
(Background Sources)			
Forested/Shrub/Open Land			
Deciduous Forest	437	10,512	10,512
Openland/Shrub/Rangeland	1559	37,500	37,500
Confier Forest	8	192	192
Wetland			
Forested	9	191	191
Water Body			
Lake/Reservoir	21	445	445
LA Subtotal:	2821	102,662	78,535 (**LA**)
Overall Totals:	6696	1,403,846	1,191,784 (overall 15% reduction)

**Load estimates based on PLoad Version 3 model (USEPA, 2001), land use acres derived from 2002 (Ann Arbor) and 1998 (township) land use coverages and a mean annual rainfall value of 34 inches.*

Michigan Department of Environmental Quality

Water Bureau

November 2004

Total Maximum Daily Load for Biota for Swift Run Creek

Washtenaw County

INTRODUCTION

Section 303(d) of the federal Clean Water Act and the United States Environmental Protection Agency's (USEPA's) Water Quality Planning and Management Regulations (Title 40 of the Code of Federal Regulations, Part 130) require states to develop Total Maximum Daily Loads (TMDLs) for water bodies that are not meeting water quality standards (WQS). The TMDL process establishes the allowable loadings of a pollutant to a water body based on the relationship between pollutant sources and in-stream water quality conditions. TMDLs provide states a basis for determining the pollutant reduction necessary from both point and nonpoint sources (NPS) to restore and maintain the quality of their water resources. The purpose of this TMDL is to identify appropriate actions to achieve the fish and macroinvertebrate community targets and habitat quality targets, specifically a reduction in sediment loadings from sources in the Swift Run Creek watershed that will result in WQS attainment. This TMDL follows the phased approach due to inherent uncertainties in deriving numeric targets and estimating loading from NPS. Under the phased approach, load allocations (LAs) and waste load allocations (WLAs) are calculated using the best available data and information, recognizing the need for additional monitoring data to determine if the load reductions required by the TMDL lead to attainment of WQS. The phased approach provides for the implementation of the TMDL while additional data are collected to reduce uncertainty.

PROBLEM STATEMENT

The TMDL reach of Swift Run Creek, a warmwater designated water body tributary to the Huron River at South Pond Park, is located in Washtenaw County in the vicinity of Ann Arbor (Figure 1). The watershed drains portions of Pittsfield Township, the city of Ann Arbor and Ann Arbor Township. The designated use (Michigan's WQS Rule 100) identified as impaired was the support of indigenous aquatic life, in this case, the macroinvertebrate communities. This condition served as the original basis for placing Swift Run Creek on Michigan's Section 303(d) list of impaired water bodies requiring the development of a TMDL. The TMDL reach is about 3.7 miles in length and is identified on the Section 303(d) list (MDEQ, 2004) as follows:

SWIFT RUN CREEK WBID#: **061203IL**
County: WASHTENAW HUC: 04090005 Size: 3.7 M
Location: Huron River confluence u/s to Ellsworth Road. Southeast of Ann Arbor.
Problem: **Macroinvertebrate community rated poor.**
TMDL YEAR(s): 2004 RF3RchID: 4090005 25

This document represents the basis for the development of a biota TMDL that focuses on the restoration of the biological communities within the impacted perennial reach of Swift Run Creek to meet Michigan's WQS designated uses.

Within the approximately 2994-acre watershed, the flow in the headwater reach of Swift Run Creek upstream of Creek Drive (Pittsfield Township - Section 11, R6E, and T3S) is classified by the United States Geological Survey (USGS) as intermittent. Flow in the Swift Run Creek TMDL reach is classified by the USGS as perennial from Creek Drive downstream (Figure 1) to the Huron River confluence. Within the 3.7-mile perennial reach, impairment is attributed to degraded water quality, unstable and flashy flow regimes, reduced bank stability (bank erosion), sedimentation, and reduced stream habitat quality. Excessive runoff/washoff sources throughout this highly urbanized watershed (from headwaters downstream) results in an impaired biological community.

The determination of impairment within the TMDL reach was based on the August 1997 Michigan Department of Environmental Quality (MDEQ) Procedure 51 biological community assessment findings for Swift Run Creek (unpublished). A Procedure 51 macroinvertebrate community assessment involves the collection of representative taxa from each available habitat type in the stream survey reach (woody debris, cobble, gravel, sand, etc.). Of the numbers of organisms collected and representative of a given survey reach, the relative percent of each taxon is derived. The Procedure 51 scoring and rating of macroinvertebrate communities is based on the assessment of 9 metrics with total score ranges of 5 to 9, 4 to -4, and -5 to -9 that have corresponding ratings of excellent, acceptable, and poor, respectively. A poor (score of -8) macroinvertebrate community characterized the lower reach of the stream at Hogback Road in August 1997 (Wuycheck, 2003). An additional assessment conducted in September 2003 at Shetland Drive (located north of Clark Road) also indicated poor macroinvertebrate communities based on the Procedure 51 community assessment score of -6 (Wuycheck, 2003).

Habitat quality was assessed in August 1997 at Hogback Road and in September 2003 at Shetland Drive, using Procedure 51 protocols (Figure 2). The Hogback Road site was assessed in August 1997 using the MDEQ (1997) habitat assessment protocol, and the September 2003 habitat assessment used the updated MDEQ (2002) protocol. The Procedure 51 habitat assessment protocol used in August 1997 involved score ranges of less than 35, 35 to 70, 71 to 106, and 107 to a maximum of 135 points representing habitat quality ratings of poor, fair, good, and excellent, respectively. The August 1997 habitat score and rating at the Hogback Road site was 66 (out of a possible score of 135) indicating overall fair (moderately impaired) conditions. The total point score ranges using the updated MDEQ (2002) habitat assessment protocol are less than 56, 56 to 104, 105 to 154, and greater than 154 to a maximum of 200 points with ratings of poor, marginal, good, and excellent, respectively. The September 2003 habitat score and rating at the Shetland Drive site (using the May 2002 updated Procedure 51 habitat assessment protocol) was 114 (out of a possible score of 200) indicating overall good conditions. However, scores for the individual metric categories of Embeddedness, Flow Stability, and Bank Stability of both the August 1997 and September 2003 assessments indicated 50% or less than their maximum potential scores. These scores indicate unstable habitat conditions in Swift Run Creek.

Volunteer biological community assessments by the Huron River Watershed Council characterize the macroinvertebrate communities as stable but poor (Huron River Watershed Council, 2003).

Total suspended solids (TSS) and flow monitoring in the Swift Run Creek watershed was conducted during the months of June, July, and August 2003 by Limno-Tech, Incorporated (LTI) as part of a Clean Michigan Initiative (Contract 071B1001643) funded monitoring program. The project, requested by the MDEQ, required monitoring three times (two completed) during the

survey period to characterize background TSS concentrations during dry-weather, stable flow conditions and to monitor at least three wet-weather runoff events to assess increases in stream TSS and flow during a response to wet-weather events of 0.1 inches or greater. Effort was directed towards sampling TSS and flow during the rise and fall of the Swift Run Creek hydrograph. Results from the study indicated an average background TSS concentration of 13.0 milligrams per liter (mg/l) and 14.5 mg/l during stable, base flow conditions of June 23, 2003, and August 1, 2003, respectively (LTI, 2003b).

Wet-weather event monitoring at the most downstream site at Thornoak Road, during 24-hour precipitation accumulations of 1.22, 0.61, and 1.02 inches on July 21, August 1-2, and August 12, 2003, showed in event maximum (event average) TSS concentrations of 1,115 mg/l (662 mg/l), 689 mg/l (211 mg/l), and 1,032 mg/l (378 mg/l), respectively. This information indicates that precipitation runoff/washoff events in the watershed substantially increase the amount of TSS in transport in Swift Run Creek. In-stream flows measured at the most downstream station at Huron River Drive, vicinity of Thornoak Drive, during the three wet-weather event monitoring dates of July 21, August 1-2, and August 12 showed increases from 11 to 127 cubic feet per second (cfs), <0.1 to 19 cfs, and 5 to 14 cfs, respectively, demonstrating substantial flow responses to precipitation events.

Excessive storm water runoff to Swift Run Creek from the municipal and commercial sites in the watershed is considered the most probable cause of the biological community impairment. There are a minimum of 26 National Pollutant Discharge Elimination System (NPDES) permitted storm water outfalls throughout the Swift Run Creek watershed, the flow from which contributes to unstable habitat conditions. Approximately 425 acres or 14.5% of the Swift Run Creek watershed (2,994 acres) is impervious; e.g., parking lots and buildings (Purdue, 2003). Such areas are commonly designed to divert and direct precipitation directly to nearby water bodies to facilitate rapid drainage. Substantial degradation in biological communities has been demonstrated to occur in watersheds containing 10% to 20% impervious surface areas that directly discharge to a water body (WPT, 1994).

The primary contributor to poor stream quality is excessive runoff/washoff volumes resulting in flashy, destabilizing extremes in stream flow conditions in this highly urbanized/commercialized watershed. This condition results in substantial stream bank erosion and sediment induced erosivity of both habitat and colonizing organisms, siltation, and sedimentation impacts on biologically important and desirable habitat. Reductions in storm sewer runoff rates, resulting flashy stream conditions, and reduced stream bank erosion through more stable flow management are necessary to reduce impacts on the aquatic life and meet WQS.

NUMERIC TARGETS

The impaired designated use for Swift Run Creek relates to indigenous aquatic life. Michigan's WQS require, as a minimum, the protection of a variety of designated uses, including indigenous aquatic life [Rule 100(1)(f)]. Attainment of WQS for the indigenous aquatic life designated use will be demonstrated based on assessments of macroinvertebrate community integrity and habitat quality.

The primary numeric targets are based upon Michigan's biological community and habitat quality assessment Procedure 51 (MDEQ, 1997, 1998, and 2002). The biota TMDL target is to establish a macroinvertebrate community with acceptable, reproducible scores equal to or greater than -4. Macroinvertebrate communities will be evaluated based on a minimum of two Procedure 51 biological assessments conducted in successive years, following the implementation of Best Management Practices (BMPs) to stabilize runoff/washoff discharges

and extremes in stream flow conditions, minimize bank erosion, and sediment loadings to the subject TMDL reach.

A target habitat score of equal to or greater than 110 will be used to demonstrate restoration of acceptable habitat quality. This score is consistent with the most recent habitat assessment score (114 for September 2003) for the acceptable habitats assessed at Shetland Drive. This level of conservation is appropriately high enough to account for both temporal and spatial variability within the watershed and provide a buffer for the variability within the macroinvertebrate and habitat assessment protocol.

A secondary numeric target based on TSS will be used to further assess improvements in Swift Run Creek. The secondary target goal is a mean annual, in-stream TSS concentration of 80 mg/l for wet-weather runoff/washoff events. This secondary numeric target may be overridden by achievement of the biological and habitat numeric targets. However, if the TSS numeric target is achieved but the biota or habitat numeric targets are not achieved, then the TSS target may have to be reevaluated. The secondary numeric target is intended to help guide proper control over NPS of excessive suspended solids loads from runoff, as well as the runoff discharge rates and instantaneous runoff volumes that affect increased stream flow instability, stream bank erosion, and increased suspended solids concentrations.

The mean annual target concentration of 80 mg/l TSS is based on a review of existing conditions and published literature on the effects of TSS to aquatic life. Vohs et al. (1993) indicated that a chemically inert suspended solids concentration of 100 mg/l appears to separate those streams with a fish population from those without. Gammon (1970) demonstrated decreases in the standing crop of both fishes and macroinvertebrates in river reaches continuously receiving suspended solids loadings of less than 40 mg/l. The European Inland Fisheries Advisory Commission stated that in the absence of other pollution, a fishery would not be harmed at suspended solids concentrations less than 25 mg/l. Good to moderate fisheries can be found at 25 to 80 mg/l suspended solids, good fisheries were unlikely to be found at 80 to 400 mg/l, while only poor fisheries are typically found at 400 mg/l (Alabaster, 1972).

Water quality goals for suspended solids (finely divided solids) may be represented by the following categories:

Optimum	= $\leq$ 25 mg/l
Good to Moderate	= >25 to 80 mg/l
Less than moderate	= >80 to 400 mg/l
Poor	= >400 mg/l

Since the TMDL purpose is to restore the biological community to an acceptable condition and attain WQS, a value of 80 mg/l as a mean annual TSS target for wet-weather events was chosen for Swift Run Creek as a secondary target.

Overall, the secondary target of 80 mg/l TSS is intended to evaluate solids load affects and assist in orienting and focusing corrective actions for source reductions. Additional TSS targets, based on flow-related considerations, may be developed as additional data on Swift Run Creek become available. At this time, sufficient, site-specific data are unavailable regarding the flow and TSS concentration relationship associated with storm water sources during wet weather runoff periods to establish specific numeric targets. Therefore, to allow for additional data collection, this TMDL is established as a phased TMDL.

SOURCE ASSESSMENT

Stream flow conditions of Swift Run Creek can best be described as unstable and flashy in response to storm events as characterized by the flow extremes recorded during the June, July, and August 2003 surveys conducted by LTI.

From the Huron River confluence upstream, land use in the Swift Run Creek watershed is dominated by residential, commercial, and transportation uses (Table 3). Such development within a watershed alters its hydrologic characteristics because increased areas of impervious surface result in increased runoff and washoff of solids and pollutant loads being discharged to stream reaches within the watershed (Fonger and Fulcher, 2001; and Schueler and Holland, 2000). Substantial reductions in vegetative riparian zones and pervious areas throughout the watershed of Swift Run Creek and the extensive use of structural features, including paved impervious surface areas (e.g., roads and parking lots), curb and gutter, and numerous direct storm sewer discharges, dominate the landscape and contribute to rapid precipitation runoff rates to Swift Run Creek.

There is one NPDES permitted industrial storm water outfall in the Swift Run Creek watershed: Ann Arbor Manufacturing - Permit Number MIS410029 (Table 1, Figure 2). This facility discharges an undetermined volume of storm water to the headwaters of the stream in the vicinity of Ellsworth Road and is subject to the provisions of the general permit No. MIS510000 that requires identifying the level of control necessary to comply with this TMDL. LTI (2003a) identified one Washtenaw County storm water outfall to Swift Run Creek and at least 25 storm water outfalls that are covered under the city of Ann Arbor's Phase 1 Municipal Separate Storm Sewer System (MS4) program (Table 2, Figure 2). The MS4 permitted outfalls require plan development to achieve the TMDL by minimizing pollutant loads to the "maximum extent practicable."

Determination of the annual TSS loads to the Swift Run Creek watershed from the various land use categories involved estimates of the acres of each land use category (LTI, 2003a), a mean annual rainfall of 34 inches, and USEPA's Simple Method model approach (USEPA, 2001). These aspects were used in conjunction with TSS export coefficients derived from the Rouge River Project (Cave et al., 1994). The estimated annual TSS load from the point sources (WLA) versus the NPS land use categories (LA) in the Swift Run Creek watershed is about 511,844 pounds and 40,945 pounds, respectively (Table 3). The percentage of the total estimated annual TSS load to the Swift Run Creek from NPDES non-storm water point sources (WLA), NPDES storm water sources (WLA), and nonpoint sources (LA) is approximately 552,789 pounds, representing 0%, 93%, and 7% of current contributions, respectively. The use of annual load estimates for TSS is used for comparative purposes to better express the potential magnitude of the TSS loads to Swift Run Creek. Also, this load estimate relates to the 80 mg/l TSS target, a mean annual concentration.

LINKAGE ANALYSIS

A suitable method used to develop a TMDL that addresses the severity of the impacts of sedimentation to a biological community is to measure sediment impacts on stable, colonizable substrates in the stream channel and the associated changes in the biological community.

Increased siltation and embeddedness of colonizable substrates resulting from excessive bank erosion and sedimentation has been demonstrated to impair the biological integrity of rivers (Waters, 1995) by obscuring or reducing the suitability of colonizable or useable substrate by stream biota. With improved habitat through the reduction in sedimentation, both fish and

macroinvertebrate communities respond with an increase in species diversity and an increase in the number of individuals of each species. As a result, the Procedure 51 assessment scores and ratings for quality of the fish and macroinvertebrate communities and habitat are expected to increase as sedimentation rates decline, embeddedness decreases, and habitat diversity increases. These latter characteristics will serve to demonstrate improvement in habitat conditions, WQS attainment, and overall stream quality as expressed through an acceptably rated biological community.

TMDL DEVELOPMENT

The TMDL represents the maximum loading that can be assimilated by a water body while still achieving WQS. The Swift Run Creek biotic community has been impaired by unstable flow conditions, bank erosion, and excessive sedimentation. Therefore, the TMDL is based on reducing sediment loads throughout the watershed to a level that supports a biological community that meets WQS. Using the metrics from Procedure 51, a minimum numeric score of -4 for macroinvertebrate communities and a habitat score of 110 or greater will serve as primary targets for this biota TMDL.

Concurrent with the selection of numeric endpoints, this TMDL also defines the environmental conditions that will be used when defining allowable levels. Some TMDLs are designed around the concept of critical condition. A critical condition is defined as the set of environmental conditions that, if controls are designed to protect, will ensure attainment of objectives for all other important conditions. For example, the critical conditions for the control of point sources in Michigan are provided in Rules 323.1082 and 323.1090 of Michigan's WQS. In general, the lowest monthly 95% exceedance flow for a stream is used to establish effluent limits for point sources. However, the excessive flows to Swift Run Creek are attributable to wet-weather driven discharges. As such, there is no single condition that is protective for all conditions, but efforts are directed towards wet-weather runoff/washoff events.

The secondary target of 80 mg/l TSS is used to develop a TMDL load goal for TSS during wet-weather runoff/washoff events, especially from storm water discharges from the area 1,918 total acres) of urban/industrial/built-up land use category that represents about 66% of the land use area in the Swift Run Creek watershed.

ALLOCATIONS

TMDLs are comprised of the sum of individual WLAs for permitted point sources and LAs for NPS and natural background levels. A margin of safety (MOS), either implicit or explicit, accounts for uncertainty in the relationship between pollutant loads and the quality of the receiving waters. Conceptually, this relationship is defined by the equation:

$$TMDL = \Sigma^{WLAs} + \Sigma^{LAs} + MOS$$

The TMDL represents a maximum load of a pollutant or stressor that can be discharged to a receiving water and still meet WQS. The overall TMDL load capacity is allocated among the three TMDL components: WLA for point sources, LA for NPS and background loads, and the MOS.

WLA

The estimated total annual TSS load from all non-storm water NPDES permitted point sources is zero (Table 1) since there are none in the watershed.

Based on acres of land use categories listed under “Urban/Industrial/Built-Up” of Table 3 and TSS export coefficients derived from the Rouge River Project (Cave et al., 1994), a total annual TSS load estimate of approximately 511,844 pounds is attributable to NPDES industrial and municipal permitted storm water runoff/washoff discharges to the Swift Run Creek watershed (Table 3). All categories are predicted to be meeting the 80 mg/L target secondary target, with the exception of the industrial category, which is predicted to be contributing an average of 149 mg/L TSS to Swift Run Creek (Cave et al., 1994). To achieve the goal of 80 mg/L as an annual average during wet weather events from all point sources, a reduction of only 1% in TSS loads would be necessary from all permitted point sources, resulting in a projected annual WLA of 507,278 pounds of TSS (Table 3).

For individual and general NPDES permitted point source discharges, the receiving stream design flow equals the lowest 95% exceedance flow. However, it is proposed that any TSS limits in NPDES point source permits be established at an effluent limit based on best available treatment (BAT) so as to minimize TSS loads to Swift Run Creek, which then makes it unnecessary to consider mixing zone scenarios. The permitted storm water point source contributions to the WLA are also considered controllable through the existing NPDES permit requirements and storm water through the Phase I and Phase II MS4 programs.

To achieve the primary (biota) and secondary (TSS) TMDL targets, NPDES permitted individual, general, and storm water runoff flows from current or future point sources will need to be managed throughout the watershed to minimize stream bank erosion and habitat impairment that causes a poor macroinvertebrate community within the TMDL reach. It will be necessary to employ BAT (applied to individual or general point sources) or “maximum extent practicable” treatment (storm water point sources) that will attenuate the runoff delivery rates and volume inputs to Swift Run Creek in order to reduce flashiness, better stabilize and normalize stream flow conditions, and minimize stream bank erosion, TSS resuspension, and sedimentation impacts.

LA

The LA component of the TMDL defines the load capacity for a pollutant that is nonpoint in origin that includes the following land use categories: agricultural, forested/shrub/open land, and/or water bodies (Table 1). An estimated annual TSS load of 40,945 pounds (LA) is attributed to these categories of NPS in the watershed. All but the agricultural land uses are treated as background load sources because runoff concentrations of TSS are typically less than 80 mg/l. Therefore, the only targeted load reduction source is from agricultural sources, which has a runoff average TSS concentration of 149 mg/l (Cave et al., 1994). A 46% annual reduction (from 23,868 to 13,168 pounds) from agricultural areas in the watershed is recommended resulting in the annual LA, TSS load target of 30,245 pounds, based on achieving a runoff mean annual average concentration of 80 mg/l TSS, the target concentration during wet-weather runoff/washoff events.

In summary, the proposed accumulative annual TSS load estimate to Swift Run Creek (WLA + LA) is 537,523 pounds/year, an overall 3% reduction from existing estimated loads. With the absence of any individual or general NPDES non-storm water permitted point source discharges in the Swift Run Creek watershed, 0% of the annual load is allocated to individual or general NPDES permitted point sources, 94% (507,278 pounds/year) is allocated to the NPDES permitted industrial storm water and the municipal storm water outfalls covered under the Phase I and Phase II MS4 Storm Water Programs, and 6% (30,245 pounds/year) attributed to the LA.

Suspended solids data from the 2003 LTI study indicate that there are sources either unaccounted for, and/or underestimated, in terms of suspended solids contributions to Swift Run Creek. Land use data used to develop the LA and WLA projections for suspended solids do not predict the elevated TSS concentrations observed during the 2003 wet-weather events; e.g., up to 1115 mg/L TSS. Possibilities for the inconsistency between the modeled WLA/LA TSS contributions and the observed TSS concentrations are underestimated contributions from land use practices and/or sources of TSS originating in-stream (e.g. resuspension and/or stream bank erosion during wet-weather events). The latter is likely the most probable cause for the elevated TSS concentrations observed as evidenced by the increases in both TSS concentrations and flow during wet-weather events.

To achieve the primary and secondary TMDL targets, a reduction in the wet-weather runoff/washoff of TSS load through controls in the runoff rates and volume discharges are necessary. It will require employing BMPs that attenuate the runoff delivery rates and volume inputs to Swift Run Creek in order to reduce flashiness, better stabilize and normalize stream flow conditions, and minimize stream bank erosion, TSS resuspension and excessive sedimentation that impacts habitat quality.

MOS

The MOS in a TMDL is used, in part, to account for variability of source inputs to the system and is either implicit or explicit. An MOS is implicit for a biota TMDL because the quality of the biological community, its integrity, and overall composition represent an integration of the effects of the spatial and temporal variability in sediment loads to the aquatic environment.

The habitat score of equal to or greater than 110 will be used to demonstrate acceptable stream quality conditions and represent adequate control of anthropogenic sediment sources to assure improved habitat quality and the biological communities. This targeted score is closely associated with macroinvertebrate community scores of -3 or greater, potentially providing better results than a minimally acceptable value of -4.

For comparison of survey assessment with results from 2003, follow-up biological and habitat quality assessments will be conducted during stable flow conditions during the months of June through September. The results will best reflect an MOS that is implicit and expresses integration of the effects of the variability in sediment loads in the aquatic environment and minimize seasonal variability.

SEASONALITY

Seasonality is addressed in the TMDL in terms of sampling periods for fish and macroinvertebrate communities. To minimize temporal variability in the biological community, sampling will be conducted during June through September of each year during stable, low flow conditions. For assessing TSS loads to Swift Run Creek, seasonal event monitoring will be conducted to define and characterize both hydraulic and TSS loads from the Swift Run Creek watershed that influences the biota TMDL reach.

MONITORING PLAN

Monitoring will be conducted by the MDEQ to assess progress towards meeting the biota and habitat TMDL targets following implementation of applicable BMPs and control measures. Subsequently, annual sampling of the macroinvertebrate community and habitat quality at locations in the vicinity of Hogback Road and Shetland Drive, as a minimum, will be conducted

until assessment results from two consecutive years demonstrate attainment of TMDL targets at these sites. For best comparative purposes, follow-up biological and habitat assessments will be conducted in a June to September time frame, during stable flow conditions. Every effort will be made to sample during similar stream conditions and assess the same sampling locations.

In-stream monitoring of TSS, stream flow, and representative land use runoff/washoff characteristics for a variety of stable flow and wet-weather events will be necessary to refine the TSS loadings estimates for the Swift Run Creek watershed. This information will further define the level of TSS load reduction necessary, seasonally, climatologically, and annually.

Once the BMPs are in place to minimize the effects of runoff and flashy conditions that exist in Swift Run Creek, stream flow and TSS sampling can be implemented so as to measure progress towards the secondary numeric target of 80 mg/l as a mean annual TSS value during wet-weather runoff events. Multiple sampling during critical high flow events, as well as low flow events, needs to be conducted to estimate future TSS loads in Swift Run Creek.

REASONABLE ASSURANCE

The focus of the actions to protect Swift Run Creek is primarily directed towards installing BMPs and other control measures to reduce and minimize solids loads with primary emphasis on reducing runoff peak flows that result in increased flow flashiness in the stream that substantially increases TSS concentrations resulting from resuspension and bank erosion. Control measures potentially include industrial and municipal storm water discharge volume, chemical-specific permit limits, and approved BMPs for areas currently not under any permit.

Rule 323.2161a(8), adopted pursuant to Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451), allows that "A permittee shall comply with any more stringent effluent limitations in the national permit, including permit requirements that modify or are in addition to, the minimum measure based on a total maximum daily load (TMDL) or equivalent analysis." In addition, Rule 323.2161a(10) allows that the "department may establish monitoring requirements in accordance with state or watershed specific monitoring plans ar as needed for a permitte to demonstrate the pollution reduction achieved by implementing best management practices." For sites of new construction, the rules specifically require development of a program to evaluate the post-construction storm water runoff from projects, including an ordinance designed to prevent or minimize water quality impacts including extreme flow volumes and conditions.

The regulatory mechanisms are available to reduce the storm water impacts of the urban/industrial/built-up sources on Swift Run Creek. Where the necessary data are available, permit requirements will be established in the NPDES permits. Where necessary, additional data to determine specific loadings and flow volumes associated with these sources will be collected through the NPDES permit requirements.

In addition to establishment of permit requirements, the NPDES storm water permittees in the watershed (industrial, Phase I, or Phase II) are required to collectively develop a watershed management plan that includes the detailing of short- and long-term goals and attainment actions, public education plans, illicit discharge elimination plans, and the development (by each local unit of government within the Swift Run Creek watershed) of their individual storm water prevention plans. The Ann Arbor Township and Pittsfield Township master plans acknowledge that proposed actions for the Swift Run Creek watershed are needed to manage both quality and quantity issues to be consistent with Phase I and II water practices for construction and

postconstruction activities (Ann Arbor Township Planning Commission, 2001 and Pittsfield Township, 2001).

The MDEQ district staff will continue to work with and assist interest groups in the Swift Run Creek watershed to assist in defining and designing approvable actions and programs that assess, develop, plan, and implement BMPs and control measures that best minimize or prevent soil erosion and excessive runoff rates to the Swift Run Creek watershed.

Recommended actions include:

- Through monitoring of point source discharges, identify sources of excessive wet-weather TSS loadings and flow volumes to Swift Run Creek through NPDES permit conditions. Establish permit conditions as necessary.

- Upgrade and maintain the current vegetative riparian zone to reduce soil erosion and loadings to Swift Run Creek from sources within the watershed. BMPs need to be employed within the riparian zone adjacent to the urbanized, residential, industrialized, and commercial areas to minimize the loss through erosion and direct runoff/washoff, thereby minimizing habitat impairment of Swift Run Creek.

- Implementation of BMPs in the storm water permits program that reduces sediment loadings and moderate runoff release rates and excessive runoff/washoff to the Swift Run Creek watershed are expected to improve and protect designated use support throughout the watershed. The goals are for reduced solids loadings and greater flow stability throughout the watershed so that WQS are restored and protected. Available guidance regarding runoff detention and stream protection is provided by Fongers and Fulcher, 2001; and Schueler and Holland, 2000.

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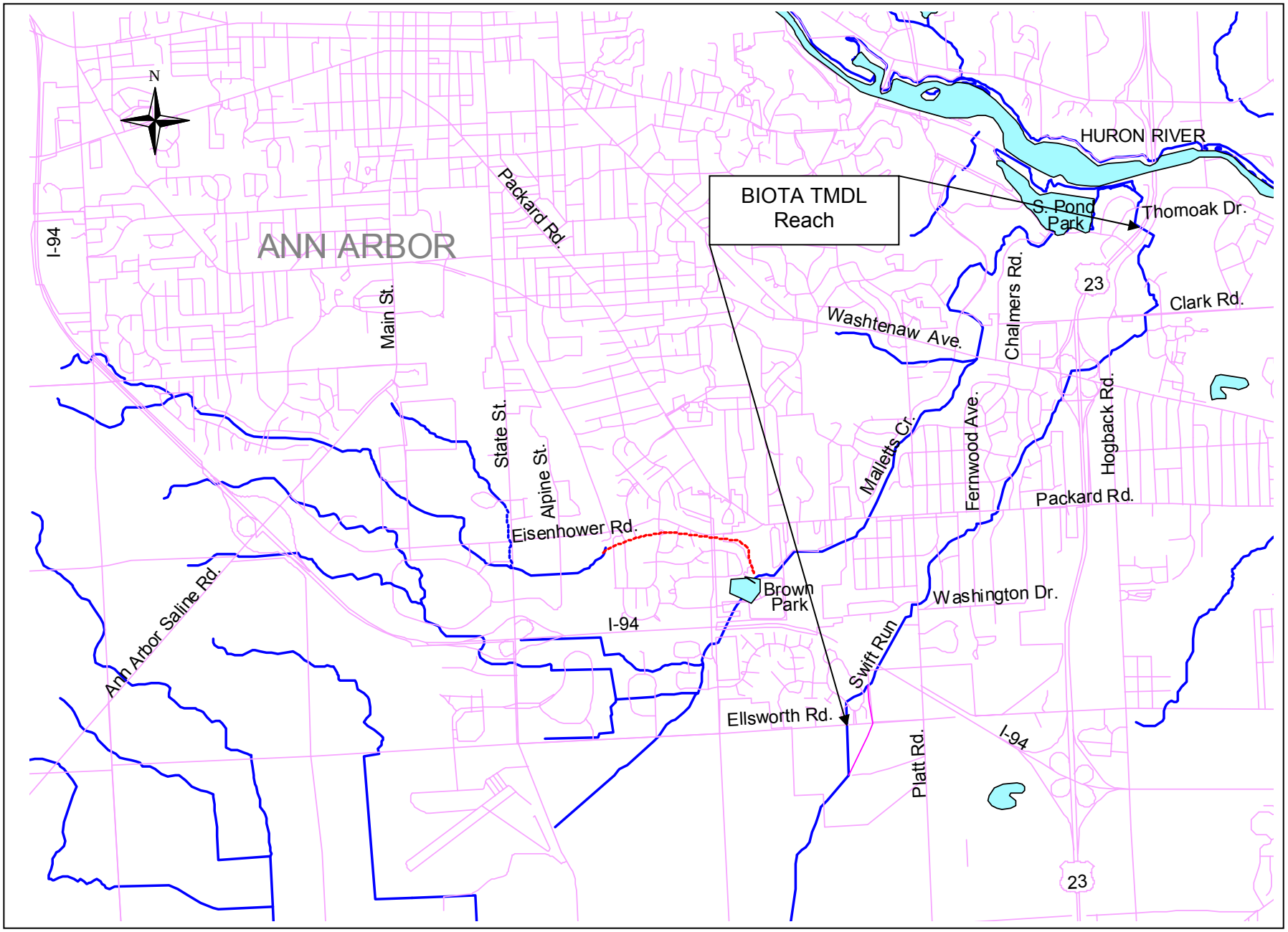

Figure 1. Swift Run Creek Biota TMDL Reach, Washtenaw County, Michigan (MIRIS, 2003).

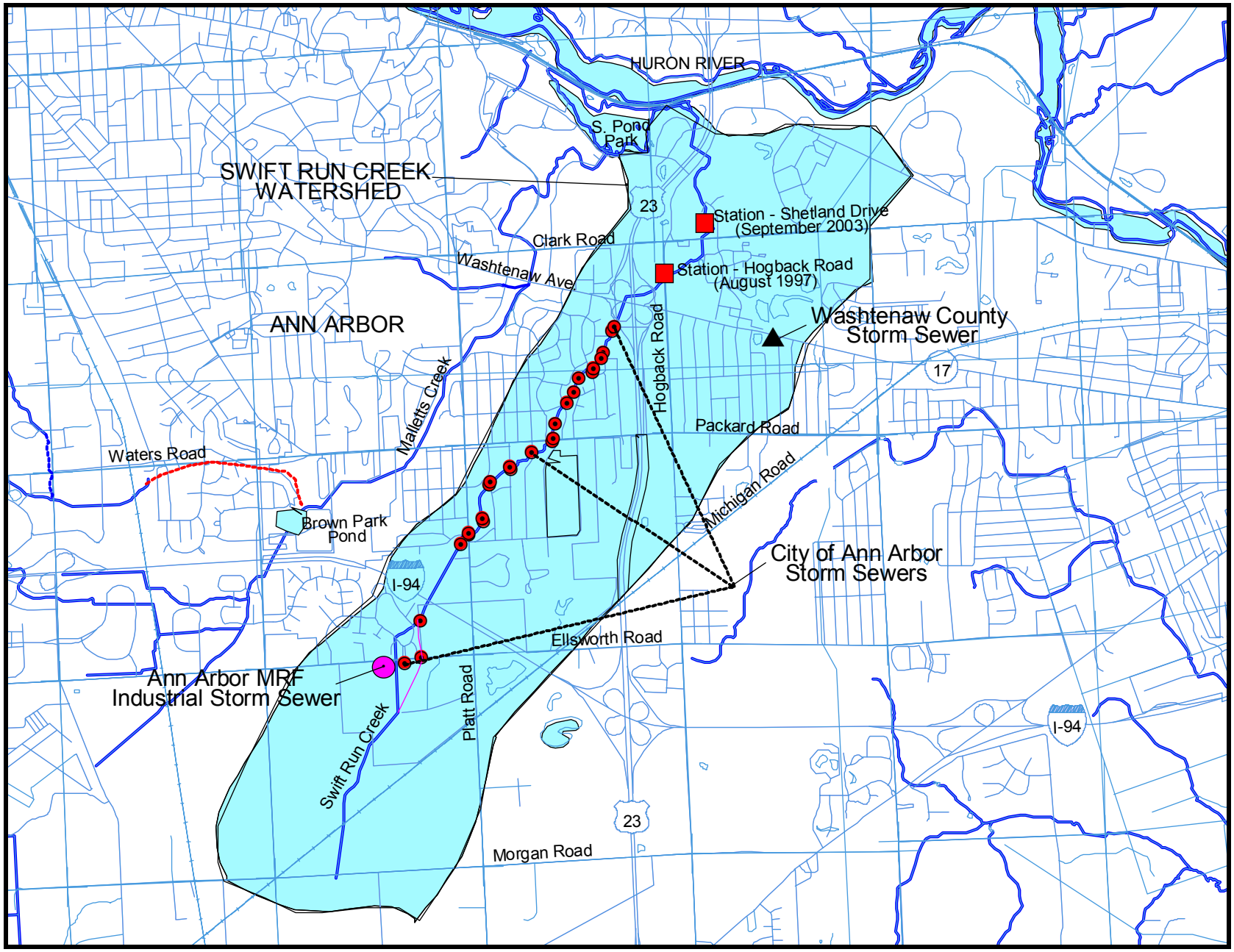

Figure 2. Washtenaw County Phase I storm sewer outfall, city of Ann Arbor managed storm sewers, industrial storm sewer, and biological community assessment sites (August 1997 and September 2003). Source: Scott Wade – (LTI. 2003a).

Table 1. Industrial storm water NPDES permitted outfall tributary to the Swift Run Creek watershed (Source: MDEQ/WB NPDES permit Management System).

FACILITY NAME	PERMIT NUMBER	DESIGN FLOW	LATITUDE (decimal degrees)	LONGITUDE (decimal degrees)
Ann Arbor MRF	MIS410029	unknown	42.2275	-83.7147

Table 2. Washtenaw County Phase I – MS4 Program storm sewer outfalls in the Swift Run Creek watershed managed by the city of Ann Arbor and Washtenaw County (Source: Scott Wade – LTI. 2003a).

Storm Water NPDES Permits (Phase 1 – MS4 Program):

- Washtenaw County **(1 outfall)**
- City of Ann Arbor **(25 outfalls)**

Table 3. Land use categories and TSS loads in the Swift Run Creek watershed, Washtenaw County, Michigan (Source: Scott Wade – LTI [2003a] using 2002 [Ann Arbor] and 1998 [Township] land use coverages).

Source Category	Acres	Estimate Current TSS (pounds/year)*	TMDL TSS Target Load TSS (pounds/year)
WLA Components:			
NPDES Non-Storm Water TSS Load		None	None
Urban/Industrial/Built-Up			
Residential	678	138,943	138,943
Commercial and Service	627	185,514	185,514
Industrial	13	9,861	5,295 (46% reduction)
Transportation/Comm/Util.	600	177,526	177,526
Subtotal:		511,844	507,278 (<1% reduction)
WLA Total:	1,918	511,844	507,278 **(WLA)**
LA Components:			
Agricultural Land			
Cropland	349	23,868	13,168 (45% reduction)
(Background Sources)			
Forested/Shrub/Open Land			
Open Land/Shrub/Range Land	702	16,886	16,886
Water Body			
Lake/Reservoir	9	191	191
LA Subtotal:	1,541	40,945	30,245 **(LA)**
Overall Totals:	2,978	552,789	537,523 (overall 3% reduction)

**TSS load estimates based on PLoad Version 3 model (USEPA, 2001), land use acres derives from 2002 land use database coverage for Ann Arbor, 1998 land use coverage for the townships, and a mean annual rainfall value of 34 inches,*

Michigan Department of Environmental Quality
Water Bureau
August 2005

Total Maximum Daily Load for Biota for Paint Creek
Washtenaw County, Michigan

INTRODUCTION

Section 303(d) of the federal Clean Water Act and the United States Environmental Protection Agency's (USEPA's) Water Quality Planning and Management Regulations (Title 40 of the Code of Federal Regulations, Part 130) require states to develop Total Maximum Daily Loads (TMDLs) for water bodies that are not meeting water quality standards (WQS). The TMDL process establishes the allowable loadings of a pollutant to a water body based on the relationship between pollutant sources and in-stream water quality conditions. TMDLs provide states a basis for determining the pollutant reductions necessary from both point and nonpoint sources (NPS) to restore and maintain the quality of their water resources. The purpose of this TMDL is to identify appropriate actions necessary to achieve support of a designated coldwater fish community by increasing and maintaining dissolved oxygen (D.O.) in the Paint Creek watershed to meet WQS.

PROBLEM STATEMENT

Paint Creek is a coldwater designated water body tributary to Stony Creek that originates in an area located between the cities of Ann Arbor and Ypsilanti, then flows south through an in-stream detention basin, thence, to the confluence of Stony Creek (Figure 1). The TMDL reach begins immediately downstream of the detention basin and extends downstream 0.5 miles. The designated use (Rule 100(7) of the Part 4 rules, WQS, promulgated under Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act (NREPA), 1994 PA 451, as amended) identified as impaired is the support of coldwater fish (trout) populations. The occurrence of fish kills and D.O. WQS criteria exceedances (less than a minimum of 7 milligrams per liter (mg/l)) served as the basis for placing Paint Creek on Michigan's Section 303(d) list of impaired water bodies requiring the development of a TMDL. The TMDL reach attributed to fish kills involves 0.5 of the 4.6 miles listed as requiring TMDLs. The Section 303(d) listing reads (Wolf and Wuycheck, 2004):

PAINT CREEK WBID#: **061201D**
County: WASHTENAW HUC: 04100001 Size: 4.6 M
Location: R6E, T3S, Sec.12 at Ypsilanti, stations are located just above and below the detention basin 1600 feet S. of I-94.
Problem: **D.O.; Fish kills; Pathogens (Rule 100).**
TMDL YEAR(s): 2005 RF3RchID: 4100001 18

This document represents the basis for the development of a biota TMDL that focuses on the restoration of the coldwater fisheries designated use support within a 0.5 mile reach of Paint Creek immediately downstream of the in-stream detention basin. Specifically, the TMDL will focus on the elimination of fish kills by meeting Michigan's WQS for D.O. in coldwater streams. To achieve the coldwater designated use for D.O., a D.O. TMDL was concurrently developed that defines a minimum D.O. target of 7.0 mg/l (Brunsen, 2005a). The 303(d) listings for D.O. and pathogens involve the entire 4.6 mile TMDL reach.

BACKGROUND

Within the 55,000 acre watershed of Paint Creek, there are approximately 55 river miles of streams of which 22 stream miles are described by the U.S. Geological Survey as perennial. Paint Creek is designated by the Michigan Department of Natural Resources (MDNR) (MDNR, 1997) as a trout stream and, therefore, is protected by Michigan's WQS for a coldwater fisheries designated use. The 2,700 acres comprising the Paint Creek watershed upstream of the detention basin contains about 4.1 miles of stream, known as the Upper Paint Creek Drain, which is characterized as intermittent. The Biota TMDL reach involves about 0.5 miles immediately downstream of the detention basin discharge. Paint Creek was originally listed as needing a TMDL based on fish kill complaints received circa 1992, prior to upgrades made to the detention basin.

Mr. Dennis Wojcik of the Washtenaw County Drain Commissioner's (CDC's) office provided the following summary regarding the upper Paint Creek detention basin (Wojcik, 2005):

The Upper Paint Creek Detention Basin was constructed as a part of the Upper Paint Creek Drain, a legally established Chapter 20 County Drain. Construction of the basin was initiated in 1972 and was substantially complete by 1974. The 44 acre detention basin was originally constructed as a flood control structure. In 1996, environmental retrofits were constructed within the basin. Included in these retrofits were a sediment forebay, with flow diversion infrastructure, and a micro-pool at the outlet. The goals of the project were the removal of sediment and pollutants and the reduction of discharge water temperature. The project won the 1996 Urban Drainage & Storm Water Management Award from the Michigan Association of County Drain Commissioners.

The flow extremes described above originate from excessive wet weather runoff events associated with the residential (1,136 acres), commercial (242 acres), and industrial (78 acres) land use areas upstream of the detention basin. These areas constitute about 54 percent of the 2,700 acre Paint Creek watershed located upstream of the detention basin (Table 1) (Purdue, 2005). Agricultural-related (240 acres) land uses in the upper watershed may also contribute to runoff loadings. D.O. criteria exceedances were considered to be the primary cause of the fish kills reported for Paint Creek.

Even with the presence of the detention basin, but prior to its modification, periodic fish kills (circa 1992) reportedly occurred due to substantial runoff events in excess of the detention basin capacity. No fish kills have been reported since the installment of the forebay and micropool structures in 1996 (Figure 2). The forebay installation represents an extra storage space provided near the inlet of the detention basin to attenuate flows and trap incoming sediments before they accumulate in the detention basin proper. The micropool also serves for additional solids removal and flow attenuation prior to discharge.

The MDNR Fisheries Division attempted to maintain a brown trout fishery in Paint Creek downstream of the detention basin by annually (April of 1979 through 1997) stocking, on average, about 6,000 brown trout at two to six locations (Figure 3, Table 2; MDNR, 2005).

Oemke (1989) reported acceptable coldwater fish and macroinvertebrate communities in a biological survey of Paint Creek conducted on July 28, 1989, at the Stony Creek Road site located about 0.7 miles downstream of the detention basin discharge. The fish community was comprised of seven taxa of fishes, including various sizes of brown trout. These data indicated that Paint Creek was supporting its coldwater fishery designated use.

An additional biological community and habitat assessment of Paint Creek was conducted on September 11, 1990 (Oemke, 1991). The fish community was assessed at three reaches in Paint Creek downstream of the detention basin as follows: upstream of Merritt Road (2.5 miles downstream of detention basin), Judd Road (5.6 miles downstream of the detention basin), and Liss Road (9.4 miles downstream of the detention basin) (Figure 1). Trout were found at all three sites but the Liss Road fish community contained less than 50 fish total, which indicates the site was not meeting WQS.

Rule 64 of Michigan's WQS (D.O. in Great Lakes, connecting waters, and inland streams) sets forth the following criteria for the protection of coldwater designated streams:

> Rule 64. (1) A minimum of 7 milligrams per liter of dissolved oxygen in all Great Lakes and connecting waterways shall be maintained, and, except for inland lakes as prescribed in R 323.1065, a minimum of 7 milligrams per liter of dissolved oxygen shall be maintained at all times in all inland waters designated by these rules to be protected for coldwater fish. In all other waters, except for inland lakes as prescribed by R 323.1065, a minimum of 5 milligrams per liter of dissolved oxygen shall be maintained. These standards do not apply for a limited warmwater fishery use subcategory or limited coldwater fishery use subcategory established pursuant to R 323.1100(10) or during those periods when the standards specified in subrule (2) of this rule apply.
>
> (2) Waters of the state, which do not meet the standards set forth in subrule (1) of this rule, shall be upgraded to meet those standards. For existing point source discharges to these waters, the commission may issue permits pursuant to R 323.2145, which establish schedules to achieve the standards set forth in subrule (1) of this rule. If existing point source dischargers demonstrate to the commission that the dissolved oxygen standards specified in subrule (1) of this rule are not attainable through further feasible and prudent reductions in their discharges or that the diurnal variation between the daily average and daily minimum dissolved oxygen concentrations in those waters exceeds 1 milligram per liter, further reductions in oxygen- consuming substances from such discharges will not be required, except as necessary to meet the interim standards specified in this subrule, until comprehensive plans to upgrade these waters to the standards specified in subrule (1) of this rule have been approved by the commission and orders, permits, or other actions necessary to implement the approved plans have been issued by the commission. In the interim, all of the following standards apply:
>
> (a) For waters of the state designated for use for coldwater fish, except for inland lakes as prescribed in R 323.1065, the dissolved oxygen shall not be lowered below a minimum of 6 milligrams per liter at the design flow during the warm weather season in accordance with R 323.1090(3) and (4). At the design flows during other seasonal periods, as provided in R 323.1090(4), a minimum of 7 milligrams per liter shall be maintained. At flows greater than the design flows, dissolved oxygen shall be higher than the respective minimum values specified in this subdivision.
>
> (3) The commission may cause a comprehensive plan to be prepared to upgrade waters to the standards specified in subrule (1) of this rule taking into consideration all factors affecting dissolved oxygen in these waters and the cost effectiveness of control measures to upgrade these waters and, after notice and hearing, approve the plan. After notice and hearing, the commission may amend a comprehensive plan for cause. In undertaking the comprehensive planning effort the commission shall provide for and encourage participation by interested and impacted persons in the affected area. Persons directly or indirectly discharging substances which contribute towards these

> waters not meeting the standards specified in subrule (1) of this rule may be required after notice and order to provide necessary information to assist in the development or amendment of the comprehensive plan. Upon notice and order, permit, or other action of the commission, persons directly or indirectly discharging substances which contribute toward these waters not meeting the standards specified in subrule (1) of this rule shall take the necessary actions consistent with the approved comprehensive plan to control these discharges to upgrade these waters to the standards specified in subrule (1) of this rule.

To assess the effectiveness of the in-stream detention basin on stream D.O. concentrations, the Michigan Department of Environmental Quality (MDEQ) staff conducted a survey of Paint Creek in 2003 (Brunsen, 2005b). These data showed D.O. concentrations in nonattainment of the daily minimum WQS criteria of 7.0 mg/l on several occasions, with the lowest D.O. recorded as 4.6 mg/L 50 feet downstream of the detention basin. The minimum D.O. concentrations measured during the September 2003 assessment at Merritt Road and Judd Road located 2.5 and 6 miles downstream of the detention basin outfall, respectively, were greater than the 7.0 mg/l WQS criteria on all but one occasion when D.O. dropped to 6.8 mg/L in response to a 1.65-inch wet weather event. Brunsen's D.O. Total Maximum Daily Load document recommends increasing the D.O. concentrations at the in-stream detention basin outfall by reducing loadings of total suspended solids (TSS) and increasing the physical turbulence of the flow to increase reaeration and oxygenation of the detention basin discharge to Paint Creek (Brunsen, 2005a). These actions are intended to eliminate D.O. WQS exceedances as the cause of fish kills in the reach.

NUMERIC TARGETS

The impaired designated use for which Paint Creek was identified on the Section 303(d) TMDL list relates to coldwater fish support. Michigan's WQS (Rule 323.1100(7)) requires the protection of MDNR Fisheries Division designated trout streams, such as Paint Creek, as coldwater fisheries.

The numeric target is based upon Michigan's biological community and habitat quality assessment Procedure 51 (MDEQ, 1990). The biota TMDL target is to establish conditions that will maintain a trout population that when assessed represents a minimum of 1 percent trout among collections of 50 or greater numbers of fish. Coldwater fish community support will be evaluated based on a minimum of two Procedure 51 biological assessments conducted in successive years, following the implementation of actions to restore and maintain Michigan's WQS criteria for D.O. levels (minimum of 7.0 mg/l).

SOURCE ASSESSMENT

Land use is dominated by areas associated with impervious surfaces within the 2,700 acre watershed upstream of the detention basin, e.g., residential, commercial, and industrial uses (Purdue, 2005). Runoff from such areas of development within a watershed alters its hydrologic characteristics because increased areas of impervious surface result in increased runoff of solids and pollutant loads to stream reaches within the watershed (Fongers and Fulcher, 2001; Schueler and Holland, 2000). Substantial reductions in vegetative riparian zones and pervious areas throughout the watershed of Paint Creek and the extensive use of structural features, including paved impervious surface areas (e.g., roads and parking lots), curb and gutter, and numerous direct storm sewer discharges, dominate the urbanized landscape and contribute to rapid precipitation runoff rates to the stream.

There are 14 National Pollutant Discharge Elimination System (NPDES) permitted discharges to Paint Creek in the TMDL reach, including general industrial and municipal storm water permits and one individual storm water permit (Table 3). These sources will be targeted in the waste load allocation (WLA) for reductions of oxygen demanding substances, specifically, TSS (Brunsen, 2005a).

LINKAGE ANALYSIS

Fish kills can occur in a water body as a result of reduced D.O., elevated temperatures and/or excessive sedimentation/siltation.

D.O. and/or elevated temperatures are limiting factors for fish. In general, aquatic organisms possess highly specialized gas exchange systems that allow maximum utilization of available oxygen. Specifically, trout require a sufficient oxygen gradient (oxygen tension gradient) between their bodies and surrounding waters to allow gas (i.e., D.O.) exchange through diffusion across the gills and into the blood. Further, there must be sufficient available oxygen to fulfill minimum metabolic demands (Davis, 1975). Fish can sometimes resist or tolerate short-term oxygen reductions and/or temperature increases. It has been determined that certain trout species may temporarily adjust to reduced D.O. levels or increased temperatures if D.O. declines and/or temperature increases are not abrupt. Behaviorally, fish may avoid low D.O. conditions by physically moving out of an area, if they are able to.

Excess sediment can profoundly affect the productivity of a trout stream (Waters, 1995). In a healthy stream, young salmon and trout are able to hide in the interstitial spaces between cobbles and boulders to avoid predation. These spaces are eliminated in a heavily sedimented water body. Excessive siltation can also clog fish gills, thereby, interfering with respiration, and interfere with spawning success by suffocation of the eggs.

The oxygen deficit causing the D.O. nonattainment status in Paint Creek can be attributed primarily to wet weather events and the TSS in the discharges and runoff to Paint Creek (Brunsen, 2005a). Solids deposited in the detention basin during wet weather events exert an oxygen demand on the overlying water. This reaction is known as sediment oxygen demand (SOD). Potential sources of TSS include both point and NPS. Low atmospheric reaeration, as described below, further contributes to D.O. nonattainment in Paint Creek.

SOD

Solids present in the water column of a flowing water body can settle to the stream bed, forming layers of sediments with variable depths and compositions. Organic solids on the surface layer of the substrate in direct contact with the water can undergo aerobic decomposition. This decomposition causes diffusion of D.O. from the water column into the sediment layer in a process called SOD, depleting D.O. levels in the overlying river water. High levels of TSS in a water body can potentially cause high SOD rates if the solids settle to the bottom and decompose.

The solids in the Paint Creek system settle out of the water column within the detention basin, which was designed to attenuate excessive flows from the city of Ypsilanti. During a substantive wet weather runoff event, the detention basin fills with storm water and covers organic decomposing material creating an additional oxygen demand in Paint Creek.

ATMOSPHERIC REAERATION

Because much of the water in Paint Creek is of groundwater origin and therefore low in D.O., atmospheric reaeration is a major source of D.O. in this system. The rate at which oxygen diffuses across the air-water interface depends on the water surface area exposed to the atmosphere through flow turbulence. Turbulence is increased by either an increase in flow velocity or by obstructions breaking up flow lines.

Indicators of low atmospheric reaeration include low in-stream velocity and a lack of substrate to create turbulence. Flow measurements and field observations were used to assess the atmospheric reaeration capabilities in Paint Creek (Brunsen, 2005b). The detention basin is designed to slow the flow of water to allow for the settling of solids out of the water column. In addition, the stream channel within and upstream of the detention basin has been straightened and there are no obstacles such as rooted plants, woody debris, or stone to increase the flow turbulence. Reaeration in this type of stream flow regime is low. Reaeration is most efficient in riffle zones where the flow is forced around or over obstacles such as stone or woody debris. The characteristics observed in the detention basin and Upper Paint Creek Drain contribute to the reduced ability of Paint Creek to reaerate lowered D.O. levels resulting from storm water runoff and discharges and the effects of the detention basin.

TMDL DEVELOPMENT

A TMDL represents the maximum load of a pollutant that can be assimilated by a water body and still achieve WQS. Prior to the completion of the current in-stream detention basin, Paint Creek experienced fish kills attributed to WQS D.O. criteria exceedances. Therefore, the TMDL is based on increasing D.O. to meet Michigan's WQS for the protection of the coldwater fish designated use.

Concurrent with the selection of numeric endpoints, this TMDL also defines the environmental conditions that will be used when defining allowable levels. Some TMDLs are designed around the concept of critical condition. A critical condition is defined as the set of environmental conditions that, if controls are designed to protect, will ensure attainment of objectives for all other important conditions. For example, the critical conditions for the control of point sources in Michigan are provided in Rules 323.1082 (Mixing zones) and 323.1090 (Applicability of WQS) of Michigan's WQS. In general, the lowest monthly 95 percent exceedance flow for a stream is used to establish effluent limits for point sources. However, the excessive flows to Paint Creek are attributable to wet weather driven discharges. Brunsen (2005a) defines the following: The critical condition for Paint Creek occurs during wet weather events. Even relatively minor wet weather events produce D.O. exceedances in the discharge from the detention basin, e.g., a 0.2-inch rainfall on September 15-16, 2003, resulted in a minimum D.O. of 6.5 mg/l. Storm water from the Upper Paint Creek Drain enters the detention basin at a low velocity to facilitate settling of sediment. Flow in excess of the hydraulic capacity of the outfall pipe to Paint Creek is temporarily stored for later discharge, which submerges organic material accumulated in the detention basin. The critical condition occurs as natural decomposition of organic material in the detention basin exerts an oxygen demand and reaeration is minimized due to quiescent conditions.

Reductions in wet weather TSS concentrations and modifications to the retention basin to increase reaeration are proposed by Brunsen to assure attainment of the D.O. WQS. TSS load reductions for Paint Creek were determined based on the D.O. concentrations observed following a September 23, 2003, rain event of 1.65" when D.O. was depressed to a minimum of 4.6 mg/L. The once in ten-year wet weather event level for the Michigan region using the Steel

Formula coefficients is 1.5 inches (Lindeberg, 1998). Therefore, the proposed load reductions based on the 1.65 inch runoff event are expected to be protective of all rain events up to and including the once in ten-year storm event of 1.5 inches.

ALLOCATIONS

TMDLs are comprised of the sum of individual WLAs for point sources and load allocations (LAs) for NPS and natural background levels. In addition, the TMDL must include a margin of safety (MOS), either implicitly or explicitly, that accounts for uncertainty in the relation between pollutant loads and the quality of the receiving water body. Conceptually, this definition is denoted by the equation:

$$TMDL = \sum WLAs + \sum LAs + MOS$$

The term TMDL represents the maximum loading that can be assimilated by the receiving water while still achieving WQS. The overall loading capacity is subsequently allocated into the TMDL components of WLAs for point sources, LAs for NPS, and the MOS.

The following discussion regarding WLA and LA allocations for TSS is excerpt from the D.O. TMDL (Brunsen (2005a) with which the biota TMDL is linked: A completely mixed reactor (CMR) model was used to determine the reduction of oxygen demanding pollutants required to reach the target D.O. standard of 7 mg/l as a daily minimum in Paint Creek. The CMR model was developed by the MDNR, based on Thomann's Finite Cell Approach (Argiroff, 1990). This model uses a steady state and time-variable approach to calculate the effects of pollutant loads on a standing body of water based on the mass balance equations for decay, SOD, and reaeration. The model was calibrated and verified using data collected in September 2003 (D.O., stage, rainfall) and construction drawings (slope, volume, topography) provided by the Washtenaw CDC under both dry and wet weather conditions. Predictive simulations were run with the calibrated and verified model to determine the load reductions required to meet the WQS of 7 mg/l as a daily minimum in Paint Creek under the design conditions.

This phased-approach D.O. TMDL will target a 50 percent reduction in TSS loads to Paint Creek from point and NPS sources. The 50 percent TSS load reduction was chosen due to the results of D.O. modeling using the data collected during the 1.65 inch rainfall event observed during the September 2003 study. The model indicates that oxygen demanding pollutants contributed to the creek and detention basin should be reduced 50 percent to ensure WQS are met within the impaired reach of Paint Creek and Upper Paint Creek Drain.

WLA

The WLA for the impaired reach of Paint Creek is allocated to the NPDES permitted facilities identified in Table 3. These NPDES permits are assumed to address the commercial, industrial, and high and low density residential development land uses described in Table 1. Discharges covered under the MS4 and industrial storm water permits in the watershed will be allocated 42,850 pounds of the TSS load after subtracting the MOS.

LA

TSS inputs resulting from land use-related sediment loads will be targets for reduction in this TMDL. These land uses include agricultural, grass/pasture, and forest. These sources in the watershed will be allocated 10,713 pounds of the TSS load reductions after subtracting the MOS.

MOS

The MOS accounts for any uncertainty or lack of knowledge concerning the relationship between pollutant loading and water quality. The MOS can be either implicit (i.e., incorporated into the TMDL analysis thorough conservative assumptions) or explicit (i.e., expressed in the TMDL as a portion of the loadings). Consistent with the D.O. TMDL, an explicit MOS of 10 percent, or 5,951 pounds of TSS, will be used (Brunsen, 2005a). The use of 10 percent as a MOS reflects the uncertainty between the modeled allowable loadings and actual loadings of TSS to the TMDL reach.

SEASONALITY

The summer and early fall seasons represent the critical conditions for D.O. attainment in Paint Creek. The inability to meet the coldwater daily minimum D.O. standard of 7 mg/l is greatest in the summer and early fall periods due to elevated air and water temperatures, therefore, requiring a higher degree of saturation to maintain the 7 mg/l daily minimum D.O. concentration. Therefore, the reduction in TSS loads based on observed summer conditions should result in decreased D.O. diurnal variations and attainment of WQS in the Paint Creek during all seasons.

MONITORING PLAN

Monitoring of the biological community in Paint Creek to determine its WQS attainment status will be conducted in two successive years following 1) the installation of best management practices (BMPs) in the watershed to reduce sources of TSS loadings and 2) a remedy to the effects of the detention basin on D.O. following wet weather events (e.g., installation of a riffle zone or some other form of reaeration) using the MDEQ biological and habitat assessment Procedure 51 (MDEQ, 1990). For best comparative purposes, follow-up biological and habitat assessments will be conducted during the June to September time frame and stable flow conditions. Every effort will be made to sample during similar stream conditions and assess the same sampling locations as sampled during the 1989 and 1990 studies.

REASONABLE ASSURANCE

There are several measures in the NPDES permits identified in Table 3 that will contribute to attaining WQS in the affected reaches of the Paint Creek watershed.

The industrial storm water general permits identified in Table 3 require that if there is a TMDL established by the MDEQ for the receiving water, which restricts a material that could impair or degrade water quality, then the required storm water pollution prevention plan shall identify the level of control for those materials necessary to comply with the TMDL and an estimate of the current annual load of those materials via storm water discharges to the receiving stream.

The Ypsilanti MS4-Washtenaw and Pittsfield Township MS4 jurisdictional permits require that the permittee implement BMPs to comply with six minimum measures and any corrective action plans for TMDLs. The six minimum measures include education and outreach, public involvement and participation, illicit discharge elimination, post construction storm water management for new development and redevelopment projects, construction storm water runoff control, and pollution prevention/good housekeeping.

The Ypsilanti Township, Washtenaw CDC and Washtenaw County Road Commission (CRC) MS4 watershed permits and certificates of coverage require that the permittees submit to the MDEQ approvable illicit discharge elimination plans, public education plans, public participation plans, and storm water pollution prevention initiatives (SWPPI). The objective of a SWPPI is to reduce the discharge of pollutants to the maximum extent practicable. Specifically, the SWPPI requires, at a minimum, an evaluation and implementation of pollution prevention and good housekeeping practices, a description of storm water structural controls to reduce pollutants, development and implementation of a storm water management program for areas of development, and a requirement to implement BMPs to prevent or minimize water quality impacts.

With the backing of the townships and other municipal agencies, Eastern Michigan University acquired a Clean Water Act Section 319 grant in 2003 to develop a watershed management plan for the Stony Creek watershed, which includes Paint Creek (Stony Creek Watershed Steering Committee, 2005). The watershed plan was completed in May 2005, and submitted to the MDEQ for approval. The objectives of the plan were to identify, document, and prioritize all NPS within the watershed. The MDEQ approved the plan on June 7, 2005 with respect to criteria specified in the Administrative Rules for the Clean Michigan Initiative NPS Pollution Control Grants promulgated pursuant to Part 88. As an outgrowth of the Stony Creek watershed planning project, a watershed council for Stony Creek is under formation.

The Michigan Department of Transportation (MDOT) statewide MS4 permit requires the permittee to reduce the discharge of pollutants to the maximum extent practicable and employ BMPs to comply with TMDL requirements.

The MDEQ, Water Bureau, district staff and the Washtenaw CDC will determine what projects are still pending in the detention basin and which future modifications can be made to the detention basin to insure that Paint Creek will attain the WQS of 7 mg/l as a daily minimum in the future. The focus of the actions to protect Paint Creek is directed towards reducing the loading of TSS and installing BMPs and other control measures to increase D.O. to meet WQS.

The MDEQ district staff will continue to work with and assist interest groups in the Paint Creek watershed to assist in defining and designing approvable actions and programs that assess, develop, plan, and implement BMPs and control measures that best minimize excessive runoff rates to the Paint Creek watershed.

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Michigan Department of Environmental Quality
August 26, 2005

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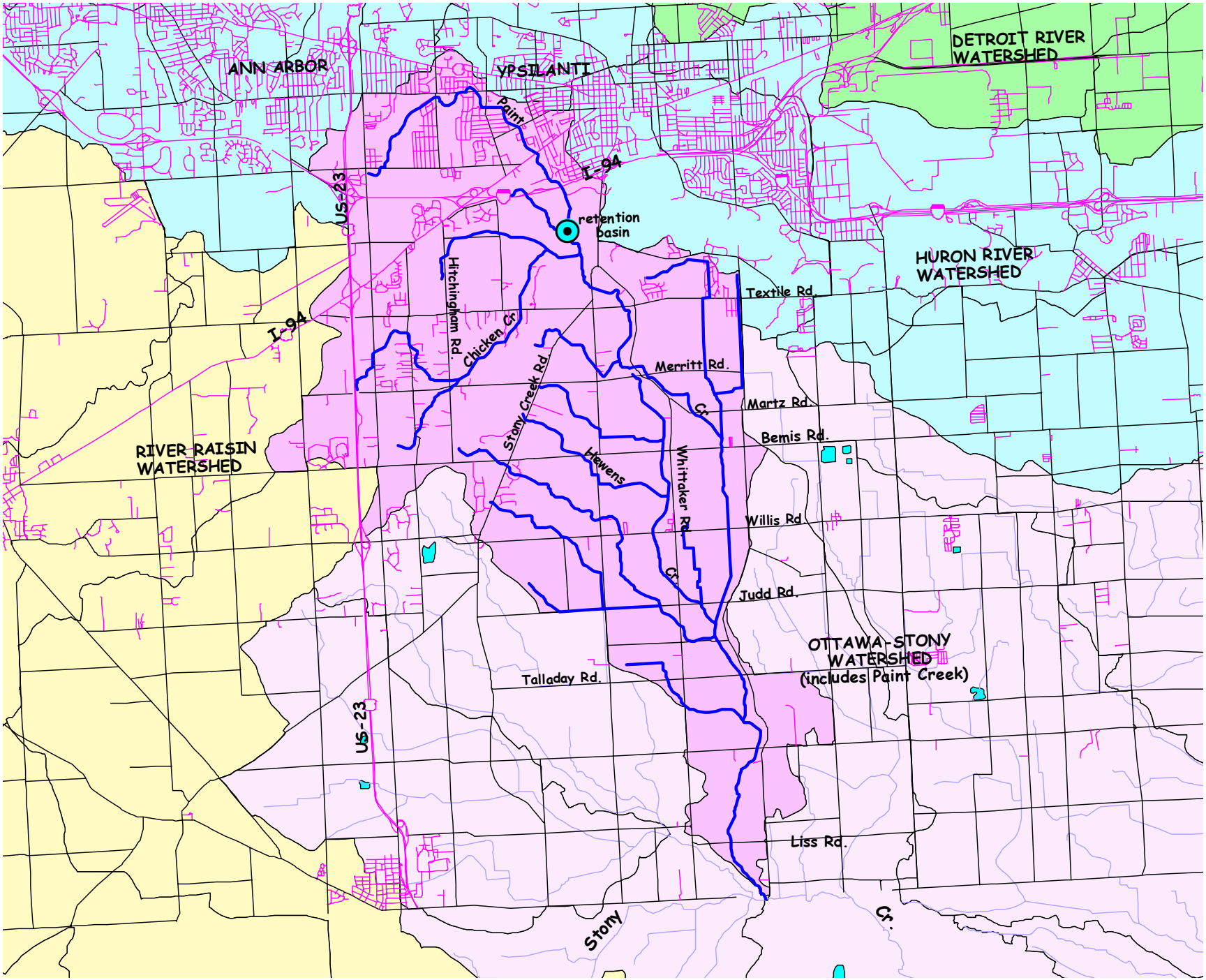

Figure 1. Paint Creek watershed downstream to Stony Creek confluence (1/2 inch ≅ 1 mile). (MIRIS, 2005).

Figure 2. Paint Creek 44 acre detention basin with forebay and micropool (1/2 inch ≅ 200 feet).

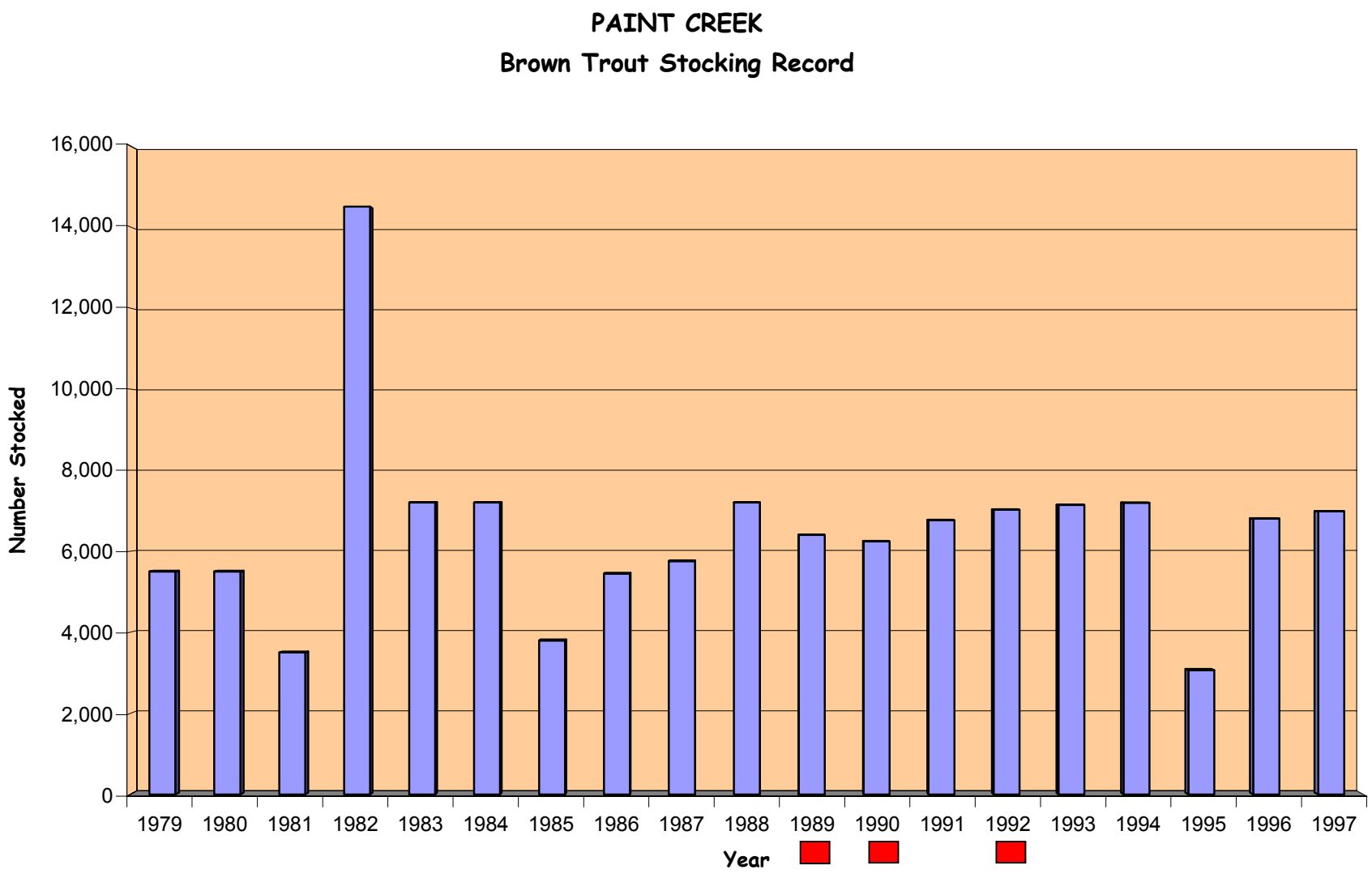

Figure 3. Paint Creek watershed MDNR Fisheries Division's brown trout stocking records (MDNR, 2005 Web site).

Table 1. Land use categories (1992) in the Paint Creek watershed upstream of the detention basin, Washtenaw County, Michigan (Purdue, 2005)

Land use category	Acres	Percent of total
Water*	43	1.6
Commercial**	242	8.9
Agriculture*	240	8.9
Residential**	1136	42
Grass/Pasture*	474	17.5
Forest*	486	18.0
Industrial**	78	3.1
Total	**2700**	**100**

* Used in the LA.
** Used in the WLA.

Table 2. MDNR Fisheries Division brown trout stocking records for Paint Creek, Washtenaw County, Michigan. (Source: MDNR, 2005 Web site)

YEAR	NUMBER
1979	5,500
1980	5,500
1981	3,500
1982	14,500
1983	7,200
1984	7,200
1985	3,797
1986	5,450
1987	5,760
1988	7,200
1989	6,400
1990	6,243
1991	6,767
1992	7,026
1993	7,140
1994	7,198
1995	3,067
1996	6,807
1997	6,989

Table 3. NPDES permitted discharges to upper Paint Creek watershed. (NMS, 2005).

Permittee	Permit Number	Type	Receiving Water Body
INDUSTRIAL STORM WATER:			
Corrigan Moving Systems	MIS510181	Industrial general permit	Paint Creek
Doan Companies - Ypsilanti	MIS510459	Industrial general permit	Stony Creek
Doan Construction-Ypsilanti	MIS510178	Industrial general permit	Paint Creek
Engineered Plastic Products	MIS510588	Industrial general permit	Paint Creek
Huron Advertising Company	MIS510180	Industrial general permit	Paint Creek
London Aggregate-Ypsilanti	MIS510576	Industrial general permit	Paint Creek
Pollard Banknote Ltd-Ypsilanti	MIS510497	Industrial general permit	Paint Creek
United Parcel Service	MIS410015	Industrial general permit	Paint Creek
MS4 STORM WATER:			
Ypsilanti MS4 - Washtenaw	MIS040015	Jurisdiction general permit	Paint Creek
Ypsilanti Township MS4	MIG610037	Watershed general permit	Paint Creek
Pittsfield Township MS4	MIS040021	Jurisdiction general permit	Paint Creek
Washtenaw CDC MS4	MIG610039	Watershed general permit	Paint Creek
Washtenaw CRC MS4	MIG610314	Watershed general permit	Paint Creek
MDOT – Statewide MS4	MI0057364	Statewide Individual Permit	Paint Creek

Table 4. Annual TSS load source allocations and numeric targets for Paint Creek.

Water Body	Current Annual TSS Load (lbs)	Load Capacity TSS Numeric Target (lbs)	WLA Annual TSS Load (lbs)	LA Annual TSS Load (lbs)	MOS (lbs)
Industrial/Municipal Storm Water Permitted Outfalls*	97,769	42,850	42,850		-
Other Land Use Related Sources**	21,259	10,713		10,713	-
Paint Creek Total Annual Loads	119,028	59,514	42,850	10,713	5,951

* These figures include the commercial, industrial, and high and low density residential development land use categories described in Table 1 as it is assumed these categories would fall under the MS4 and industrial permit categories.

** These figures include the water, agricultural, grass/pasture and forest categories described in Table 1.

*** Loadings calculated using the L-THIA model (Purdue, 2005).

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
WATER DIVISION
SEPTEMBER 2004

TOTAL MAXIMUM DAILY LOAD FOR PHOSPHORUS IN FORD AND BELLEVILLE LAKES

Location:

Ford and Belleville Lakes are impoundments of the Huron River, located in Washtenaw and Wayne Counties (see Figure 2 in Kosek, 1996 [attached]; and Figure 4 in Brenner and Rentschler, 1996 [attached]).

Pollutant:

Total Phosphorus.

Summary:

These lakes receive high nutrient loadings, causing severe water quality problems, most notably nuisance algae blooms. In 1991, Ford Lake suffered a September algae bloom so severe that a hazardous material response team was summoned to investigate the "green paint spill." At the September 1987 meeting of the Water Resources Commission, the state of Michigan established a goal of 30 micrograms per liter (µg/L) phosphorus concentration for Belleville Lake as part of an effort to restore designated uses of the lake. The Michigan Department of Environmental Quality (MDEQ) has determined that a 50 µg/L phosphorus concentration must be met going into Ford Lake during the period of April-September (the algae growing season) in order to achieve the 30 µg/L goal for Belleville Lake. Other impoundments along this section of the Huron River watershed are expected to benefit from the reduced phosphorus as well.

The MDEQ has developed the loading capacity for both lakes based on the phosphorus concentration goal established for Belleville Lake (Kosek, 1996). This loading capacity will be used to determine the Total Maximum Daily Load (TMDL) and associated National Pollutant Discharge Elimination System (NPDES) permit limits for all involved point source dischargers, and also to determine the magnitude of the phosphorus reductions necessary from other sources. As part of a watershed 104(b)(3) grant from the United States Environmental Protection Agency (USEPA), the local communities have been involved in the process of developing an implementation plan for these reductions (Brenner and Rentschler, 1996).

TMDL Development:

The phosphorus concentration is the critical variable in this system, since it is the limiting nutrient for algae growth in these short retention time lakes. If the total phosphorus concentration going into Ford Lake can be kept at or below 50 µg/L in April-September, then the lakes should respond by decreasing the algae growth to nonnuisance levels and Belleville Lake should meet its 30 µg/L goal. Therefore, the loading capacity is expressed as a phosphorus concentration of 50 µg/L at the Michigan Avenue bridge on the Huron River (just upstream of Ford Lake) for the months of April through September (see Table 13 in Kosek, 1996).

Phosphorus load, though related to the concentration, will vary with flow. Figure 1 shows graphically how the load varies with flow, with the monthly average loads indicated on the line. In order to decrease present loadings (represented by 1995 data in Figures 1 and 2) to the

loading capacity levels, it will be necessary to reduce phosphorus loads from both point and nonpoint sources. The wasteload allocations (WLAs) and load allocations (LAs) were calculated for each month (Table 1).

Table 1. WLAs and LAs for the Ford and Belleville Lakes TMDL for Phosphorus.

	WLA/LA by Month (lb/d)					
	APR	MAY	JUN	JUL	AUG	SEP
TMDL	304	214	139	88	74	103
Ann Arbor WWTP	150	60	60	50	50	60
Chelsea WWTP	9.5	2.2	2.2	1.8	1.8	2.2
Dexter WWTP	3.0	0.9	0.9	0.8	0.8	0.9
Loch Alpine WWTP	1.5	0.6	0.6	0.5	0.5	0.6
Chrysler-Chelsea	0.5	0.3	0.3	0.3	0.3	0.3
Other Point Sources[a]	1.5	1.7	1.7	1.7	1.7	1.7
Total Point Source WLA	166	66	66	55	55	66
Nonpoint Source LA	91	100	61	29	19	37
Remaining	47	48	12	4	0	0

[a]There are 12 minor point source dischargers in the watershed area of interest. For more details, see Brenner and Rentschler, 1996.

TMDL implementation consists of reducing point and nonpoint source loads to the levels presented in Table 1. Communities would gradually implement phosphorus reduction activities over a five-year period. A Section 319 grant proposal has been submitted to provide funding for the implementation of a local information and education campaign, which has been developed. Lake and river sampling will continue in order to monitor how well the reductions are being achieved.

Calculations:

LA:

Due to the highly variable nature of nonpoint source loads, the development of the LA was complex. The general concept used to develop the LA for the nonpoint sources was to subtract the amount of reduction from watershed-specific best management practices from the current nonpoint source loads. A detailed land use study was performed to determine the maximum reductions possible through extensive use of best management practices tailored to the land uses in the middle Huron River watershed. Best management practices based on the specific area and type of land use in each subwatershed basin would reduce the nonpoint source load by as much as 58% (Brenner and Rentschler, 1996). The maximum usage of the most effective best management practices is recommended.

Since the TMDL corresponds to a constant concentration at various flows, allowable loads are best expressed as a linear equation (Figure 1). The average flows for the period of record for each month were used to calculate the TMDL loads by month. Several of the critical months in 1995 deviated from the average flows for the period of record. Rather than use the unusually high or low loadings that were calculated for these months in 1995, "expected" nonpoint source

loads under current point and nonpoint source management practices were calculated for each month (except April) based on the average flow for the period of record. These calculations were based on a linear regression of the measured loads and flow conditions for each month in 1995 (Figure 2). A summary of the nonpoint source load calculations is presented in Table 2. Current "expected" conditions are highlighted in bold in Table 2.

The nonpoint source load allocations are equal to a 57% reduction from current "expected" nonpoint source loads in April and a 58% reduction from current "expected" nonpoint source loads in May-September.

WLA:

Phosphorus load restrictions are not needed to protect these lakes during the months of October through March, since algae growth does not occur at those times and the water will be flushed out of the lakes before the algae growing season starts. The limit of 1 milligram per liter (mg/L) would be retained in the point source permits during the months of October through March for the purposes of Great Lakes protection.

The critical algae growing season begins in May. Therefore, allowing some time of passage and cycling of phosphorus through the system, reductions in the phosphorus loadings need to begin in April. The point sources will be expected to operate in such a manner so as not to exceed the allocated waste loads. Options to meeting the allocated waste loads will include permit requirements to 1) meet the individual WLA in Table 1; 2) meet the aggregate total point source WLA in Table 1; or 3) enter into a Cooperative Agreement to meet the point source WLA in Table 1 for phosphorus. It is left to each facility to determine the exact dynamics of the concentration and flow rates used to meet these loadings at the respective plants.

Late snowmelt and spring rains usually cause high flow conditions in April, so the phosphorus concentrations remain relatively low despite higher loading rates. Therefore, the point source WLA for April incorporates larger loadings (166 lb/d) and serves as a transitional period between the unrestricted winter loads and the stringent summer loads. The loading rate of 166 lb/d approximates concentrations of 0.6 mg/L phosphorus at the design flows of the point sources. For the months of May, June, and September, the WLA among the point sources drops to 66 lb/d (Table 2), which approximates concentrations of 0.4 mg/L phosphorus at the current flows of the wastewater treatment plants. For the months of July and August, the WLA among the point sources is reduced to 55 lb/d (Table 2). Please note that the loads for July and August are less than those proposed in the phosphorus reduction strategy developed by the local stakeholders (see Table 14 in Brenner and Rentschler, 1996).

Table 2. Information Used to Calculate WLAs and LAs.

	LA by Month (lb/d)					
	APR	MAY	JUN	JUL	AUG	SEP
TMDL	304	214	139	88	74	103
1995 Total Load	246	319	244	211	331	85
"Expected" Load	304	336	223	145	123	168
1995 Point Sources	92	97	77	78	86	80
Ann Arbor WWTP	150	60	60	50	50	60
Chelsea WWTP	9.5	2.2	2.2	1.8	1.8	2.2
Dexter WWTP	3.0	0.9	0.9	0.8	0.8	0.9
Loch Alpine WWTP	1.5	0.6	0.6	0.5	0.5	0.6
Chrysler-Chelsea	0.5	0.3	0.3	0.3	0.3	0.3
Other Point Sources[a]	1.5	1.7	1.7	1.7	1.7	1.7
Total Point Source WLA	166	66	66	55	55	66
1995 Nonpoint Sources	155	223	159	99	122	46
"Expected" Nonpoint Sources[b]	212	239	146	68	46	87
Nonpoint Source LA	91	100	61	29	19	38
Remaining	47	48	12	4	0	0

[a]There are 12 minor dischargers in the watershed area of interest. For more details, see Brenner and Rentschler, 1996.

[b]For April-June, using respective 1995 point source loads. For July-September, using 77 lb/d point source load. For all months, using "expected" loads as totals.

References:

Kosek, S. 1996. A Phosphorus Loading Analysis and Proposed TMDL for Ford and Belleville Lakes, Washtenaw and Wayne Counties, December 1994-November 1995. MDEQ Report No. MI/DEQ/SWQ-96/005.

Brenner, A. and P. Rentschler. 1996. The Middle Huron Initiative: A Total Maximum Daily Load Analysis for the Middle Portion of the Huron River Watershed. Huron River Watershed Council.

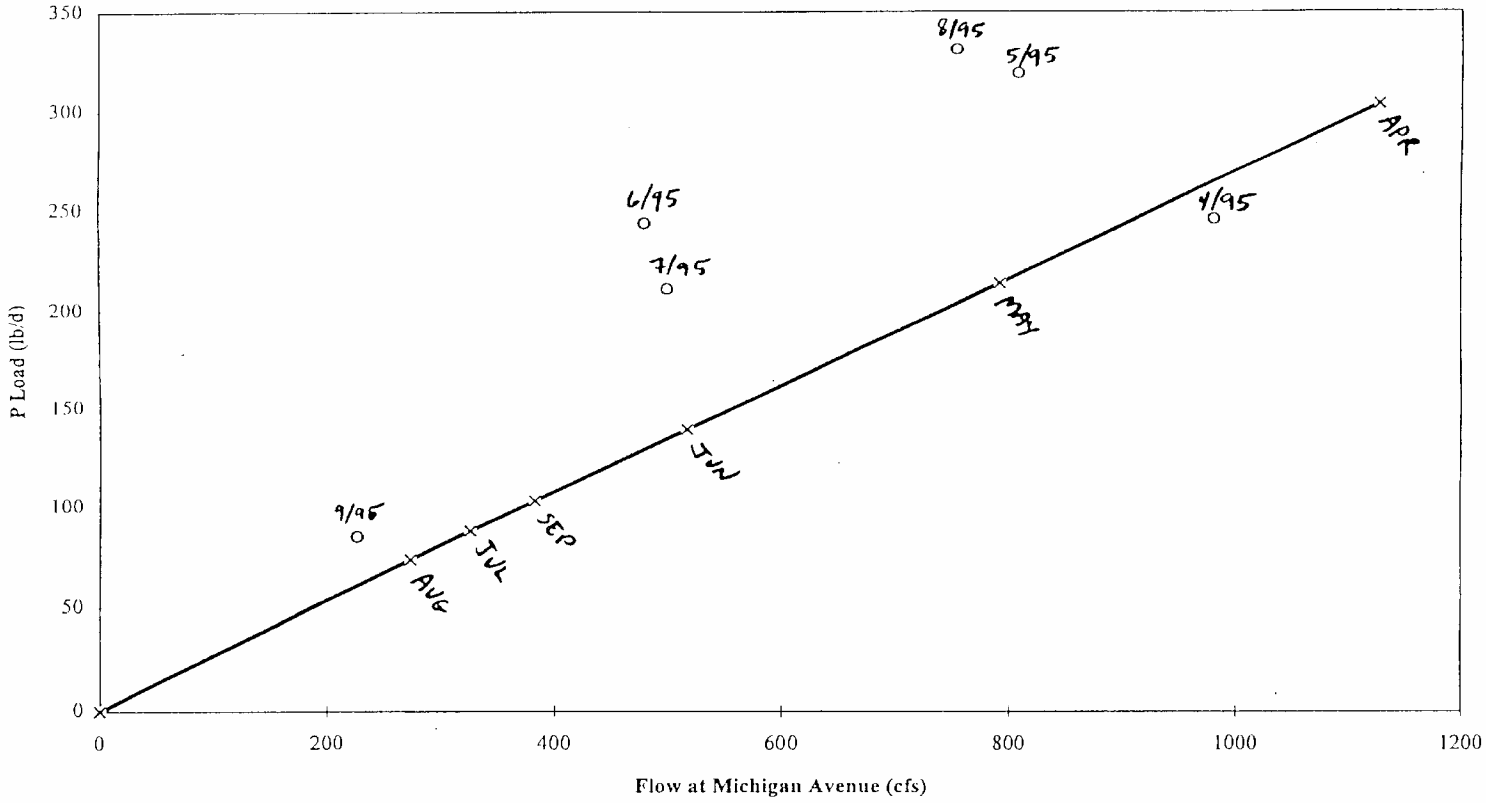

Figure 1: HRWI TMDL and 1995 data relative to average flow.

HRWILOAD.XLS

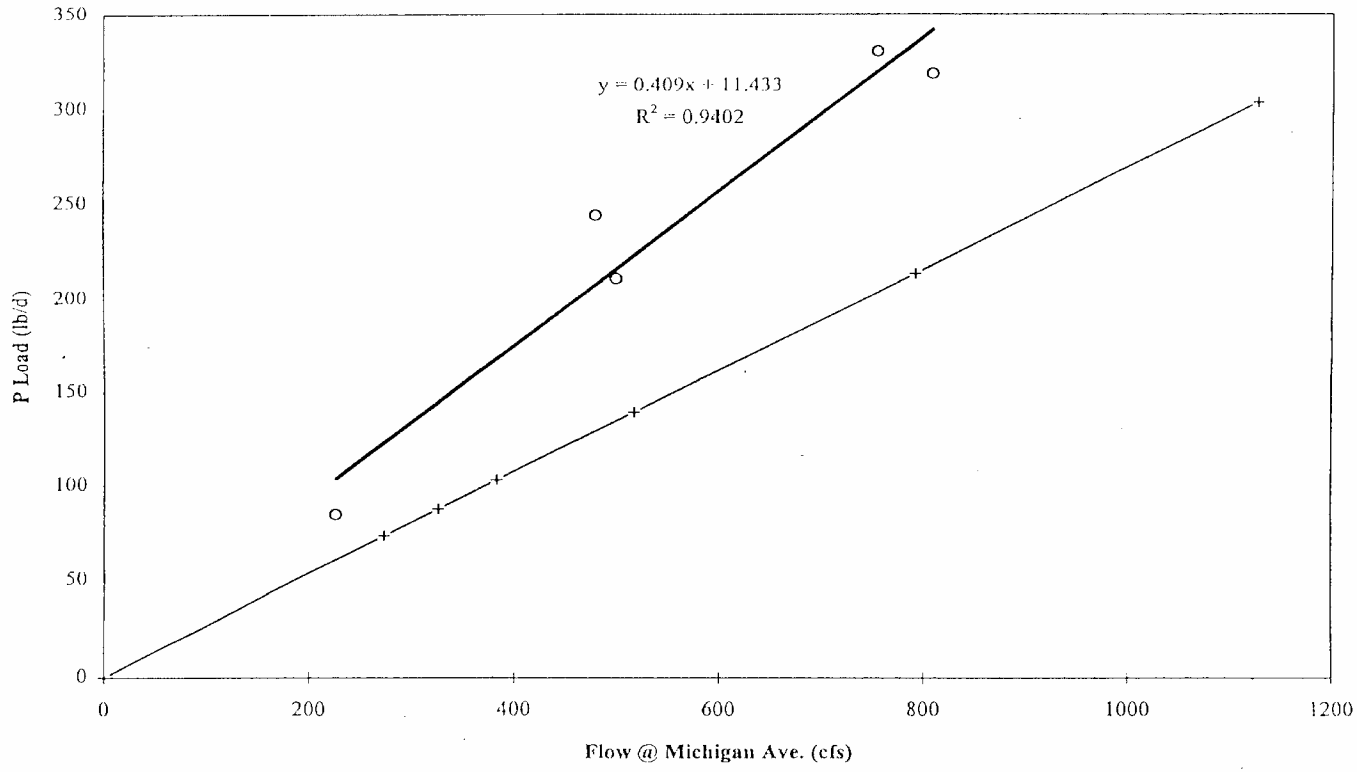

Figure 2: Huron River TMDL and 1995 data relative to average flow. Linear regression line and equation for calculation of "expected" total load.

TMDL 1 (50 ug/L) | 1995 | Linear (1995)

HRWILOAD.XLS

Michigan Department of Environmental Quality
Surface Water Quality Division
August 2001

Total Maximum Daily Load for *Escherichia Coli* in Geddes Pond, Huron River, Washtenaw County

INTRODUCTION

Section 303(d) of the federal Clean Water Act and the United States Environmental Protection Agency's (USEPA's) Water Quality Planning and Management Regulations (40 Code of Federal Regulations Part 130) require states to develop Total Maximum Daily Loads (TMDLs) for waterbodies that are not meeting Water Quality Standards (WQS). The TMDL process establishes the allowable loadings of pollutants for a water body based on the relationship between pollution sources and in-stream water quality conditions. TMDLs provide states a basis for determining the pollutant reductions necessary from both point and nonpoint sources to restore then maintain the quality of their water resources. This TMDL follows the phased approach due to inherent uncertainties in estimating loading from nonpoint sources. Under the phased approach, load allocations and wasteload allocations are calculated using the best available data and information, recognizing the need for additional monitoring data to determine if the load reductions required by the TMDL lead to attainment of WQS. The phased approach provides for the implementation of the TMDL while additional data are collected to reduce uncertainty.

As part of the TMDL development, a support document was developed (Limno-Tech, Inc., 2000). This document contains background information about the listed waterbody, known water quality data, and source assessment. The TMDL was developed based on this support document and additional information, including a site visit by the Michigan Department of Environmental Quality (MDEQ) in December 2000 (Thelen, 2001).

PROBLEM STATEMENT

This TMDL addresses approximately five miles of the Huron River near Ann Arbor where recreational uses are impaired by elevated levels of pathogens. Michigan's Section 303(d) list (Creal and Wuycheck, 2000) cites the upstream terminus as Geddes Avenue and the downstream terminus as the Geddes Dam at Dixboro Road. However, based on a December 19, 2000 site visit by the MDEQ (Thelen, 2001), the upstream boundary was extended to Argo Dam (Figure 1) for TMDL development to include an important recreational area at the confluence of Allen Creek with the Huron River. The TMDL reach is on the Section 303(d) list as:

Waterbody: **Huron River (Geddes Pond)** WBID#: **061203B**
County: Washtenaw RF3RchID: 4090005 9 Size: 2 M
Location: Geddes Pond Dam u/s to Geddes Avenue.
Status: **2** Problem: **Pathogens (Rule 100).**
TMDL YEAR(s): 2000

The Huron River (Geddes Pond) was placed on the Section 303(d) list due to impairment of recreational uses by the presence of elevated levels of pathogens. Most of the data collection efforts in the listed reach were made in the early to middle 1980s. More than 500 samples were collected in Lower Geddes Pond for fecal coliform analysis in the1980s, but less than 100 samples were collected in the 1990s. Samples for *Escherichia coli (E. coli)*, the pathogen of concern, were collected in the 1980s, but not in the 1990s. Despite the sparse data available,

some general trends in bacterial concentration can be made over time. Lower Geddes Pond has consistently exhibited the highest bacteria concentrations among all Huron River reaches in the Ann Arbor area. Historical exceedances of state standards and high bacteria counts were common in the 1970s, 1980s, and 1990s, although improvements have been made since the peaks of the 1980s (Limno-Tech, Inc., 2000).

NUMERIC TARGETS

The impaired designated use for the Huron River at this location is total body contact. Rule 100 of the Michigan WQS requires that this waterbody be protected for total body contact recreation from May 1 to October 31. The target levels for this designated use are the ambient *E. coli* standards established in Rule 62 of the WQS as follows:

> R 323.1062 Microorganisms.
> Rule 62. (1) All waters of the state protected for total body contact recreation shall not contain more than 130 *Escherichia coli (E. coli)* per 100 milliliters, as a 30-day geometric mean. Compliance shall be based on the geometric mean of all individual samples taken during 5 or more sampling events representatively spread over a 30-day period. Each sampling event shall consist of 3 or more samples taken at representative locations within a defined sampling area. At no time shall the waters of the state protected for total body contact recreation contain more than a maximum of 300 *E. coli* per 100 milliliters. Compliance shall be based on the geometric mean of 3 or more samples taken during the same sampling event at representative locations within a defined sampling area.

For this TMDL, the WQS of 130 per 100 milliliters (ml) as a 30-day geometric mean is the target level for the TMDL reach from May 1 to October 31. Wet and dry weather geometric mean concentrations from the 1980s show *E. coli* concentrations higher for Geddes Pond than for any part of the Huron River immediately upstream. Wet weather fecal coliform data for three decades of sampling in Geddes Pond showed the geometric mean concentration at 436 per 100 ml in the 1980s, with an observed maximum of 110,000 per 100 ml. For dry weather, the fecal coliform geometric mean peaked at 104 per 100 ml, with an observed maximum of 120,000 per 100 ml. Geddes Pond is also the receiving water for three direct tributaries (Millers Creek, Malletts Creek and Swift Run Creek), plus Traver Creek and Allen Drain immediately upstream. Observed fecal coliform counts in these tributaries in the 1980s ranged from 1,515 per 100 ml to 19,840 per 100 ml as a wet weather geometric mean. Maximum wet weather counts in the 1980s for Malletts Creek were 740,000 per 100 ml (Limno-Tech, Inc., 2000).

SOURCE ASSESSMENT

Potential pathogen sources for this waterbody include sources typically associated with urban and suburban runoff because the immediate watershed is primarily comprised of these land types.

Municipalities in the Huron River watershed include the city of Ann Arbor, the University of Michigan (U-M), Ann Arbor Township, Northfield Township, Pittsfield Township, Lodi Township, Scio Township, Ypsilanti Township, and Superior Township. Table 1 shows the distribution of land for each subwatershed in the listed reach of the Huron River.

Table 1. Distribution of land for each subwatershed in the listed reach of the Huron River.

	Subwatershed Area (sq. mi)	Percentage of Land Area in Subwatershed	Percentage of Immediate Watershed
Allen Creek			
City of Ann Arbor	4.0	90	
University of Michigan	0.43	10	
Total area	4.43	100	13
Traver Creek			
City of Ann Arbor	3.3	45	
University of Michigan	0.072	1	
Ann Arbor Township	3.8	52	
Northfield Township	0.17	2	
Total area	7.342	100	22
Millers Creek			
City of Ann Arbor	2.4	67	
University of Michigan	1.2	33	
Ann Arbor Township	0.0028	0.0007	
Total area	3.6028	100	11
Mallets Creek			
City of Ann Arbor	7.6	68	
University of Michigan	0.42	3.7	
Pittsfield Township	2.5	23	
Ann Arbor Township	0.017	0.2	
Lodi Township	0.43	3.8	
Scio Township	0.1403	1.3	
Total area	11.1073	100	32
Swift Run			
City of Ann Arbor	1.9	35	
Pittsfield Township	2.7	50	
Ann Arbor Township	0.69	13	
Superior Township	0.09	1.6	
Ypsilanti Township	0.021	0.4	
Total area	5.401	100	16
Direct Drainage			
City of Ann Arbor	1.8	82	
University of Michigan	0.39	18	
Total area	2.19	100	6
TOTAL	**34.0731**		**100**

Further source evaluation indicates that bacteria loads from a large part of Ann Arbor enter Geddes Pond via the storm water system. Bacteria loads are also delivered to Geddes Pond by tributaries that drain a large portion of Ann Arbor. Other potential pathogen sources for Geddes Pond include upstream inputs, illicit sewer connections, pet and wildlife feces, and a small number of on-site wastewater treatment systems (septic systems) (Limno-Tech, Inc., 2000).

LINKAGE ANALYSIS

The link between the *E. coli* concentration in the Huron River and the identified sources on the tributaries is the basis for the development of the TMDL. The linkage is defined as the cause and effect relationship between the selected indicators and the identified sources. This provides the basis for estimating the total assimilative capacity of the river and any needed load reductions. For this TMDL, the primary loading of pathogens enters the Huron River directly through the tributaries and storm sewers within the listed reach. Given the low level of *E. coli* in the Huron River upstream of the listed reach, the guiding water quality management principle used to develop the TMDL was that compliance with the numeric pathogen target in the Huron River depended on pathogen control in the tributaries and storm sewers. If the pathogen inputs to the tributaries and storm sewers could be controlled, then total body contact recreation in the Huron River would be protected.

TMDL DEVELOPMENT

The TMDL represents the maximum loading that can be assimilated by the waterbody while still achieving WQS. As indicated in the Numeric Targets section, the target for this pathogen TMDL is the WQS of 130 *E. coli* per 100 ml. Concurrent with the selection of a numeric concentration endpoint, TMDL development also defines the environmental conditions that will be used when defining allowable levels. Many TMDLs are designed around the concept of a "critical condition." The critical condition is defined as the set of environmental conditions that, if controls are designed to protect, will ensure attainment of objectives for all other conditions. For example, the critical conditions for the control of point sources in Michigan are given in R 323.1090. In general, the lowest monthly 95% exceedance flow is used to address aquatic life concerns. However, bacteria sources to the Huron River in the listed reach arise from a mixture of dry and wet weather-driven sources, and there is no single critical condition that is protective for all other conditions. In addition, for most pollutants, TMDLs are expressed on a mass loading basis (e.g., pounds per day). For *E. coli* indicators, however, mass is not an appropriate measure, and the USEPA allows pathogen TMDLs to be expressed in terms of organism counts (or resulting concentration). Therefore, this pathogen TMDL is concentration-based consistent with R 323.1062 and the TMDL is equal to the target concentration of 130 *E. coli* per 100 ml.

The majority of the land (67%) in the Geddes Pond watershed falls under the jurisdictions of the city of Ann Arbor and the University of Michigan (U-M) (Table 2). These entities now have National Pollutant Discharge Elimination System (NPDES) required storm water permits. Other municipalities in the watershed will soon be considered to have permits in Phase 2 of the storm water permitting program. These storm water permits provide a mechanism for controlling bacterial loads to Geddes Pond and a structure for source characterization efforts. Therefore, this TMDL categorizes allowable loads by subwatershed and storm water permit holders, where applicable.

Table 2. Distribution of land in immediate Geddes Pond Watershed by Government Entity.

Government Entity	Number of Sq. Miles	Percent of Total Watershed
Ann Arbor	21	62.0
Pittsfield Township	5.2	15.3
Ann Arbor Township	4.5	13.3
University of Michigan	2.5	7.4
Lodi Township	0.43	1.3
Scio Township	0.14	0.4
Superior Township	0.09	0.2
Ypsilanti Township	0.021	0.1
TOTAL	**33.881**	**100.0**

Because bacteria loads originate from a number of different locations, there is not a single unique loading capacity that will ensure compliance with WQS. Rather, there are a large number of different allowable levels that will all ensure compliance, as long as they are distributed properly throughout space.

For this TMDL, an allocation strategy has been selected that assumes equal bacteria loads per unit area for all lands within the watershed. The allocation process for each month of the recreational season (May through October) is outlined below.

1. This TMDL is concentration-based so the TMDL is equal to the pathogen WQS of 130 *E. coli* per 100 ml.

2. All surface tributaries (not enclosed) are required to comply with the WQS of 130 *E. coli* per 100 milliliter (ml) as a monthly average. This requirement applies to Traver Creek, Millers Creek, Malletts Creek, and Swift Run Creek.

3. For the enclosed tributaries, the daily maximum WQS of 300 *E. coli* per 100 ml shall apply as a monthly average. The enclosed tributaries of the watershed are Allen Creek and the direct drainage area. Based on a December 19, 2000 MDEQ site visit (Thelen, 2001), it was determined that the confluence of Allen Creek with the Huron River represents an important recreational area. By maintaining the concentration of 300 *E. coli* per 100 ml in Allen Creek, any area of WQS exceedance in the Huron River will be minimized.

4. The average *E. coli* concentration in Barton Pond was determined to be 10 *E. coli* per 100 ml and was used as background. To confirm the background concentration, a sampling station was added upstream of Argo Dam. This station is downstream of Barton Pond, but upstream of the listed reach of the Huron River.

5. If surface tributaries meet the monthly average of 130 *E. coli* per 100 ml, the enclosed tributaries meet a monthly average of 300 *E. coli* per 100 ml and background levels do not significantly increase, then total body contact recreation for the Huron River will be met.

Consistent with the allocation strategy, Table 3 shows the allowable concentrations for each of the subwatersheds of the listed reach of the Huron River.

Table 3. Allowable *E. coli* Concentrations for the Subwatersheds of the Huron River.

	May	June	July	August	September	October
	Monthly Average *E. coli* Concentration (per 100 ml)					
Allen Creek	300	300	300	300	300	300
Traver Creek	130	130	130	130	130	130
Millers Creek	130	130	130	130	130	130
Malletts Creek	130	130	130	130	130	130
Swift Run Creek	130	130	130	130	130	130
Direct drainage	300	300	300	300	300	300

ALLOCATIONS

TMDLs are comprised of the sum of individual wasteload allocations (WLAs) for point sources, and load allocations (LAs) for nonpoint sources and natural background levels. In addition, the TMDL must include a margin of safety (MOS), either implicitly or explicitly, that accounts for uncertainty in the relation between pollutant loads and the quality of the receiving water body. Conceptually, this definition is denoted by the equation:

$$TMDL = \sum WLAs + \sum LAs + MOS$$

The term TMDL represents the maximum loading that can be assimilated by the receiving water while still achieving WQS. The overall loading capacity is subsequently allocated into the TMDL components of WLAs for point sources, LAs for nonpoint sources, and the MOS. As previously indicated, this pathogen TMDL will not be expressed on a mass loading basis and is concentration-based consistent with EPA regulations at 40 CFR 130.2(1).

WLAs

There are about 10 permitted non-storm water point source discharges within the listed reach. However, none of these have applied for or reported discharges of *E. coli.* Therefore, the WLA for this TMDL is equal to zero.

LAs

The primary sources of bacteria in the watershed consist of urban runoff from lands under the jurisdiction of two entities that have municipal storm water permits, the city of Ann Arbor and the U-M (see Figure 1 and Table 2). Runoff from lands in Pittsfield Township is also included and the township will soon be required to have a permit in Phase 2 of the storm water permitting program. While runoff from these entities is or will be covered by NPDES permits, it was still considered under the LA category because of the diffuse nature of the sources.

A small portion of land in the watershed does not fall under the jurisdiction of existing (or soon to be developed) storm water permits. This includes lands in Ann Arbor, Northfield, Lodi, Scio, Superior, and Ypsilanti Townships. Runoff from these lands is also included in the LA category.

Because this TMDL is concentration-based, the determination of individual LAs will be based on the assumption of equal bacteria loads per unit area for all lands within the watershed. Therefore, the relative responsibility for achieving the necessary reductions of bacteria and maintaining acceptable conditions in the subwatersheds will be determined by the amount of land under the jurisdiction of the various local units of governments within each of the subwatersheds. Table 1 gives the relative LAs by subwatershed for each of the local entities. The percentage of land within the subwatersheds for each of the local units of government gives a clear indication of the relative amount of effort that will be required by each entity to restore and maintain the total body contact designated use to this reach of the Huron River.

The government entity with the largest percent land area in the Geddes Pond watershed is Ann Arbor. The City of Ann Arbor makes up a majority of the Allen Creek, Millers Creek, Malletts Creek and Direct Drainage subwatersheds and is the second largest government entity in the Traver Creek subwatershed next to Ann Arbor Township. Pittsfield Township contains the largest percentage of land area in the Swift Run Creek subwatershed (see Tables 1 and 2).

The upstream sources of *E. coli* entering the listed reach must also be included in the LA category. Measurements of *E. coli* have been made in Barton Pond. The average concentration determined from these measurements was 10 *E. coli* per 100 ml. The TMDL assumes that the upstream boundary concentration will remain consistent at all river flows.

MOS

This section addresses the incorporation of a MOS in the TMDL analysis. The MOS accounts for any uncertainty or lack of knowledge concerning the relationship between pollutant loading, water quality and knowledge of continuous point sources of *E. coli*. The MOS can be either implicit (i.e., incorporated into the TMDL analysis thorough conservative assumptions) or explicit (i.e., expressed in the TMDL as a portion of the loadings). This TMDL uses an implicit MOS through the establishment of a substantial reserved allocation in the Huron River. Conservative assumptions in the development of the TMDL included the surface tributaries meeting the monthly average WQS of 130 *E. coli* per 100 ml; the enclosed tributaries meeting a monthly average of 300 *E. coli* per 100 ml; and the background conditions equaling 10 *E. coli* per 100 ml. Given these assumptions and the much larger flow in the Huron River compared to the tributaries, the pathogen WQS will be met in the listed reach with a substantial MOS or reserved allocation. The example loading assessment, given below, demonstrates that the magnitude of the MOS can also be estimated under any chosen flow scenario.

Example Loading Assessment

Although this TMDL is concentration-based, an example calculation using counts per day was used to simulate a loading assessment. The TMDL, on a loading basis, can be calculated as a function of stream flow using the following equation:

$$TMDL = Q_{riv,x} \times C_{WQS}$$

Where:

TMDL = Loading capacity in the river (counts per time).
$Q_{riv,x}$ = River flow (volume of water per time).
C_{WQS} = WQS concentration (counts per volume of water).

The loading capacity defined in the above equation applies to all river flows for which WQS apply. It must be noted that the loading capacity in the TMDL reach is directly dependent upon the upstream loads (because they directly affect C_x).

The monthly average flows for the Huron River and tributaries from May through October are given in Table 4 and were used to demonstrate the relative magnitude of allowable loads from the various units of government for one flow scenario.

Table 4. Huron River and Tributary Average Flows (cfs) Used to Calculate Loading.

Waterbody	May	June	July	August	September	October
Huron River	606	403	243	183	216	268
Allen Creek	4.45	3.49	1.78	1.34	1.58	1.97
Traver Creek	1.87	1.25	0.75	0.57	0.67	0.83
Millers Creek	2.92	1.94	1.17	0.88	1.04	1.29
Mallets Creek	6.55	4.35	2.62	1.98	2.33	2.89
Swift Run Creek	1.01	0.67	0.4	0.31	0.36	0.45
direct drainage	1.31	1.15	0.53	0.4	0.47	0.58

Using the previously stated conditions from the allocation strategy, the allocations based on average flow conditions were determined using the following process:

1. For the Huron River and each tributary, the allowable concentrations were converted to allowable loads.

2. LAs were determined for each local entity based on the relative areas of jurisdiction within each subwatershed. These results are given in Table 5.

3. The background levels of *E. coli* for the Huron River were converted to loads and are given in Table 6.

4. The Huron River flows used in the calculations were based on United States Geological Survey gage data of statistical monthly means for the years 1915-1997. The gage is located 4.2 miles upstream of Geddes Dam on the Huron River at Wall Street in Ann Arbor, Michigan.

The results of the loading assessment for the listed reach of the Huron River under average flow conditions are given in Table 7. The assessment shows that if the LAs are met, the TMDL will not be exceeded in the Huron River for each month of the recreational season. It also demonstrates the relative magnitude of the reserved allocation or MOS for each month.

Table 5. Load Allocations for Huron River Tributaries for Average Flow (relative loading units*)

	Watershed Area (sq. mi)	May	June	July	August	September	October
****Allen Creek**							
City of Ann Arbor	4.0	29.7	23.4	11.7	8.9	10.4	13.0
University of Michigan	0.43	3.3	2.6	1.3	1.0	1.2	1.4
Total LA	4.43	33.0	26.0	13.0	9.8	11.6	14.4
Traver Creek							
City of Ann Arbor	3.3	2.65	1.80	1.08	0.81	0.94	1.17
University of Michigan	0.072	0.06	0.04	0.02	0.02	0.02	0.03
Ann Arbor Township	3.8	3.05	2.07	1.24	0.93	1.09	1.35
Northfield Township	0.17	0.14	0.09	0.06	0.04	0.05	0.06
Total LA	7.342	5.9	4.0	2.4	1.8	2.1	2.6
Millers Creek							
City of Ann Arbor	2.4	6.20	4.13	2.46	1.86	2.19	2.73
University of Michigan	1.2	3.10	2.06	1.23	0.93	1.10	1.36
Ann Arbor Township	0.0028	0.01	0.01	0.01	0.01	0.01	0.01
Total LA	3.6028	9.3	6.2	3.7	2.8	3.3	4.1
Mallets Creek							
City of Ann Arbor	7.6	14.23	9.44	5.68	4.31	5.06	6.29
University of Michigan	0.42	0.79	0.52	0.31	0.24	0.28	0.35
Pittsfield Township	2.5	4.68	3.11	1.87	1.42	1.67	2.07
Ann Arbor Township	0.017	0.03	0.02	0.01	0.01	0.01	0.01
Lodi Township	0.43	0.81	0.53	0.32	0.24	0.29	0.36
Scio Township	0.1403	0.26	0.17	0.10	0.08	0.09	0.12
Total LA	11.1073	20.8	13.8	8.3	6.3	7.4	9.2
Swift Run							
City of Ann Arbor	1.9	1.13	0.74	0.46	0.35	0.39	0.49
Pittsfield Township	2.7	1.60	1.05	0.65	0.50	0.54	0.70
Ann Arbor Township	0.69	0.41	0.27	0.17	0.13	0.14	0.18
Superior Township	0.09	0.05	0.03	0.02	0.01	0.02	0.02
Ypsilanti Township	0.021	0.01	0.01	0.01	0.01	0.01	0.01
Total LA	5.401	3.2	2.1	1.3	1.0	1.1	1.4
****Direct Drainage**							
City of Ann Arbor	1.8	7.89	6.90	3.21	2.38	2.79	3.53
University of Michigan	0.39	1.71	1.50	0.69	0.52	0.61	0.77
Total LA	2.19	9.6	8.4	3.9	2.9	3.4	4.3
TOTAL LA		**81.8**	**60.5**	**32.6**	**24.6**	**28.9**	**36.0**

* Relative Loading Units = *E. coli* concentration (130 counts/100 ml) x River flow (cfs) x (10 x .646 x 3.785) / 10^3
** Allen creek and Direct Drainage use *E. coli* concentration of 300 counts/100 ml

Table 6. Background Loads of *E. coli* for the Huron River (relative loading units)*.

May	June	July	August	September	October
150	99	59	45	53	66

*relative loading unit = *E. coli* concentration (10 cts/100ml) x River flow (cfs) x (10 x .646 x 3.785)/10^3

Table 7. TMDL including LAs, WLAs, and MOS for the Huron River, May to October 31 (relative loading units).*

	May	June	July	August	September	October
WLA	0	0	0	0	0	0
LA	231.8	159.5	91.6	69.6	81.9	102
MOS (reserved allocation)	1694.2	1121.5	680.4	512.4	605.1	750
TOTAL LOAD	1926	1281	772	582	687	852

*relative loading unit = *E. coli* concentration (130 cts/100ml) x River flow (cfs) x (10 x .646 x 3.785)/10^3

SEASONALITY

Seasonality in the TMDL is addressed by expressing the TMDL in terms of a total body contact recreation season that is defined as May 1 through October 31 by Rule 100 of the WQS. There is no total body contact during the remainder of the year primarily due to cold weather. In addition, because this is a concentration based TMDL, WQS will be met regardless of flow conditions in the applicable season.

MONITORING

As previously discussed, this TMDL was developed following a phased approach. First, needed reductions of pollutant loads were estimated. Next, water quality will be monitored to determine the effectiveness of reductions. Recommended monitoring includes sample collection from all five tributaries (Swift Run Creek, Mallets Creek, Millers Creek, Traver Creek, and Allen Creek) at stations 1, 2, 3, 5, and 6 (Figure 1). One upstream location (station 7, Figure 1), as well as one location in Geddes Pond (station 4, Figure 1) will be sampled. Sampling will also include one wet and dry weather event. Initially, in May 2001 each station will be sampled five times. Subsequent sampling from June through September will be based on data collected in May. If sampling in May 2001 indicates WQS are exceeded, sampling will be oriented toward source identification. If sampling indicates WQS are met, sampling frequency will be increased to determine if WQS are met.

In future years, assuming WQS are not met immediately, sampling frequency will be once per month from May through September at all seven locations. Sampling will be adjusted as needed to assist in continued source identification and elimination. When these results indicate that the waterbody may be meeting WQS, sampling will be conducted at the appropriate frequency to determine if the 30-day geometric mean value of 130 *E. coli* per 100 ml is being met.

REASONABLE ASSURANCE ACTIVITIES

Urban storm water runoff is likely the dominant source of *E. coli* to Geddes Pond. Implementation activities to meet the TMDL require measures to reduce *E. coli* sources and loads. These measures will include activities that are already required of the NPDES municipal storm water permitees within the watershed. These permits have been in place since 1996, allowing the permittees several years to initiate quality programs. Currently, the city of Ann Arbor, Michigan Department of Transportation, and the U-M hold NPDES municipal storm water permits.

The city of Ann Arbor's NPDES municipal storm water permit contains several general requirements that, when implemented, could help reduce the delivery of pathogens to Geddes Pond. The permit requires a plan for effective elimination of illicit discharges and prohibition of illicit discharges. The permit requires that all catch basins be mapped and regularly cleaned. Effective storm water management in areas of redevelopment and new development is required. A public education program on storm water management and impacts of storm water pollution is also required.

The city of Ann Arbor is actively pursuing all of the above requirements and has an ongoing storm drain examination program that includes cross-connection searches. Some ordinances have been changed to require more storm water management in new developments. They have an active public education program that has been developed in cooperation with the Huron River Watershed Council.

The Ann Arbor campus of U-M also has an NPDES storm water permit. The U-M has developed the required storm water management program that contains several elements that could help reduce the delivery of pathogens to local waters and eventually to Geddes Pond on the Huron River. The U-M's permit essentially requires the same management activities as the city of Ann Arbor's NPDES permit, including illicit discharge elimination, pollution prevention, and public education.he U-M is actively meeting the permit requirements. For example, for illicit connections, the U-M campus is divided into a grid system and each grid is routinely tested for illicit connections.

When the Phase 2 storm water requirements are applicable, other municipalities in the watershed will also be considered for an NPDES municipal storm water permit. These permits will likely require activities that reduce pathogen inputs, similar to those in the city of Ann Arbor and U-M storm water permits.

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Michigan Department of Environmental Quality
August 10, 2001

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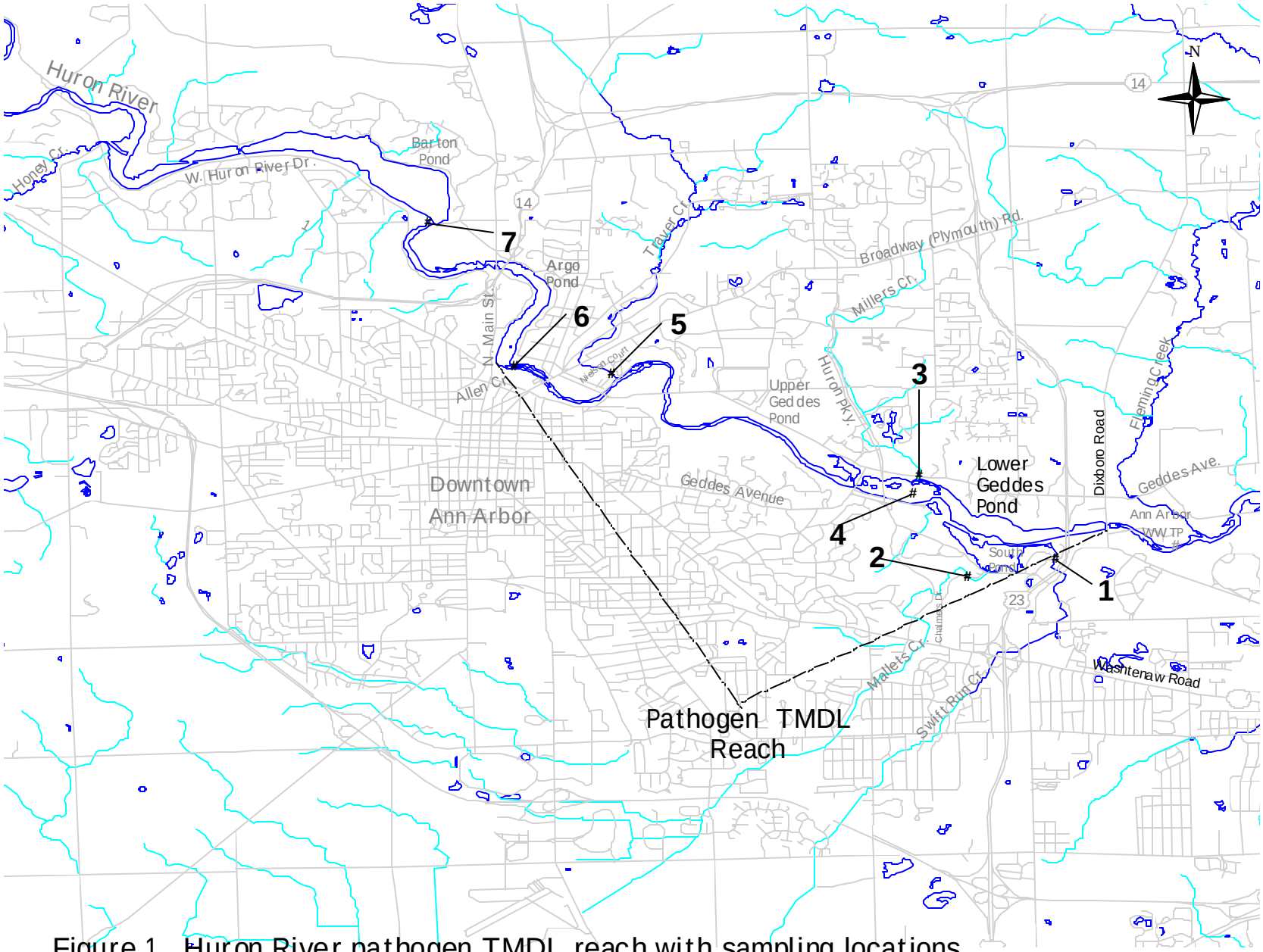
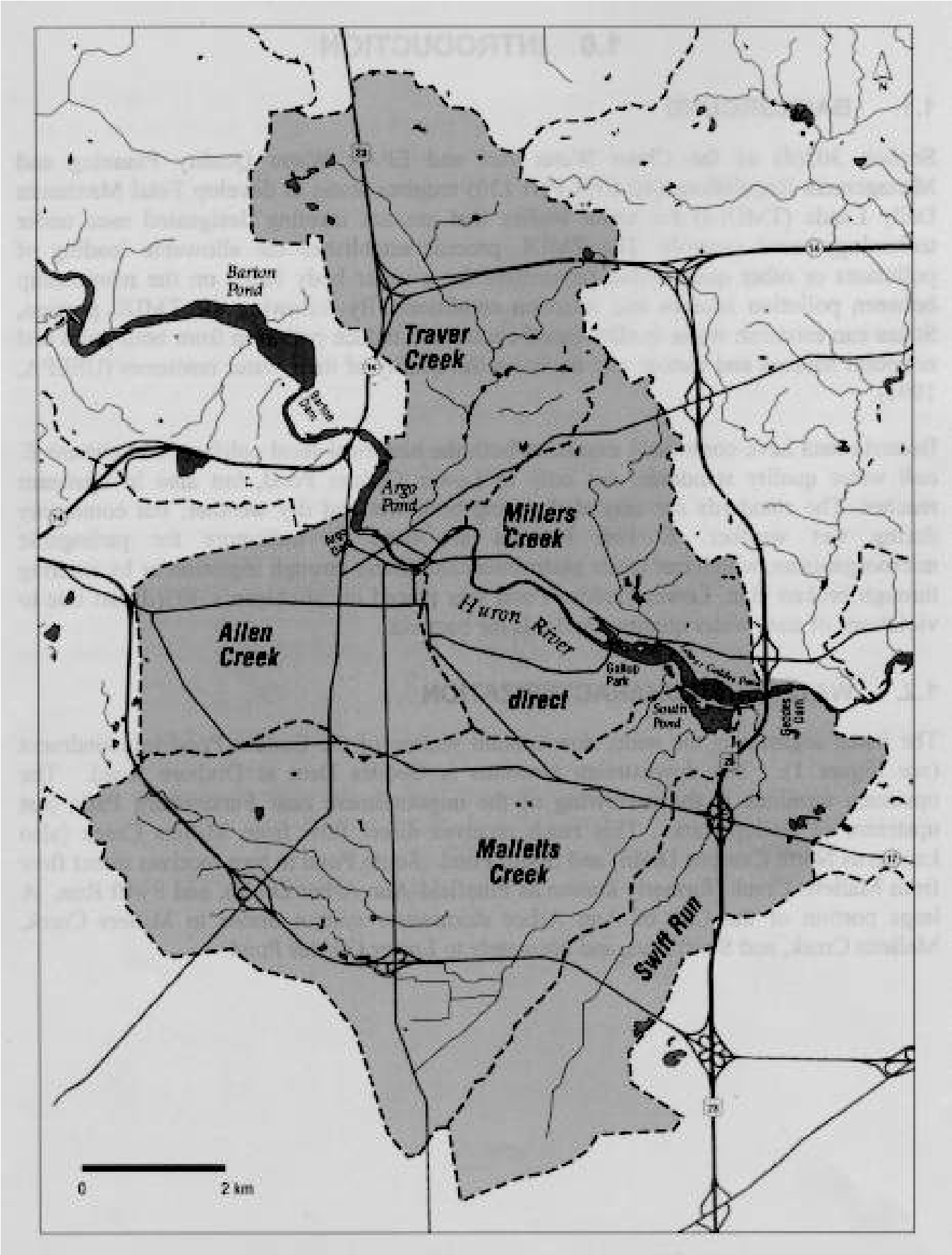


Figure 1. Huron River pathogen TMDL reach with sampling locations.

Figure 2. Subwatersheds in the Huron River TMDL listed reach.



Michigan Department of Environmental Quality

Water Division

August 2004

Total Maximum Daily Load for Biota for Malletts Creek

Washtenaw County

INTRODUCTION

Section 303(d) of the federal Clean Water Act (CWA) and the United States Environmental Protection Agency's (USEPA's) Water Quality Planning and Management Regulations (Title 40 of the Code of Federal Regulations, Part 130) require states to develop Total Maximum Daily Loads (TMDLs) for water bodies that are not meeting Michigan's Water Quality Standards (WQS). The TMDL process establishes the allowable loads of a pollutant to a water body based on the relationship between pollutant sources and in-stream water quality conditions. TMDLs provide states a basis for determining the pollutant reduction necessary from both point and nonpoint sources (NPS) to restore and maintain the quality of their water resources. The purpose of this TMDL is to identify appropriate actions to achieve the fish and macroinvertebrate community targets and habitat quality targets, specifically a reduction in sediment loadings from sources in the Malletts Creek watershed that will result in WQS attainment. This TMDL follows the phased approach, due to inherent uncertainties in deriving numeric targets and estimating loading from NPS. Under the phased approach, load allocations (LAs) and waste load allocations (WLAs) are calculated using the best available data and information, recognizing the need for additional monitoring data to determine if the load reductions required by the TMDL lead to attainment of the WQS. The phased approach provides for the implementation of the TMDL while additional data are collected to reduce uncertainty.

PROBLEM STATEMENT

The TMDL reach of Malletts Creek, a warmwater designated water body tributary to the Huron River at South Pond Park, is located in Washtenaw County in the vicinity of Ann Arbor (Figure 1). The impaired designated uses (Rule 100 of the Michigan WQS) include the lack of support of acceptable communities of warmwater fish and other aquatic life (macroinvertebrate) communities. This condition served as the basis for placing Malletts Creek on Michigan's Section 303(d) list of impaired water bodies requiring the development of a TMDL. The TMDL reach is about two miles in length and is identified on the Section 303(d) list (Creal and Wuycheck, 2002) as follows:

MALLETTS CREEK WBID#: **061203I**
County: WASHTENAW HUC: 04090005 Size: 2 M
Location: Huron River confluence u/s to Packard Road.
Problem: **Fish and macroinvertebrate communities rated poor.**
TMDL YEAR(s): 2004 RF3RchID: 4090005 499

This document represents the basis for the development of a biota TMDL that focuses on the

restoration of the biological communities of the impacted perennial reach of Malletts Creek in order to meet Michigan's WQS.

The headwater reach of Malletts Creek upstream of the Brown Park Pond dam is classified by the United States Geological Survey (USGS) as intermittent. Malletts Creek is classified by the USGS as perennial from Brown Park Pond Dam downstream to the Huron River confluence. Within the two-mile biota TMDL reach, habitat impairment is attributed to unstable flow regimes, reduced bank stability, bank erosion, sedimentation, and reduced stream quality due to excessive runoff/washoff throughout this highly urbanized watershed.

The TMDL reach was based on the August 1997, Michigan Department of Environmental Quality's (MDEQ's) Procedure 51, biological community assessment findings for Malletts Creek (Wuycheck, 2003). The Procedure 51 fish community assessments involve the evaluation of ten metrics with a score and rating system as follows: a score range of 5 to 10 is rated excellent; a score range of 4 to -4 is rated acceptable; and a score range of -5 to -10 is rated poor. The macroinvertebrate community assessments involve the evaluation of nine metrics with a score and rating system as follows: a score range of 5 to 9 is rated excellent; a score range of 4 to -4 is rated acceptable; and a score range of -5 to -9 is rated poor. A poor-rated macroinvertebrate community characterized the stream at Packard Road and a poor-rated fish community characterized the community upstream of Chalmers Road (Figure 1). The fish community was rated acceptable (-2) at East Eisenhower Parkway in the headwaters of the watershed, but poor (-7) at Chalmers Road located approximately 0.1 mile upstream of the Huron River confluence at South Pond Park. Additional Procedure 51 macroinvertebrate community assessments conducted in August 2002 and September 2003, at Scheffler Park (located between Platt Road and Washtenaw Road off Edgewood Drive) and Chalmers Road, indicated acceptable macroinvertebrate community scores of -3 and -1; and -3 and -2, respectively.

Procedure 51 habitat quality assessments involve the evaluation of ten metrics with a scoring and rating system as follows: a habitat score less than 56 is rated poor, 56 to 104 is rated marginal, 105 to 154 is rated good and a score greater than 154 (with a maximum of 200 points) is rated excellent. Habitats at two stations (Packard Road and Chalmers Road) in August 1997, were rated good (slightly impaired) based on scores of 83 and 93, respectively, based on the 1997 version of Procedure 51. The August 2002 and September 2003, habitat scores and ratings, using the May 2002, updated Procedure 51 habitat assessment protocol for sites at Scheffler Park (Edgewood Drive) and Chalmers Road were 141 and 150 in 2002; and 131 and 135 in 2003, respectively. This indicates that, overall, the habitats assessed were rated good. However, scores for the individual metric categories of flow stability and bank stability were generally 50 percent or less than their maximum potential scores indicating unstable habitat conditions in Malletts Creek. Similar scores were recorded for these same metrics during the August 2002, biological assessments of Malletts Creek at Scheffler Park (downstream of Platt Road) and Chalmers Road.

Biological community assessments by the Huron River Watershed Council (HRWC) volunteers characterized the macroinvertebrate communities at Scheffler Park and Chalmers Road as poor in the spring of 2003 (HRWC, 2003). The differences between the MDEQ and HRWC biological community assessment results may be attributed to assessment procedure used and/or seasonal differences.

Total suspended solids (TSS) monitoring in the Malletts Creek watershed was conducted during

the months of June, July, and August 2003, by Limno-Tech, Incorporated (LTI), as part of a Clean Michigan Initiative (CMI)-funded monitoring program. The assessment was prompted by MDEQ staff concern about the impact of excessive sedimentation on habitat quality and, therefore, the biological community. The project, requested by the MDEQ, required monitoring at least twice during the survey period to characterize background TSS concentrations during dry weather, stable flow conditions and to monitor at least three wet weather runoff events to assess increases in stream TSS during these events. Effort was directed towards sampling TSS during the rise and fall of the Malletts Creek hydrograph in response to a rainfall/runoff event of 0.1 inches or greater. Survey results (LTI, 2003b) indicated average background, stable, base flow TSS concentrations at Chalmers Road of 5 to 10 milligrams per liter (mg/l). Precipitation events of 1.22, 0.61, and 1.02 inches on June 21, August 1 through August 2, and August 12, 2003, resulted in maximum (average) in-stream TSS concentrations of 460 mg/l (257mg/l), 130 mg/l (95 mg/l), and 1276 mg/l (572 mg/l), respectively. This information indicates that precipitation runoff/washoff events in the watershed substantially increase the amount of TSS in transport in Malletts Creek. In-stream flows measured at the USGS gage (#04174518) during the three wet weather event monitoring dates show increases from 1.6 to 178 cubic feet per second (cfs); 1.7 to 60 cfs, and 2 to 205 cfs, respectively, demonstrating substantial flow responses to precipitation events observed.

Municipal and commercial site storm water runoff/washoff associated with the numerous storm water outfalls within the Malletts Creek watershed are considered the most probable sources of unstable habitat conditions and associated impacts to aquatic life. The primary contributors to poor stream quality include excessive runoff/washoff, stream bank erosion, elevated runoff volumes, flow extremes (both lows and highs), and runoff rates from substantial areas of impervious surfaces in this highly urbanized/commercialized watershed that cause flashy, unstable flow conditions. These factors result in severe stream bank erosion; sediment induced erosivity of both habitat and colonizing organisms; and siltation and sedimentation of biologically important and desirable habitat. Reductions in storm sewer runoff rates and solids loads from both commercial and municipal storm water runoff sites, along with reduced stream bank erosion through more stable flow management are necessary to reduce impacts on the aquatic life.

NUMERIC TARGETS

The impaired designated use for Malletts Creek is aquatic life. Michigan's WQS require, as a minimum, the protection of a variety of designated uses, including aquatic life (Rule 100(1)(f)). The fish and macroinvertebrate communities of Malletts Creek are impacted due to habitat impairment and instability due to excessive bank erosion, sedimentation, and unstable flow extremes. Achievement of WQS for the aquatic life designated use is to be demonstrated via assessments of the integrity of the fish and macroinvertebrate community and habitat quality.

The primary numeric targets involve the use of Michigan's biological community and habitat quality assessment Procedure 51 (MDEQ, 1997 and 1998). The biota TMDL target is to establish both a fish community and macroinvertebrate community with acceptable, reproducible scores, each equal to or greater than -4 (acceptable). Both fish and macroinvertebrate communities will be evaluated based on a minimum of two Procedure 51 biological assessments to be conducted in successive years. The assessments would follow the implementation of Best Management Practices (BMPs) intended to stabilize flow extremes, bank erosion, and sediment loadings to the subject TMDL reach.

The Procedure 51 stream habitat quality assessment procedure has been revised and will also be used (MDEQ, 2002). A target habitat score equal to or greater than 130 is provided to assure protection of habitat conditions and minimized impairment to habitat. This is consistent with current acceptable scores for the habitats assessed at Scheffler Park and Chalmers Road. This level of conservation is appropriately high enough to minimize both temporal and spatial variability within the watershed and provide a buffer for the variability within the macroinvertebrate and habitat assessment protocol.

A secondary numeric target established to improve habitat conditions is for TSS. TSS measurements will be used to further assess improvements in Malletts Creek. The secondary goal is represented by a mean annual, in-stream TSS concentration target of 80 mg/l to characterize wet weather runoff/washoff events. This secondary numeric target may be overridden by achievement of the biological and habitat numeric targets. However, if the TSS numeric target is achieved, but the biota or habitat numeric targets are not achieved, then the TSS target may have to be reevaluated. Achievement of the secondary numeric target will help guide proper control over NPS of excessive suspended solids loads from runoff, as well as the runoff discharge rates and instantaneous runoff volumes that affect increased stream flow instability, stream bank erosion, and increased suspended solids concentrations.

The mean annual target concentration of 80 mg/l TSS is based on a review of existing conditions and published literature on the effects of TSS. Vohs et al., (1993) indicated that chemically inert TSS of 100 mg/l appears to separate those streams with a fish population from those without. The European Inland Fisheries Advisory Commission stated that in the absence of other pollution, a fishery would not be harmed at suspended solids concentrations less than 25 mg/l. Good to moderate fisheries can be found at 25 to 80 mg/l TSS; good fisheries were unlikely to be found at 80 to 400 mg/l, while only poor fisheries are typically found at 400 mg/l (Alabaster, 1972). Decreases were demonstrated in the standing crop of both fishes and macroinvertebrates in an area receiving suspended solids loadings of no more than 40 mg/l (Gammon, 1970).

Water quality for suspended solids (finely divided solids) may be represented by the following categories:

Optimum	= $\leq$25 mg/l
Good to Moderate	= >25 to 80 mg/l
Less than Moderate	= >80 to 400 mg/l
Poor	= >400 mg/l

Since the TMDL purpose is to restore the biological community to an acceptable condition and attain WQS, a value of 80 mg/l as a mean annual TSS target for wet weather events was chosen for Malletts Creek.

Overall, the secondary target of 80 mg/l TSS (as a mean annual value) is intended to evaluate solids loading influences and assist in orienting and focusing corrective actions for source reductions. Additional TSS targets based on flow related considerations may be developed as additional data on Malletts Creek become available.

The Washtenaw County Drain Commissioner's office has focused on reducing total phosphorus loads, including those from Malletts Creek, to the Huron River in response to the Huron River nutrient TMDLs for Ford and Belleville Lakes (Kosek, 1996). Current, local pollutant reduction and implementation plans for Malletts Creek involve the phosphorus TMDL to reduce the

occurrence of nuisance algal blooms in both Ford and Belleville Lakes. The Malletts Creek Restoration Plan targets a 50% reduction in total phosphorus, which is characterized as "…functionally equivalent to the mean TSS concentration of 80 mg/l…" (Malletts Creek Restoration Plan, 2000). Therefore, adherence to either the 80 mg/l TSS secondary target and/or the 50% total phosphorus reduction target will, presumably, equally effect desired reductions in both the TSS and/or total phosphorus loads, the latter targeted in the existing Malletts Creek Restoration Plan.

SOURCE ASSESSMENT

From the Huron River confluence upstream, land use in the watershed is dominated by residential, commercial, and industrial development. The estimated impervious surface area in the Malletts Creek watershed is 37% or 2478 acres (Malletts Creek Restoration Plan, 2000). Increasing the percent of impervious surface within a watershed can severely affect the extremes in a stream's hydrologic and hydraulic characteristics. Such increases cause rapid precipitation runoff and washoff of suspended solids and contaminant loads to the receiving waters (Fonger and Fulcher, 2001; Schueler and Holland, 2000). Substantial reductions in vegetative riparian zones and pervious areas throughout the watershed of Malletts Creek and the extensive use of structural features, including paved impervious surface areas (e.g., roads and parking lots), curb and gutter, and numerous direct storm sewer discharges, dominate the landscape and serve to increase the rate of precipitation runoff to Malletts Creek.

Existing stream flow conditions of Malletts Creek can best be described as unstable and flashy in response to storm events as characterized by the flow extremes recorded at the USGS Malletts Creek (#04174518) stream flow gage (Figure 2). Note in this August 2003 example, the extremes in flow fluctuation from low flows of 2 cfs to highs of over 400 cfs occurred within a three to six-hour period. The hydrograph demonstrates the very flashy and unstable stream flow conditions that occur during wet weather runoff/washoff events. This condition results in excessive stream bank erosion, sedimentation, and erosivity of otherwise stable, inhabitable substrate suitable for macroinvertebrate colonization and fish community development. Therefore, the sources of sediment loadings to Malletts Creek are primarily attributable to periodic erosion and storm water runoff/washoff from impervious surfaces associated with residential, industrial, and commercial-dominated land uses in the watershed.

There are five National Pollutant Discharge Elimination System (NPDES) permitted dischargers in the Malletts Creek watershed that have general permits (Table 1 and Figure 3). Two facilities discharge treated groundwater and the other three discharge non-contact cooling water. Collectively, none of the five NPDES permitted point source facilities is required to monitor TSS in its effluent discharged to Malletts Creek since TSS limits are not commonly required or needed for these types of discharges. The combined maximum design discharge total of 1.673 million gallons/day or 610 million gallons/year applies to the five dischargers. Therefore, a worst-case estimate of TSS load for each of these five facilities was made assuming a TSS monthly average concentration of 25 mg/l; a typical monthly average permit limit provided in NPDES permits. The estimated TSS load from the five general permitted facilities is 349 pounds/day or 127,396 pounds/year.

There are at least 161 storm water outfalls to Malletts Creek watershed covered by the NPDES Phase I MS4 storm water runoff permit program (Figure 4). These outfalls are overseen by the city of Ann Arbor (137 outfalls), University of Michigan (11 outfalls), and Michigan Department of Transportation (2 outfalls - from Business Route 23 to Malletts Creek). Washtenaw County has at least 11 identified outfalls that are covered under the Phase II MS4 program.

The derivation of current annual TSS loads to the Malletts Creek watershed from the various land use categories, involved estimates of the acres of each land use category (LTI, 2003a), a mean annual rainfall of 34 inches, and the use of the USEPA's Simple Method model approach (USEPA, 2001). The estimated current, annual TSS load from the NPDES permitted storm water sources (WLA component) versus the remaining NPS land use categories (LA component) in the Malletts Creek watershed is approximately 1,173,788 pounds and 102,662 pounds, respectively (Table 2). The overall total estimated annual TSS load to the Malletts Creek from NPDES point sources, NPDES storm water, and NPS is approximately 1,403,846 pounds, representing 9%, 84%, and 7% of the total load, respectively.

In summary, excessive sedimentation and flashy flow conditions in Malletts Creek occur due to elevated wet weather event runoff/washoff volumes, associated TSS loads from the impervious urban areas in the watershed, and in-stream bank erosion and resuspension. The presence of substantial areas of impervious surfaces in the watershed has disrupted the natural hydrology of Malletts Creek, especially during wet weather runoff/washoff events. These alterations to the Malletts Creek watershed have destabilized stream banks, increased solids loads, shortened the runoff/washoff rate of delivery to the stream, modified extremes in stream flows (both high and low flows), and reduced or eliminated desirable fish and macroinvertebrate habitat. Approximately 2478 acres or 37% of the Malletts Creek watershed (6696 acres) is estimated to be impervious (Malletts Creek Restoration Plan, 2000). Stream degradation has been demonstrated to occur in watersheds containing as little as 10% to 20% impervious surface areas because of associated direct runoff discharges to a water body (Center for Watershed Protection, 1994). However, local studies within the Huron River watershed indicate a threshold range for impairment of 8% to 10% (Wiley and Martin, 1999).

LINKAGE ANALYSIS

A suitable method used to develop a TMDL that addresses the severity of the impacts of sedimentation to a biological community is to measure sediment impacts on stable, colonizable substrates in the stream channel and the associated changes in the biological community.

Increased siltation and embeddedness of colonizable substrates resulting from excessive bank erosion and sedimentation has been demonstrated to impair the biological integrity of rivers (Waters, 1995) by obscuring or reducing the suitability of colonizable or useable substrate by stream biota. With improved habitat through the reduction in sedimentation, both fish and macroinvertebrate communities respond with an increase in species diversity and an increase in the number of individuals of each species. As a result, the Procedure 51 assessment scores and ratings for quality of the fish and macroinvertebrate communities and habitat are expected to increase as sedimentation rates decline, embeddedness decreases, and habitat diversity increases. These latter characteristics will serve to demonstrate improvement in habitat conditions, WQS attainment, and overall stream quality as expressed through an acceptably rated biological community.

TMDL DEVELOPMENT

The TMDL represents the maximum loading that can be assimilated by a water body while still achieving WQS. The Malletts Creek biotic community has been impaired by unstable flow conditions, bank erosion, and excessive sedimentation. Therefore, this TMDL is focused on reducing sediment loads throughout the watershed to a level that supports a biological community that meets WQS. Using the metrics from Procedure 51, a numeric score of -4 for

both fish and macroinvertebrate communities and a habitat score of 130 or greater, will serve as primary targets for this biota TMDL.

Concurrent with the selection of numeric endpoints, this TMDL also defines the environmental conditions that will be used when defining allowable levels. Some TMDLs are designed around the concept of critical condition. A critical condition is defined as the set of environmental conditions that, if controls are designed to protect, will ensure attainment of objectives for all other important conditions. For example, the critical conditions for the control of point sources in Michigan are provided in Rules 323.1082 and 323.1090 of Michigan's WQS. In general, the lowest monthly 95% exceedance flow for a stream is used to establish effluent limits for point sources. However, the primary sediment inputs to Malletts Creek are attributable to wet weather-driven discharges and resulting in-stream conditions. As such, there is no single condition that is protective for all conditions, but efforts are directed towards wet weather runoff/washoff events.

The target of 80 mg/l TSS is used to develop a secondary TMDL loading goal for TSS during wet weather runoff/washoff events, especially from storm water discharges from the area (3875 acres) of urban/industrial/built-up land use category that represents about 58% of the land use area in the Malletts Creek watershed.

ALLOCATIONS

TMDLs are comprised of the sum of individual WLAs for point sources, LAs for NPS, and natural background levels. The TMDL must include a margin of safety (MOS), either implicitly within the WLA and/or LA, or explicitly, that accounts for uncertainty in the relation between pollutant loads and the quality of the receiving water body. This definition is denoted by the equation:

$$TMDL = \Sigma^{WLAs} + \Sigma^{LAs} + MOS$$

The TMDL represents a maximum load of a pollutant or stressor that can be discharged to a receiving water and still meet WQS. The overall TMDL load capacity is allocated among the three TMDL components: WLA for NPDES permitted point sources, LA for NPS and background loads, and the MOS.

WLAs

Presently, the estimated total annual TSS load from all point sources is approximately 1,301,184 pounds. The combined individual/general NPDES permitted point source TSS load to Malletts Creek is estimated at 127,396 pounds/year (Table 1). Based on land use category TSS export coefficients (Cave et al., 1994), a total annual TSS load estimate of approximately 1,173,788 pounds is attributable to NPDES permitted storm water runoff/washoff discharges to the Malletts Creek watershed associated with the urban/industrial/built-up sources (Table 2). The projected annual TSS load (127,396 pounds) from the individual/general NPDES permitted point sources is considered acceptable. However, the combined effect on Malletts Creek by runoff/washoff loads of TSS from the urban/industrial/built-up storm water source should be reduced in order to achieve an in-stream mean annual wet weather TSS concentration goal of 80 mg/l or less by reducing runoff/washoff delivery rates to Malletts Creek. If the goal of 80 mg/l TSS were achieved, this would represent a 16% reduction in TSS load to Malletts Creek, resulting in a projected annual WLA of 1,113,249 pounds of TSS. Reduced runoff/washoff

delivery rates to Malletts Creek will play an important role in achieving the 80 mg/l goal by reducing TSS loads from upland sources, stream bank erosion, and re-suspension of in-place TSS.

For developing water quality-based effluent limits for the individual/general NPDES permitted point source discharges, the receiving stream design flow equals the lowest 95% exceedance flow. However, it is proposed that any TSS limits in NPDES point source permits be established at the target of 25 mg/l or less, as a monthly maximum average, which then makes it unnecessary to consider mixing zone scenarios. The point source contributions to the WLA are considered controllable through the existing NPDES individual/general permit requirements and storm water through the Phase I and Phase II MS4 storm water program requirements.

LAs

The LA component defines the load capacity for a pollutant that is nonpoint in origin that includes the following land use categories: agriculture, forested/shrub/open land, wetland, and water bodies (Table 2). An estimated annual TSS load of 102,662 pounds is attributed to these land use categories of NPS in the watershed. All but the agricultural land use are considered as background load sources. Therefore, the only targeted TSS load reduction source is from agricultural sources. A 45% annual reduction (from 53,822 to 29,695 pounds) from cropland areas in the watershed is recommended, resulting in the annual LA, TSS load target of 78,535 pounds, based on achieving the 80 mg/l TSS target concentration during wet weather runoff/washoff events.

In summary, the proposed reduction in the total annual TSS load to Malletts Creek (WLA + LA) to meet the annual average target of 80 mg/l is 1,191,784 pounds/year, an overall 15% reduction. Eleven percent (127,396 pounds/year) is allocated to the general NPDES permitted point source component of the WLA, along with 83% (985,853 pounds/year) to the NPDES permitted industrial and municipal storm water outfalls covered under the Phase I and Phase II MS4 storm water program, and the remainder of 7% (78,535 pounds/year) is attributed to the LA. To achieve the WLA, a reduction in the storm water runoff/washoff of the TSS load is recommended, especially, in the urban/industrial/built-up land use categories. The percent reduction in the TSS load is based on the reduction of wet weather runoff event TSS loads with a goal of an annual average in-stream target of 80 mg/l TSS during wet weather runoff/washoff events.

MOS

The MOS in a TMDL is used, in part, to account for variability of source inputs to the system and is either implicit or explicit. An MOS is implicit for a biota TMDL because the quality of the biological community, its integrity, and overall composition represent an integration of the effects of the spatial and temporal variability in sediment loadings to the aquatic environment.

The habitat target score of 130 or greater will be used, so as to maintain habitat conditions and demonstrate acceptable stream quality conditions that provide adequate control of anthropogenic sediment sources to assure improved habitat quality and the biological communities. This targeted score is closely associated with macroinvertebrate community scores of -3 or greater, potentially providing better results than a minimally acceptable value of -4.

For comparison of survey assessment results from 1997, 2002, and 2003, follow-up biological and habitat quality assessments will be conducted during stable flow conditions within the months of June through September. The results will best reflect an MOS that is implicit and express an integration of the effects of the variability in sediment loads in the aquatic environment and minimize seasonal variability.

SEASONALITY

Seasonality is addressed in the TMDL in terms of sampling periods for fish and macroinvertebrate communities. To minimize temporal variability in the biological community, sampling will be conducted during June through September of each year during stable flow conditions. For assessing TSS loads to Malletts Creek, seasonal event monitoring will be conducted to define and characterize both hydraulic and TSS loads from the Malletts Creek watershed that influences the biota TMDL reach.

MONITORING PLAN

Monitoring will be conducted by the MDEQ to assess progress towards meeting the biota TMDL targets, following implementation of applicable BMPs and control measures. Subsequently, annual sampling of the macroinvertebrate community and habitat quality at locations in the vicinity of Chalmers Road, Washtenaw Road, Packard Road, and immediately downstream of the Brown Park Pond dam, as a minimum, will be conducted until assessment results from two consecutive years, demonstrate attainment of TMDL targets at these sites. For best comparative purposes, follow-up biological and habitat assessments will be conducted in a June to August time frame during stable flow conditions. Every effort will be made to sample during similar stream conditions and assess the same sampling locations.

In-stream monitoring of TSS, stream flow, and representative land use runoff/washoff characteristics for a variety of stable flow and wet weather events will be necessary to refine the TSS loadings estimates for the Malletts Creek watershed. This information will further define the level of TSS load reduction necessary; seasonally, climatologically, and annually.

Once the BMPs are in place to minimize the effects of runoff and flashy conditions that exist in Malletts Creek, stream flow and TSS sampling can be implemented so as to measure progress towards the secondary numeric target of 80 mg/l as a mean annual TSS value during wet weather runoff events. Multiple sampling during critical high flow events, as well as low flow events, needs to be assessed to estimate future TSS loads in Malletts Creek.

REASONABLE ASSURANCE

The focus of the actions to protect Malletts Creek is directed towards installing BMPs and other control measures to reduce and minimize solids loads and excessive runoff/washoff discharge rates to the TMDL reach. The former action is to reduce sedimentation impacts, the latter to minimize stream bank erosion associated with the erosive effects of flashy flow extremes. Overall, control measures include: NPDES individual/general and storm water permit limits and approved BMPs for areas currently not under any permit.

For the WLA, existing general NPDES permit requirements for these sources will be adequate to meet the target.

NPDES storm water permits are issued to the various dischargers within a watershed. The permittees are required to collectively develop a watershed management plan that includes the detailing of short- and long-term goals and attainment actions, public education plans, illicit discharge elimination plans, and the development (by each local unit of government within the Malletts Creek watershed) of their individual storm water prevention plans.

The MDEQ district staff will continue to work with and assist interest groups in the Malletts Creek watershed. The purpose is to assist in defining and designing approvable actions and programs that assess, develop, plan, and implement BMPs and control measures that best minimize or prevent soil erosion and excessive runoff rates to the Malletts Creek watershed.

- Upgrade and maintain the current vegetative riparian zone to reduce soil erosion and loadings to the Malletts Creek from sources within the watershed. BMPs need to be employed within the riparian zone adjacent to the urbanized, residential, industrialized, and commercial areas to minimize the loss through erosion and direct runoff/washoff, thereby minimizing habitat impairment of the Malletts Creek.

- Implementation of BMPs in the storm water permits program that reduces sediment loadings and moderate runoff release rates and excessive runoff/washoff to the Malletts Creek watershed are expected to improve and protect designated use support throughout the watershed. The goals are for reduced solids loadings and greater flow stability throughout the watershed so that WQS are restored and protected. Available guidance regarding runoff detention and stream protection is provided by Fongers and Fulcher, 2001; Schueler and Holland, 2000; and Purdue, 2003.

The MDEQ approval of BMPs and implementation plans is required prior to implementation of proposed structural improvements.

A Quality Assurance Project Plan (QAPP) is being designed for the Washtenaw County Drain Commissioner, for a Malletts Creek Regional Detention Facility site, involving the Brown Park Pond area (CDM, 2003). The facility is intended to help stabilize stream conditions due to wet weather runoff/washoff events. This QAPP may well enhance and reduce current impacts to the hydrology of Malletts Creek and foster improved habitat and biological communities.

Also, the Ann Arbor City Planning Commission's resolution regarding development in the Malletts Creek watershed requires the incorporation of the following BMPs into any proposal for development:

- Minimize impervious surfaces by efficient parking and drive design, shared parking, parking deferral, and use of multiple-story building design wherever possible.
- Provide detention facilities that meet or exceed the Washtenaw County Drain Commissioner's rules.
- In the case of redevelopment sites, provide detention for all added impervious surfaces and, if feasible, as much of the existing development as possible.
- Incorporate techniques from the MDEQ's "Guidebook of Best Management Practices for Michigan Watersheds (Peterson et al., 1993)."
- Avoid placing detention facilities in the Malletts Creek floodplain.

Since the inception of the Malletts Creek Restoration Plan (2000), the city of Ann Arbor and the Washtenaw County Drain Commissioner have partnered with the MDEQ to implement illicit

connection discharge elimination and retrofit regional detention within the basin using CMI and USEPA Section 319 Grant funding (Bobrin, 2003). Also, the 2000 plan indicates that updates of local ordinances and development standards affecting physical, biological, and chemical integrity of Malletts Creek have been made. To date, the total local public commitment for plan implementation exceeds $2 million.

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August 6, 2004

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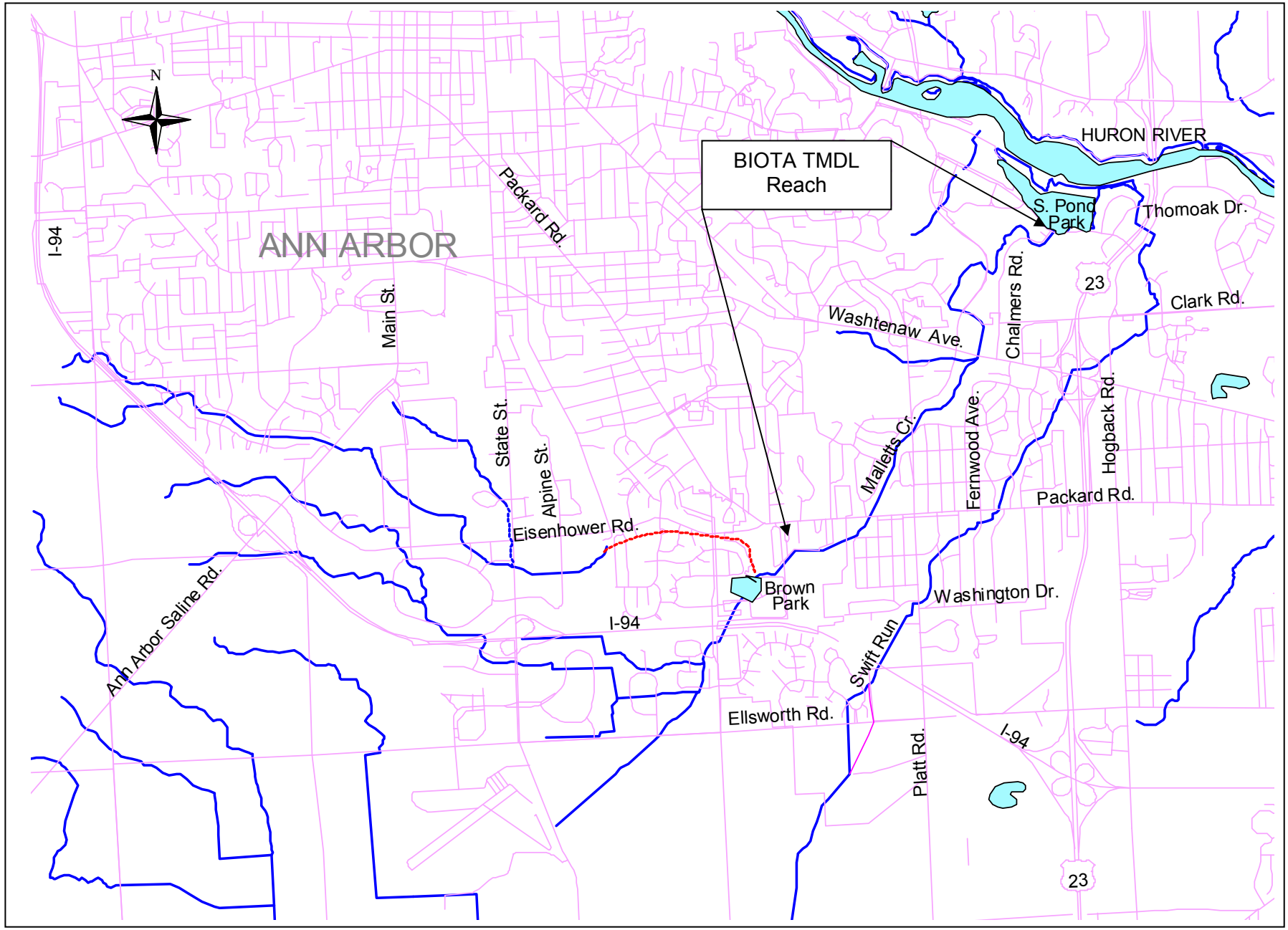
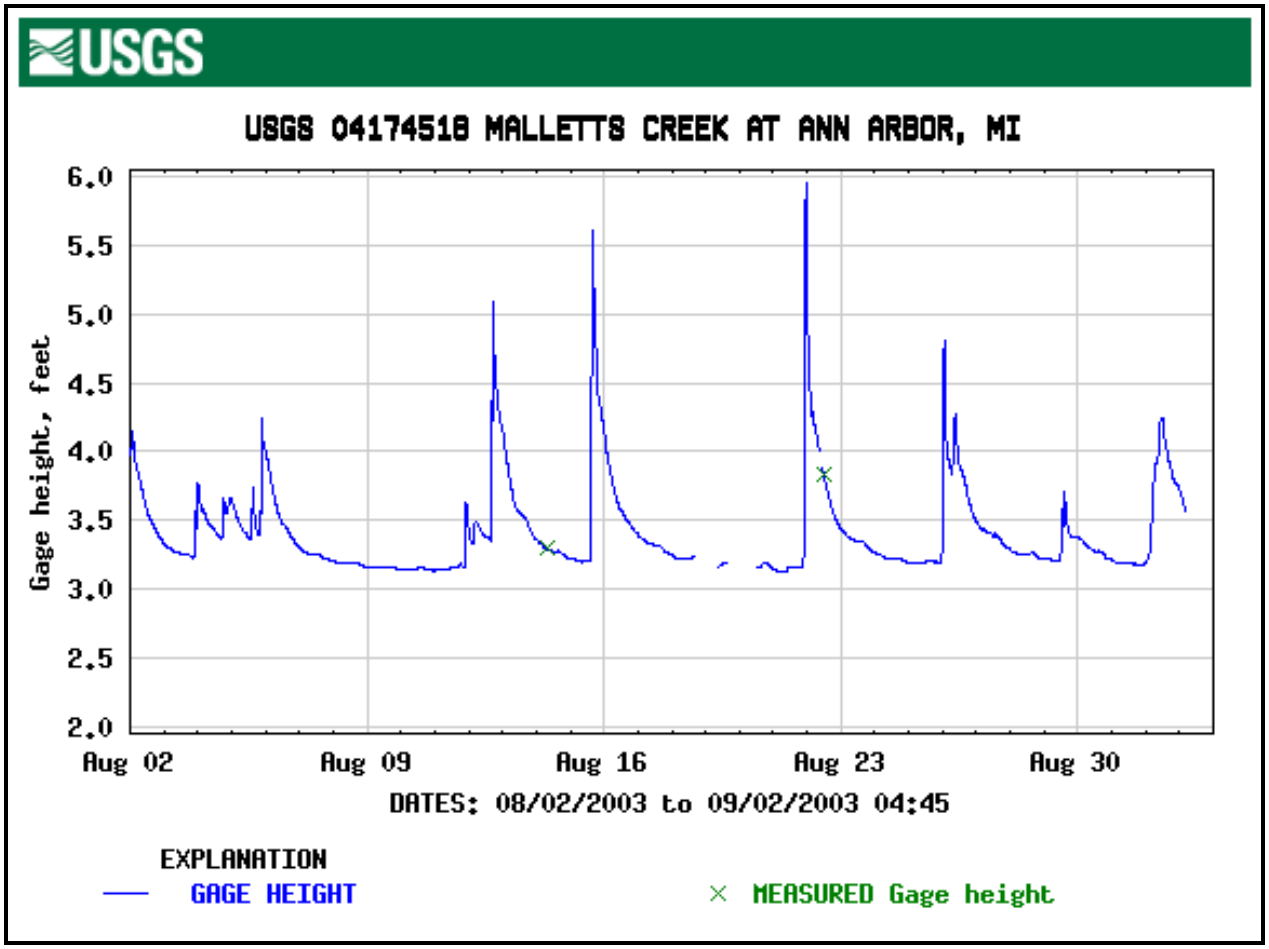


Figure 1. Malletts Creek biota TMDL reach, Washtenaw County, Michigan.



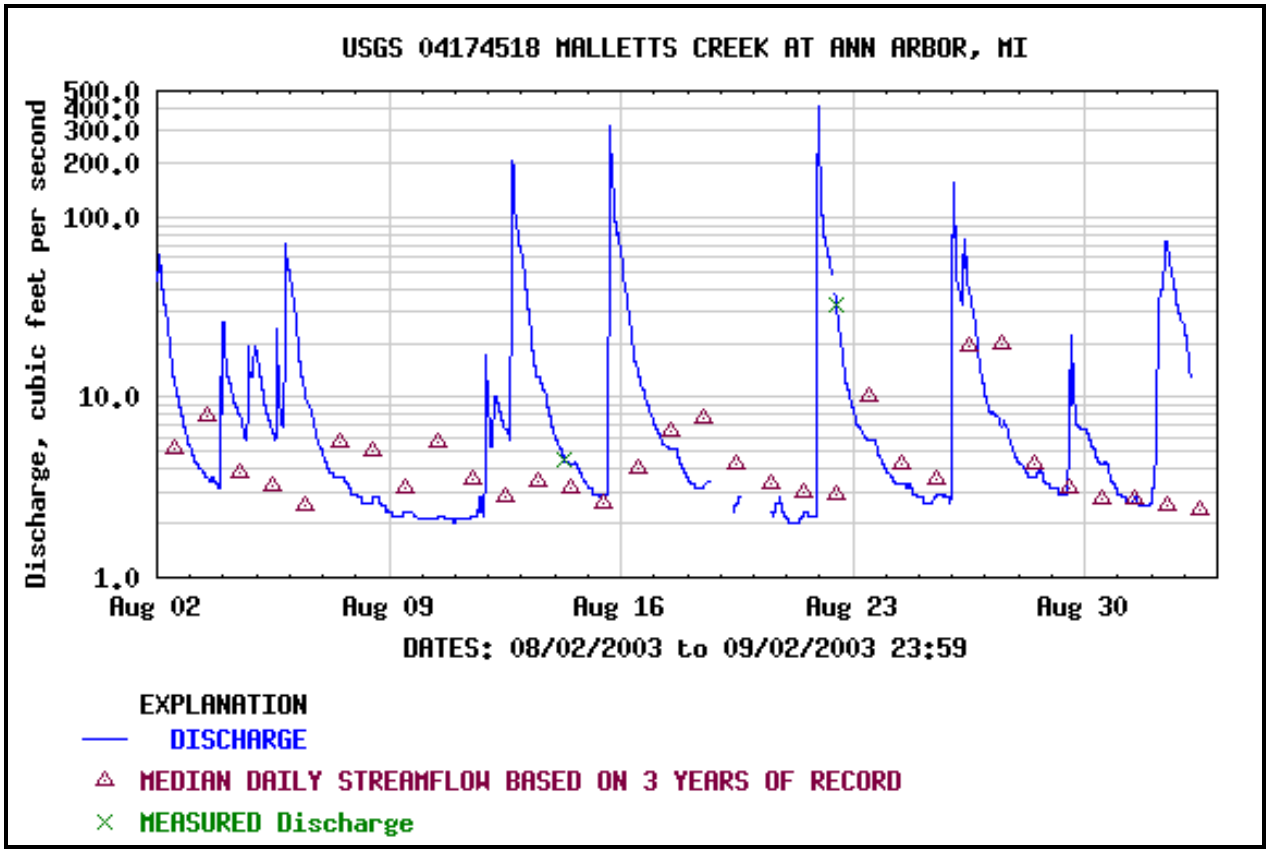


Figure 2. Malletts Creek storm event response in height and flow at the USGS gage.

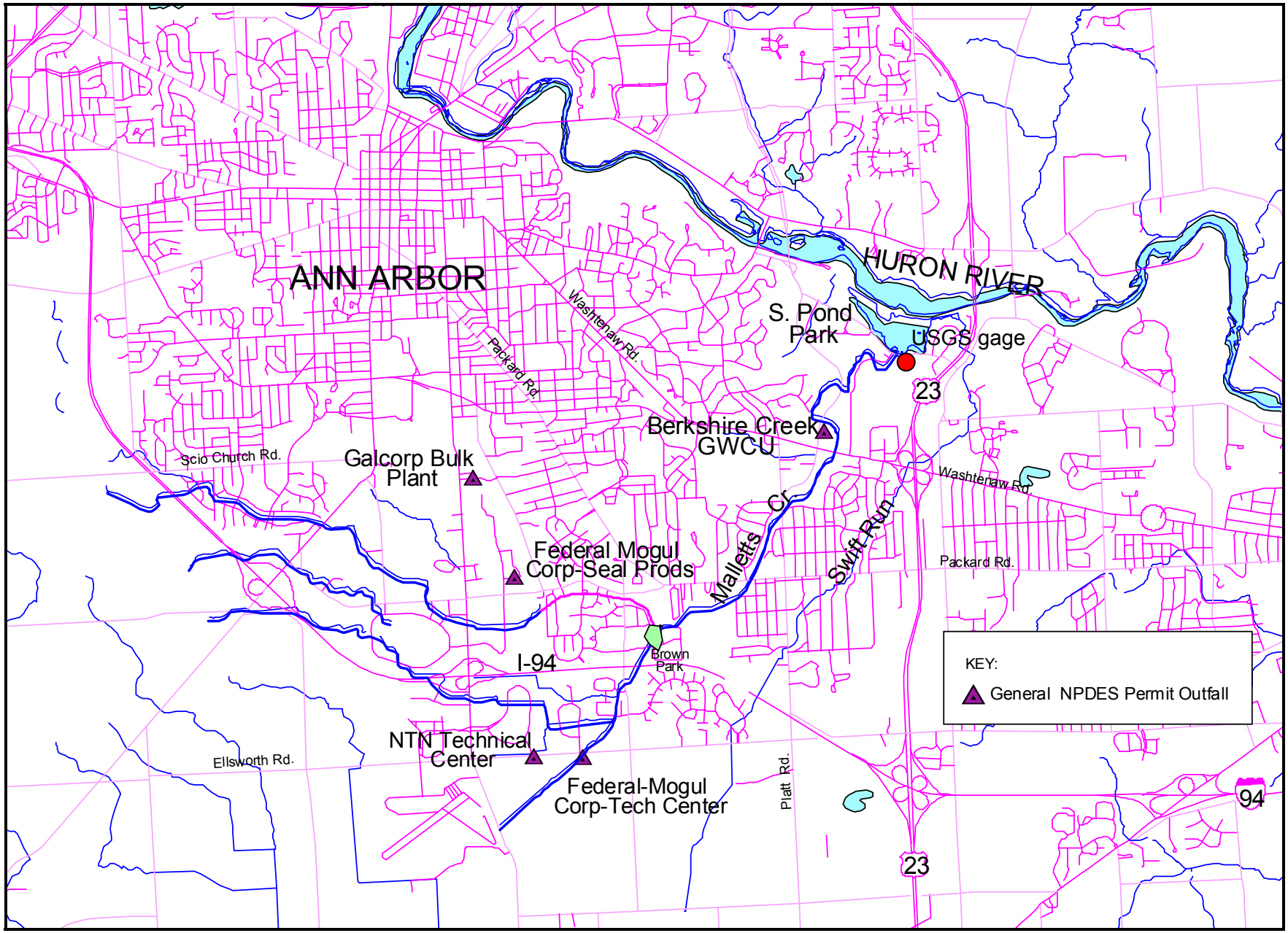


Figure 3. NPDES permitted (individual, general, and industrial storm water) facility outfalls to Malletts Creek watershed, Washtenaw County, Michigan.

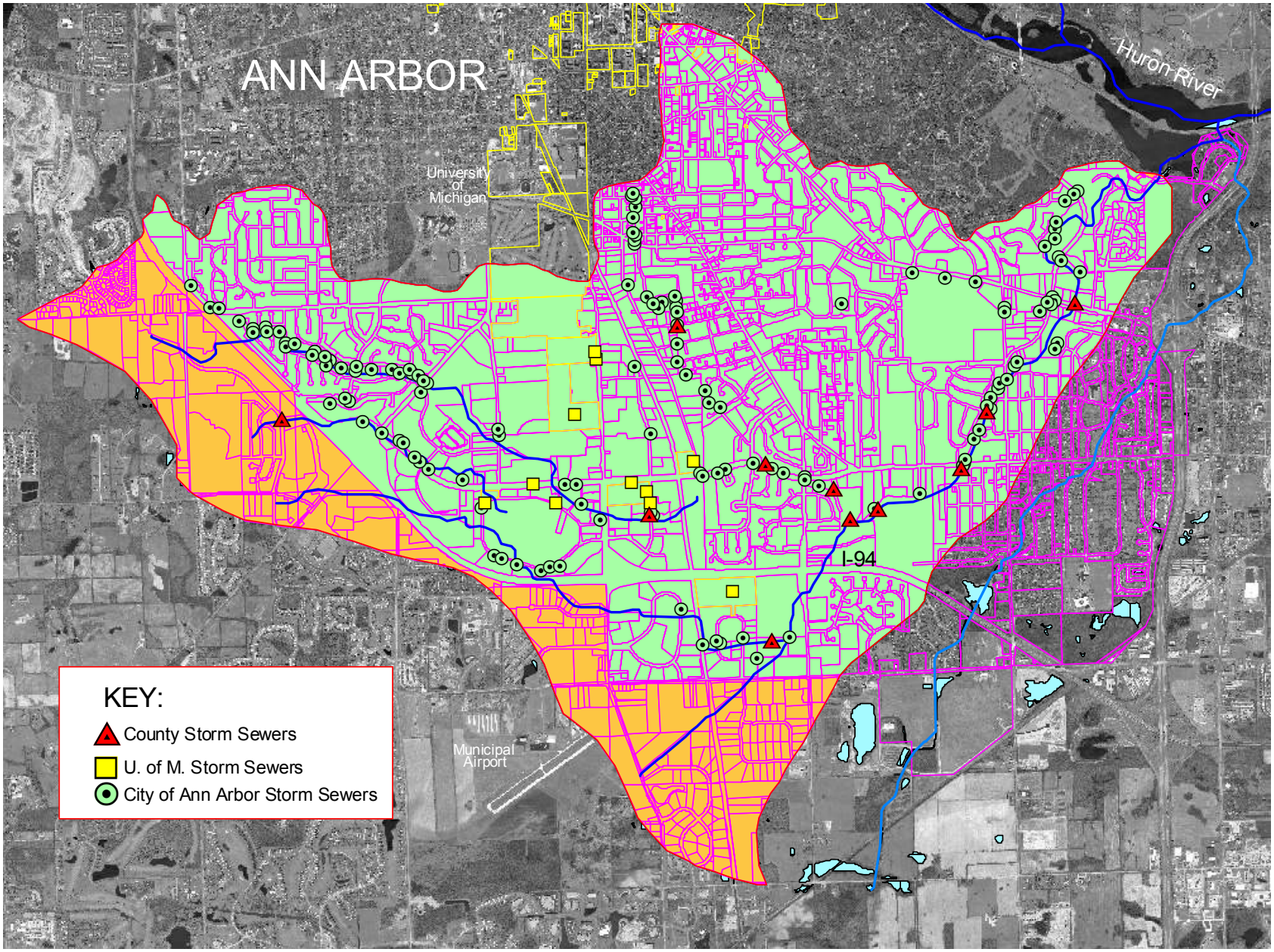


Figure 4. Washtenaw County Phase I and II storm sewer outfalls in the Malletts Creek watershed managed by the city of Ann Arbor, University of Michigan, and Washtenaw County. Source: Scott Wade – (LTI, 2003).

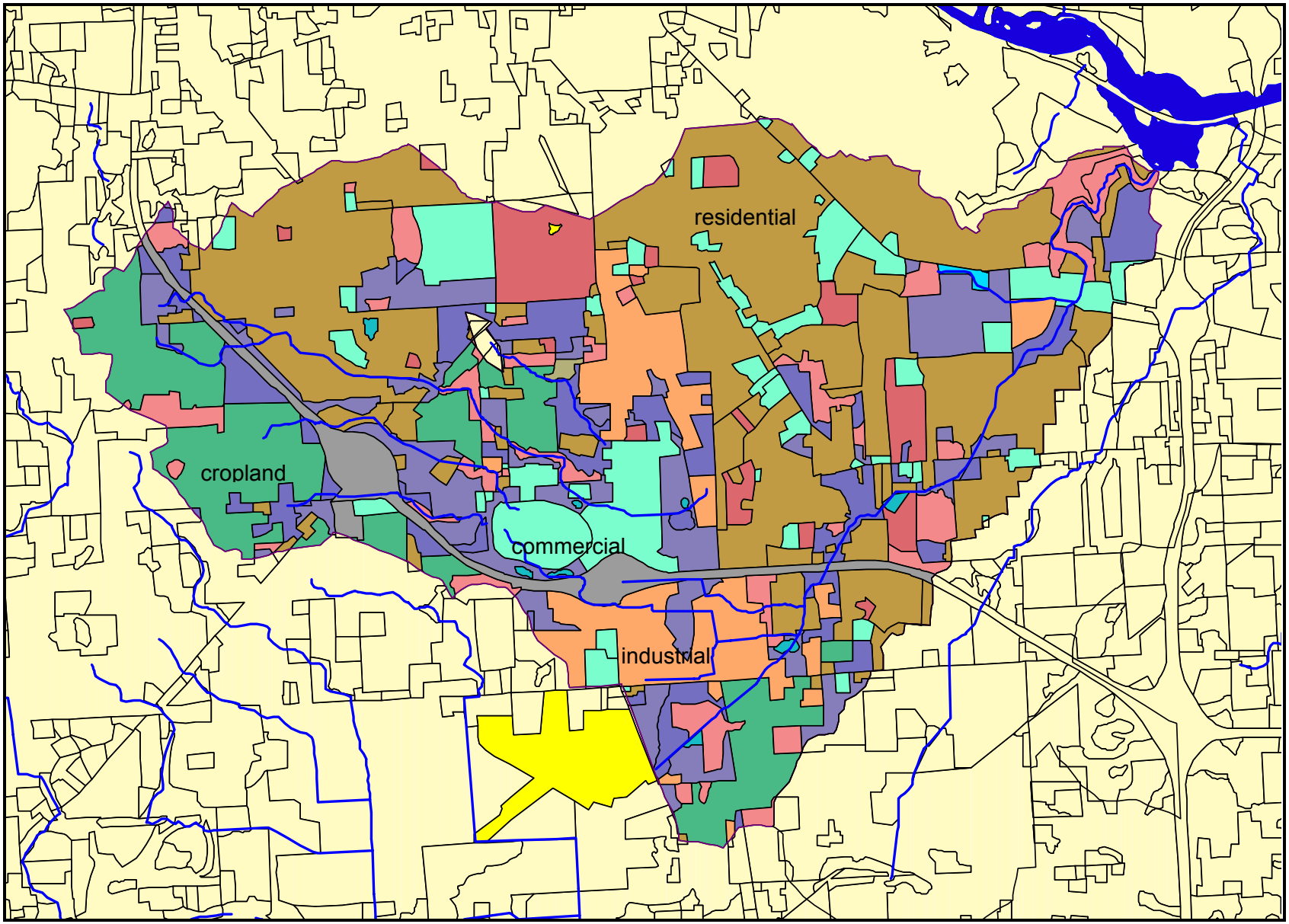


Figure 5. Land use categories in the Malletts Creek watershed, Washtenaw County, Michigan.
(Source: Scott Wade – (LTI, 2003 using 2002 (Ann Arbor) and 1998 (township) land use coverages).

Table 1. Individual, general, and industrial storm water NPDES permitted outfalls tributary to the Malletts Creek watershed and estimated TSS loads for non-storm water outfalls. (Source: MDEQ/WD NPDES permit Management System. *mgd = million gallons per day.

PERMIT NUMBER	FACILITY	DESIGN FLOW (mgd*)	Latitude (decimal degrees)	Longitude (decimal degrees)	Annual TSS Load at 25 mg/l (pounds)
General NPDES Permits:					
MIG080756	Galcorp Bulk Plant	0.043	42.255	-83.73855	3,274
MIG081010	Berkshire Creek GWCU	0.01	42.258333	-83.695	761
MIG250419	NTN Technical Center	0.33	42.22944	-83.73167	25,129
MIG250420	Federal-Mogul Corp-Tech. Center	0.09	42.917	-83.72556	6,853
MIG250421	Federal-Mogul Corp-SealProducts	1.2	42.245833	-83.73333	91,378
	Total Daily Design Flow (mgd):	**1.673**			**127,396**
Storm Water NPDES Permits (Phase I – MS4 Program):					
MI0053856	City of Ann Arbor				
MI0053902	University of Michigan				
MI0053911	Michigan Depart. of Transportation				
Storm Water NPDES Permits (Phase II – MS4 Program):					
(eleven outfalls)	Washtenaw County				

Table 2. Annual TSS loads based on NPDES permitted point sources and various land use categories in the Malletts Creek watershed. Estimated annual TSS loads and recommended TSS reductions (WLA and LA) are derived.

Source Category	Acres	Estimated Current TSS (Pounds/Year)*	TMDL TSS Target Load TSS (Pounds/Year)
WLA Components:			
NPDES Individual/General Permitted Point Source TSS Load:		127,396	127,396
NPDES Permitted Storm Water TSS Load:			
Residential	2422	496,343	
Industrial	535	202,971	
Commercial and Service	686	405,831	
Transportation/Comm/Util.	232	68,643	
Subtotal:		1,173,788	985,853 (16% reduction)
WLA Total:	3875	1,301,184	1,113,249 (**WLA)**
LA Components:			
Agricultural Land			
Cropland	787	53,822	29,695 (45% reduction)
(Background Sources)			
Forested/Shrub/Open Land			
Deciduous Forest	437	10,512	10,512
Openland/Shrub/Rangeland	1559	37,500	37,500
Confier Forest	8	192	192
Wetland			
Forested	9	191	191
Water Body			
Lake/Reservoir	21	445	445
LA Subtotal:	2821	102,662	78,535 (**LA**)
Overall Totals:	6696	1,403,846	1,191,784 (overall 15% reduction)

**Load estimates based on PLoad Version 3 model (USEPA, 2001), land use acres derived from 2002 (Ann Arbor) and 1998 (township) land use coverages and a mean annual rainfall value of 34 inches.*

Michigan Department of Environmental Quality

Water Bureau

November 2004

Total Maximum Daily Load for Biota for Swift Run Creek

Washtenaw County

INTRODUCTION

Section 303(d) of the federal Clean Water Act and the United States Environmental Protection Agency's (USEPA's) Water Quality Planning and Management Regulations (Title 40 of the Code of Federal Regulations, Part 130) require states to develop Total Maximum Daily Loads (TMDLs) for water bodies that are not meeting water quality standards (WQS). The TMDL process establishes the allowable loadings of a pollutant to a water body based on the relationship between pollutant sources and in-stream water quality conditions. TMDLs provide states a basis for determining the pollutant reduction necessary from both point and nonpoint sources (NPS) to restore and maintain the quality of their water resources. The purpose of this TMDL is to identify appropriate actions to achieve the fish and macroinvertebrate community targets and habitat quality targets, specifically a reduction in sediment loadings from sources in the Swift Run Creek watershed that will result in WQS attainment. This TMDL follows the phased approach due to inherent uncertainties in deriving numeric targets and estimating loading from NPS. Under the phased approach, load allocations (LAs) and waste load allocations (WLAs) are calculated using the best available data and information, recognizing the need for additional monitoring data to determine if the load reductions required by the TMDL lead to attainment of WQS. The phased approach provides for the implementation of the TMDL while additional data are collected to reduce uncertainty.

PROBLEM STATEMENT

The TMDL reach of Swift Run Creek, a warmwater designated water body tributary to the Huron River at South Pond Park, is located in Washtenaw County in the vicinity of Ann Arbor (Figure 1). The watershed drains portions of Pittsfield Township, the city of Ann Arbor and Ann Arbor Township. The designated use (Michigan's WQS Rule 100) identified as impaired was the support of indigenous aquatic life, in this case, the macroinvertebrate communities. This condition served as the original basis for placing Swift Run Creek on Michigan's Section 303(d) list of impaired water bodies requiring the development of a TMDL. The TMDL reach is about 3.7 miles in length and is identified on the Section 303(d) list (MDEQ, 2004) as follows:

SWIFT RUN CREEK WBID#: **061203IL**
County: WASHTENAW HUC: 04090005 Size: 3.7 M
Location: Huron River confluence u/s to Ellsworth Road. Southeast of Ann Arbor.
Problem: **Macroinvertebrate community rated poor.**
TMDL YEAR(s): 2004 RF3RchID: 4090005 25

This document represents the basis for the development of a biota TMDL that focuses on the restoration of the biological communities within the impacted perennial reach of Swift Run Creek to meet Michigan's WQS designated uses.

Within the approximately 2994-acre watershed, the flow in the headwater reach of Swift Run Creek upstream of Creek Drive (Pittsfield Township - Section 11, R6E, and T3S) is classified by the United States Geological Survey (USGS) as intermittent. Flow in the Swift Run Creek TMDL reach is classified by the USGS as perennial from Creek Drive downstream (Figure 1) to the Huron River confluence. Within the 3.7-mile perennial reach, impairment is attributed to degraded water quality, unstable and flashy flow regimes, reduced bank stability (bank erosion), sedimentation, and reduced stream habitat quality. Excessive runoff/washoff sources throughout this highly urbanized watershed (from headwaters downstream) results in an impaired biological community.

The determination of impairment within the TMDL reach was based on the August 1997 Michigan Department of Environmental Quality (MDEQ) Procedure 51 biological community assessment findings for Swift Run Creek (unpublished). A Procedure 51 macroinvertebrate community assessment involves the collection of representative taxa from each available habitat type in the stream survey reach (woody debris, cobble, gravel, sand, etc.). Of the numbers of organisms collected and representative of a given survey reach, the relative percent of each taxon is derived. The Procedure 51 scoring and rating of macroinvertebrate communities is based on the assessment of 9 metrics with total score ranges of 5 to 9, 4 to -4, and -5 to -9 that have corresponding ratings of excellent, acceptable, and poor, respectively. A poor (score of -8) macroinvertebrate community characterized the lower reach of the stream at Hogback Road in August 1997 (Wuycheck, 2003). An additional assessment conducted in September 2003 at Shetland Drive (located north of Clark Road) also indicated poor macroinvertebrate communities based on the Procedure 51 community assessment score of -6 (Wuycheck, 2003).

Habitat quality was assessed in August 1997 at Hogback Road and in September 2003 at Shetland Drive, using Procedure 51 protocols (Figure 2). The Hogback Road site was assessed in August 1997 using the MDEQ (1997) habitat assessment protocol, and the September 2003 habitat assessment used the updated MDEQ (2002) protocol. The Procedure 51 habitat assessment protocol used in August 1997 involved score ranges of less than 35, 35 to 70, 71 to 106, and 107 to a maximum of 135 points representing habitat quality ratings of poor, fair, good, and excellent, respectively. The August 1997 habitat score and rating at the Hogback Road site was 66 (out of a possible score of 135) indicating overall fair (moderately impaired) conditions. The total point score ranges using the updated MDEQ (2002) habitat assessment protocol are less than 56, 56 to 104, 105 to 154, and greater than 154 to a maximum of 200 points with ratings of poor, marginal, good, and excellent, respectively. The September 2003 habitat score and rating at the Shetland Drive site (using the May 2002 updated Procedure 51 habitat assessment protocol) was 114 (out of a possible score of 200) indicating overall good conditions. However, scores for the individual metric categories of Embeddedness, Flow Stability, and Bank Stability of both the August 1997 and September 2003 assessments indicated 50% or less than their maximum potential scores. These scores indicate unstable habitat conditions in Swift Run Creek.

Volunteer biological community assessments by the Huron River Watershed Council characterize the macroinvertebrate communities as stable but poor (Huron River Watershed Council, 2003).

Total suspended solids (TSS) and flow monitoring in the Swift Run Creek watershed was conducted during the months of June, July, and August 2003 by Limno-Tech, Incorporated (LTI) as part of a Clean Michigan Initiative (Contract 071B1001643) funded monitoring program. The project, requested by the MDEQ, required monitoring three times (two completed) during the

survey period to characterize background TSS concentrations during dry-weather, stable flow conditions and to monitor at least three wet-weather runoff events to assess increases in stream TSS and flow during a response to wet-weather events of 0.1 inches or greater. Effort was directed towards sampling TSS and flow during the rise and fall of the Swift Run Creek hydrograph. Results from the study indicated an average background TSS concentration of 13.0 milligrams per liter (mg/l) and 14.5 mg/l during stable, base flow conditions of June 23, 2003, and August 1, 2003, respectively (LTI, 2003b).

Wet-weather event monitoring at the most downstream site at Thornoak Road, during 24-hour precipitation accumulations of 1.22, 0.61, and 1.02 inches on July 21, August 1-2, and August 12, 2003, showed in event maximum (event average) TSS concentrations of 1,115 mg/l (662 mg/l), 689 mg/l (211 mg/l), and 1,032 mg/l (378 mg/l), respectively. This information indicates that precipitation runoff/washoff events in the watershed substantially increase the amount of TSS in transport in Swift Run Creek. In-stream flows measured at the most downstream station at Huron River Drive, vicinity of Thornoak Drive, during the three wet-weather event monitoring dates of July 21, August 1-2, and August 12 showed increases from 11 to 127 cubic feet per second (cfs), <0.1 to 19 cfs, and 5 to 14 cfs, respectively, demonstrating substantial flow responses to precipitation events.

Excessive storm water runoff to Swift Run Creek from the municipal and commercial sites in the watershed is considered the most probable cause of the biological community impairment. There are a minimum of 26 National Pollutant Discharge Elimination System (NPDES) permitted storm water outfalls throughout the Swift Run Creek watershed, the flow from which contributes to unstable habitat conditions. Approximately 425 acres or 14.5% of the Swift Run Creek watershed (2,994 acres) is impervious; e.g., parking lots and buildings (Purdue, 2003). Such areas are commonly designed to divert and direct precipitation directly to nearby water bodies to facilitate rapid drainage. Substantial degradation in biological communities has been demonstrated to occur in watersheds containing 10% to 20% impervious surface areas that directly discharge to a water body (WPT, 1994).

The primary contributor to poor stream quality is excessive runoff/washoff volumes resulting in flashy, destabilizing extremes in stream flow conditions in this highly urbanized/commercialized watershed. This condition results in substantial stream bank erosion and sediment induced erosivity of both habitat and colonizing organisms, siltation, and sedimentation impacts on biologically important and desirable habitat. Reductions in storm sewer runoff rates, resulting flashy stream conditions, and reduced stream bank erosion through more stable flow management are necessary to reduce impacts on the aquatic life and meet WQS.

NUMERIC TARGETS

The impaired designated use for Swift Run Creek relates to indigenous aquatic life. Michigan's WQS require, as a minimum, the protection of a variety of designated uses, including indigenous aquatic life [Rule 100(1)(f)]. Attainment of WQS for the indigenous aquatic life designated use will be demonstrated based on assessments of macroinvertebrate community integrity and habitat quality.

The primary numeric targets are based upon Michigan's biological community and habitat quality assessment Procedure 51 (MDEQ, 1997, 1998, and 2002). The biota TMDL target is to establish a macroinvertebrate community with acceptable, reproducible scores equal to or greater than -4. Macroinvertebrate communities will be evaluated based on a minimum of two Procedure 51 biological assessments conducted in successive years, following the implementation of Best Management Practices (BMPs) to stabilize runoff/washoff discharges

and extremes in stream flow conditions, minimize bank erosion, and sediment loadings to the subject TMDL reach.

A target habitat score of equal to or greater than 110 will be used to demonstrate restoration of acceptable habitat quality. This score is consistent with the most recent habitat assessment score (114 for September 2003) for the acceptable habitats assessed at Shetland Drive. This level of conservation is appropriately high enough to account for both temporal and spatial variability within the watershed and provide a buffer for the variability within the macroinvertebrate and habitat assessment protocol.

A secondary numeric target based on TSS will be used to further assess improvements in Swift Run Creek. The secondary target goal is a mean annual, in-stream TSS concentration of 80 mg/l for wet-weather runoff/washoff events. This secondary numeric target may be overridden by achievement of the biological and habitat numeric targets. However, if the TSS numeric target is achieved but the biota or habitat numeric targets are not achieved, then the TSS target may have to be reevaluated. The secondary numeric target is intended to help guide proper control over NPS of excessive suspended solids loads from runoff, as well as the runoff discharge rates and instantaneous runoff volumes that affect increased stream flow instability, stream bank erosion, and increased suspended solids concentrations.

The mean annual target concentration of 80 mg/l TSS is based on a review of existing conditions and published literature on the effects of TSS to aquatic life. Vohs et al. (1993) indicated that a chemically inert suspended solids concentration of 100 mg/l appears to separate those streams with a fish population from those without. Gammon (1970) demonstrated decreases in the standing crop of both fishes and macroinvertebrates in river reaches continuously receiving suspended solids loadings of less than 40 mg/l. The European Inland Fisheries Advisory Commission stated that in the absence of other pollution, a fishery would not be harmed at suspended solids concentrations less than 25 mg/l. Good to moderate fisheries can be found at 25 to 80 mg/l suspended solids, good fisheries were unlikely to be found at 80 to 400 mg/l, while only poor fisheries are typically found at 400 mg/l (Alabaster, 1972).

Water quality goals for suspended solids (finely divided solids) may be represented by the following categories:

Optimum	= $\leq$ 25 mg/l
Good to Moderate	= >25 to 80 mg/l
Less than moderate	= >80 to 400 mg/l
Poor	= >400 mg/l

Since the TMDL purpose is to restore the biological community to an acceptable condition and attain WQS, a value of 80 mg/l as a mean annual TSS target for wet-weather events was chosen for Swift Run Creek as a secondary target.

Overall, the secondary target of 80 mg/l TSS is intended to evaluate solids load affects and assist in orienting and focusing corrective actions for source reductions. Additional TSS targets, based on flow-related considerations, may be developed as additional data on Swift Run Creek become available. At this time, sufficient, site-specific data are unavailable regarding the flow and TSS concentration relationship associated with storm water sources during wet weather runoff periods to establish specific numeric targets. Therefore, to allow for additional data collection, this TMDL is established as a phased TMDL.

SOURCE ASSESSMENT

Stream flow conditions of Swift Run Creek can best be described as unstable and flashy in response to storm events as characterized by the flow extremes recorded during the June, July, and August 2003 surveys conducted by LTI.

From the Huron River confluence upstream, land use in the Swift Run Creek watershed is dominated by residential, commercial, and transportation uses (Table 3). Such development within a watershed alters its hydrologic characteristics because increased areas of impervious surface result in increased runoff and washoff of solids and pollutant loads being discharged to stream reaches within the watershed (Fonger and Fulcher, 2001; and Schueler and Holland, 2000). Substantial reductions in vegetative riparian zones and pervious areas throughout the watershed of Swift Run Creek and the extensive use of structural features, including paved impervious surface areas (e.g., roads and parking lots), curb and gutter, and numerous direct storm sewer discharges, dominate the landscape and contribute to rapid precipitation runoff rates to Swift Run Creek.

There is one NPDES permitted industrial storm water outfall in the Swift Run Creek watershed: Ann Arbor Manufacturing - Permit Number MIS410029 (Table 1, Figure 2). This facility discharges an undetermined volume of storm water to the headwaters of the stream in the vicinity of Ellsworth Road and is subject to the provisions of the general permit No. MIS510000 that requires identifying the level of control necessary to comply with this TMDL. LTI (2003a) identified one Washtenaw County storm water outfall to Swift Run Creek and at least 25 storm water outfalls that are covered under the city of Ann Arbor's Phase 1 Municipal Separate Storm Sewer System (MS4) program (Table 2, Figure 2). The MS4 permitted outfalls require plan development to achieve the TMDL by minimizing pollutant loads to the "maximum extent practicable."

Determination of the annual TSS loads to the Swift Run Creek watershed from the various land use categories involved estimates of the acres of each land use category (LTI, 2003a), a mean annual rainfall of 34 inches, and USEPA's Simple Method model approach (USEPA, 2001). These aspects were used in conjunction with TSS export coefficients derived from the Rouge River Project (Cave et al., 1994). The estimated annual TSS load from the point sources (WLA) versus the NPS land use categories (LA) in the Swift Run Creek watershed is about 511,844 pounds and 40,945 pounds, respectively (Table 3). The percentage of the total estimated annual TSS load to the Swift Run Creek from NPDES non-storm water point sources (WLA), NPDES storm water sources (WLA), and nonpoint sources (LA) is approximately 552,789 pounds, representing 0%, 93%, and 7% of current contributions, respectively. The use of annual load estimates for TSS is used for comparative purposes to better express the potential magnitude of the TSS loads to Swift Run Creek. Also, this load estimate relates to the 80 mg/l TSS target, a mean annual concentration.

LINKAGE ANALYSIS

A suitable method used to develop a TMDL that addresses the severity of the impacts of sedimentation to a biological community is to measure sediment impacts on stable, colonizable substrates in the stream channel and the associated changes in the biological community.

Increased siltation and embeddedness of colonizable substrates resulting from excessive bank erosion and sedimentation has been demonstrated to impair the biological integrity of rivers (Waters, 1995) by obscuring or reducing the suitability of colonizable or useable substrate by stream biota. With improved habitat through the reduction in sedimentation, both fish and

macroinvertebrate communities respond with an increase in species diversity and an increase in the number of individuals of each species. As a result, the Procedure 51 assessment scores and ratings for quality of the fish and macroinvertebrate communities and habitat are expected to increase as sedimentation rates decline, embeddedness decreases, and habitat diversity increases. These latter characteristics will serve to demonstrate improvement in habitat conditions, WQS attainment, and overall stream quality as expressed through an acceptably rated biological community.

TMDL DEVELOPMENT

The TMDL represents the maximum loading that can be assimilated by a water body while still achieving WQS. The Swift Run Creek biotic community has been impaired by unstable flow conditions, bank erosion, and excessive sedimentation. Therefore, the TMDL is based on reducing sediment loads throughout the watershed to a level that supports a biological community that meets WQS. Using the metrics from Procedure 51, a minimum numeric score of -4 for macroinvertebrate communities and a habitat score of 110 or greater will serve as primary targets for this biota TMDL.

Concurrent with the selection of numeric endpoints, this TMDL also defines the environmental conditions that will be used when defining allowable levels. Some TMDLs are designed around the concept of critical condition. A critical condition is defined as the set of environmental conditions that, if controls are designed to protect, will ensure attainment of objectives for all other important conditions. For example, the critical conditions for the control of point sources in Michigan are provided in Rules 323.1082 and 323.1090 of Michigan's WQS. In general, the lowest monthly 95% exceedance flow for a stream is used to establish effluent limits for point sources. However, the excessive flows to Swift Run Creek are attributable to wet-weather driven discharges. As such, there is no single condition that is protective for all conditions, but efforts are directed towards wet-weather runoff/washoff events.

The secondary target of 80 mg/l TSS is used to develop a TMDL load goal for TSS during wet-weather runoff/washoff events, especially from storm water discharges from the area 1,918 total acres) of urban/industrial/built-up land use category that represents about 66% of the land use area in the Swift Run Creek watershed.

ALLOCATIONS

TMDLs are comprised of the sum of individual WLAs for permitted point sources and LAs for NPS and natural background levels. A margin of safety (MOS), either implicit or explicit, accounts for uncertainty in the relationship between pollutant loads and the quality of the receiving waters. Conceptually, this relationship is defined by the equation:

$$TMDL = \Sigma^{WLAs} + \Sigma^{LAs} + MOS$$

The TMDL represents a maximum load of a pollutant or stressor that can be discharged to a receiving water and still meet WQS. The overall TMDL load capacity is allocated among the three TMDL components: WLA for point sources, LA for NPS and background loads, and the MOS.

WLA

The estimated total annual TSS load from all non-storm water NPDES permitted point sources is zero (Table 1) since there are none in the watershed.

Based on acres of land use categories listed under “Urban/Industrial/Built-Up” of Table 3 and TSS export coefficients derived from the Rouge River Project (Cave et al., 1994), a total annual TSS load estimate of approximately 511,844 pounds is attributable to NPDES industrial and municipal permitted storm water runoff/washoff discharges to the Swift Run Creek watershed (Table 3). All categories are predicted to be meeting the 80 mg/L target secondary target, with the exception of the industrial category, which is predicted to be contributing an average of 149 mg/L TSS to Swift Run Creek (Cave et al., 1994). To achieve the goal of 80 mg/L as an annual average during wet weather events from all point sources, a reduction of only 1% in TSS loads would be necessary from all permitted point sources, resulting in a projected annual WLA of 507,278 pounds of TSS (Table 3).

For individual and general NPDES permitted point source discharges, the receiving stream design flow equals the lowest 95% exceedance flow. However, it is proposed that any TSS limits in NPDES point source permits be established at an effluent limit based on best available treatment (BAT) so as to minimize TSS loads to Swift Run Creek, which then makes it unnecessary to consider mixing zone scenarios. The permitted storm water point source contributions to the WLA are also considered controllable through the existing NPDES permit requirements and storm water through the Phase I and Phase II MS4 programs.

To achieve the primary (biota) and secondary (TSS) TMDL targets, NPDES permitted individual, general, and storm water runoff flows from current or future point sources will need to be managed throughout the watershed to minimize stream bank erosion and habitat impairment that causes a poor macroinvertebrate community within the TMDL reach. It will be necessary to employ BAT (applied to individual or general point sources) or “maximum extent practicable” treatment (storm water point sources) that will attenuate the runoff delivery rates and volume inputs to Swift Run Creek in order to reduce flashiness, better stabilize and normalize stream flow conditions, and minimize stream bank erosion, TSS resuspension, and sedimentation impacts.

LA

The LA component of the TMDL defines the load capacity for a pollutant that is nonpoint in origin that includes the following land use categories: agricultural, forested/shrub/open land, and/or water bodies (Table 1). An estimated annual TSS load of 40,945 pounds (LA) is attributed to these categories of NPS in the watershed. All but the agricultural land uses are treated as background load sources because runoff concentrations of TSS are typically less than 80 mg/l. Therefore, the only targeted load reduction source is from agricultural sources, which has a runoff average TSS concentration of 149 mg/l (Cave et al., 1994). A 46% annual reduction (from 23,868 to 13,168 pounds) from agricultural areas in the watershed is recommended resulting in the annual LA, TSS load target of 30,245 pounds, based on achieving a runoff mean annual average concentration of 80 mg/l TSS, the target concentration during wet-weather runoff/washoff events.

In summary, the proposed accumulative annual TSS load estimate to Swift Run Creek (WLA + LA) is 537,523 pounds/year, an overall 3% reduction from existing estimated loads. With the absence of any individual or general NPDES non-storm water permitted point source discharges in the Swift Run Creek watershed, 0% of the annual load is allocated to individual or general NPDES permitted point sources, 94% (507,278 pounds/year) is allocated to the NPDES permitted industrial storm water and the municipal storm water outfalls covered under the Phase I and Phase II MS4 Storm Water Programs, and 6% (30,245 pounds/year) attributed to the LA.

Suspended solids data from the 2003 LTI study indicate that there are sources either unaccounted for, and/or underestimated, in terms of suspended solids contributions to Swift Run Creek. Land use data used to develop the LA and WLA projections for suspended solids do not predict the elevated TSS concentrations observed during the 2003 wet-weather events; e.g., up to 1115 mg/L TSS. Possibilities for the inconsistency between the modeled WLA/LA TSS contributions and the observed TSS concentrations are underestimated contributions from land use practices and/or sources of TSS originating in-stream (e.g. resuspension and/or stream bank erosion during wet-weather events). The latter is likely the most probable cause for the elevated TSS concentrations observed as evidenced by the increases in both TSS concentrations and flow during wet-weather events.

To achieve the primary and secondary TMDL targets, a reduction in the wet-weather runoff/washoff of TSS load through controls in the runoff rates and volume discharges are necessary. It will require employing BMPs that attenuate the runoff delivery rates and volume inputs to Swift Run Creek in order to reduce flashiness, better stabilize and normalize stream flow conditions, and minimize stream bank erosion, TSS resuspension and excessive sedimentation that impacts habitat quality.

MOS

The MOS in a TMDL is used, in part, to account for variability of source inputs to the system and is either implicit or explicit. An MOS is implicit for a biota TMDL because the quality of the biological community, its integrity, and overall composition represent an integration of the effects of the spatial and temporal variability in sediment loads to the aquatic environment.

The habitat score of equal to or greater than 110 will be used to demonstrate acceptable stream quality conditions and represent adequate control of anthropogenic sediment sources to assure improved habitat quality and the biological communities. This targeted score is closely associated with macroinvertebrate community scores of -3 or greater, potentially providing better results than a minimally acceptable value of -4.

For comparison of survey assessment with results from 2003, follow-up biological and habitat quality assessments will be conducted during stable flow conditions during the months of June through September. The results will best reflect an MOS that is implicit and expresses integration of the effects of the variability in sediment loads in the aquatic environment and minimize seasonal variability.

SEASONALITY

Seasonality is addressed in the TMDL in terms of sampling periods for fish and macroinvertebrate communities. To minimize temporal variability in the biological community, sampling will be conducted during June through September of each year during stable, low flow conditions. For assessing TSS loads to Swift Run Creek, seasonal event monitoring will be conducted to define and characterize both hydraulic and TSS loads from the Swift Run Creek watershed that influences the biota TMDL reach.

MONITORING PLAN

Monitoring will be conducted by the MDEQ to assess progress towards meeting the biota and habitat TMDL targets following implementation of applicable BMPs and control measures. Subsequently, annual sampling of the macroinvertebrate community and habitat quality at locations in the vicinity of Hogback Road and Shetland Drive, as a minimum, will be conducted

until assessment results from two consecutive years demonstrate attainment of TMDL targets at these sites. For best comparative purposes, follow-up biological and habitat assessments will be conducted in a June to September time frame, during stable flow conditions. Every effort will be made to sample during similar stream conditions and assess the same sampling locations.

In-stream monitoring of TSS, stream flow, and representative land use runoff/washoff characteristics for a variety of stable flow and wet-weather events will be necessary to refine the TSS loadings estimates for the Swift Run Creek watershed. This information will further define the level of TSS load reduction necessary, seasonally, climatologically, and annually.

Once the BMPs are in place to minimize the effects of runoff and flashy conditions that exist in Swift Run Creek, stream flow and TSS sampling can be implemented so as to measure progress towards the secondary numeric target of 80 mg/l as a mean annual TSS value during wet-weather runoff events. Multiple sampling during critical high flow events, as well as low flow events, needs to be conducted to estimate future TSS loads in Swift Run Creek.

REASONABLE ASSURANCE

The focus of the actions to protect Swift Run Creek is primarily directed towards installing BMPs and other control measures to reduce and minimize solids loads with primary emphasis on reducing runoff peak flows that result in increased flow flashiness in the stream that substantially increases TSS concentrations resulting from resuspension and bank erosion. Control measures potentially include industrial and municipal storm water discharge volume, chemical-specific permit limits, and approved BMPs for areas currently not under any permit.

Rule 323.2161a(8), adopted pursuant to Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451), allows that "A permittee shall comply with any more stringent effluent limitations in the national permit, including permit requirements that modify or are in addition to, the minimum measure based on a total maximum daily load (TMDL) or equivalent analysis." In addition, Rule 323.2161a(10) allows that the "department may establish monitoring requirements in accordance with state or watershed specific monitoring plans ar as needed for a permitte to demonstrate the pollution reduction achieved by implementing best management practices." For sites of new construction, the rules specifically require development of a program to evaluate the post-construction storm water runoff from projects, including an ordinance designed to prevent or minimize water quality impacts including extreme flow volumes and conditions.

The regulatory mechanisms are available to reduce the storm water impacts of the urban/industrial/built-up sources on Swift Run Creek. Where the necessary data are available, permit requirements will be established in the NPDES permits. Where necessary, additional data to determine specific loadings and flow volumes associated with these sources will be collected through the NPDES permit requirements.

In addition to establishment of permit requirements, the NPDES storm water permittees in the watershed (industrial, Phase I, or Phase II) are required to collectively develop a watershed management plan that includes the detailing of short- and long-term goals and attainment actions, public education plans, illicit discharge elimination plans, and the development (by each local unit of government within the Swift Run Creek watershed) of their individual storm water prevention plans. The Ann Arbor Township and Pittsfield Township master plans acknowledge that proposed actions for the Swift Run Creek watershed are needed to manage both quality and quantity issues to be consistent with Phase I and II water practices for construction and

postconstruction activities (Ann Arbor Township Planning Commission, 2001 and Pittsfield Township, 2001).

The MDEQ district staff will continue to work with and assist interest groups in the Swift Run Creek watershed to assist in defining and designing approvable actions and programs that assess, develop, plan, and implement BMPs and control measures that best minimize or prevent soil erosion and excessive runoff rates to the Swift Run Creek watershed.

Recommended actions include:

- Through monitoring of point source discharges, identify sources of excessive wet-weather TSS loadings and flow volumes to Swift Run Creek through NPDES permit conditions. Establish permit conditions as necessary.

- Upgrade and maintain the current vegetative riparian zone to reduce soil erosion and loadings to Swift Run Creek from sources within the watershed. BMPs need to be employed within the riparian zone adjacent to the urbanized, residential, industrialized, and commercial areas to minimize the loss through erosion and direct runoff/washoff, thereby minimizing habitat impairment of Swift Run Creek.

- Implementation of BMPs in the storm water permits program that reduces sediment loadings and moderate runoff release rates and excessive runoff/washoff to the Swift Run Creek watershed are expected to improve and protect designated use support throughout the watershed. The goals are for reduced solids loadings and greater flow stability throughout the watershed so that WQS are restored and protected. Available guidance regarding runoff detention and stream protection is provided by Fongers and Fulcher, 2001; and Schueler and Holland, 2000.

Prepared By: John Wuycheck
Surface Water Assessment Section
Water Bureau
Michigan Department of Environmental Quality
November 29, 2004

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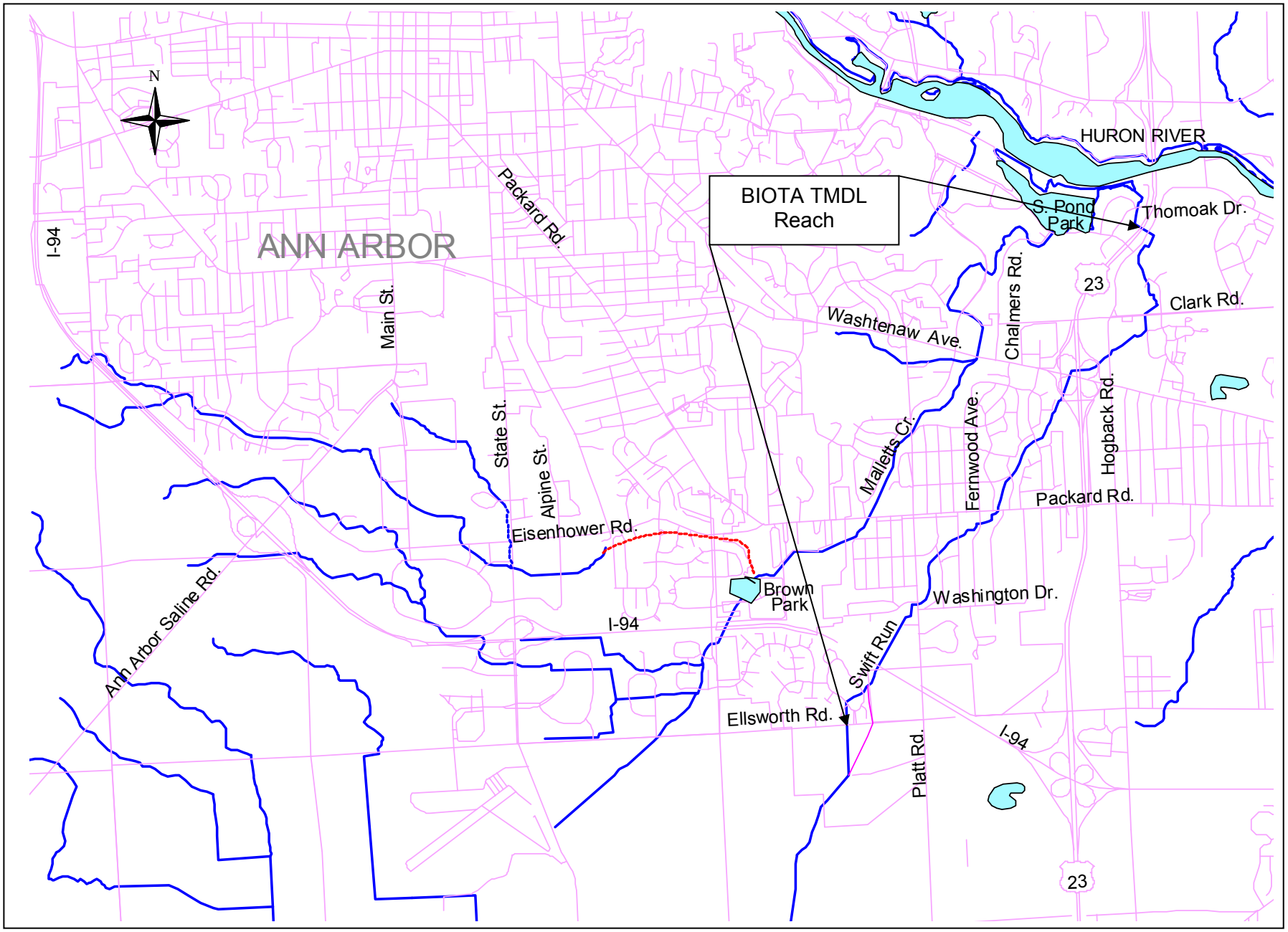

Figure 1. Swift Run Creek Biota TMDL Reach, Washtenaw County, Michigan (MIRIS, 2003).

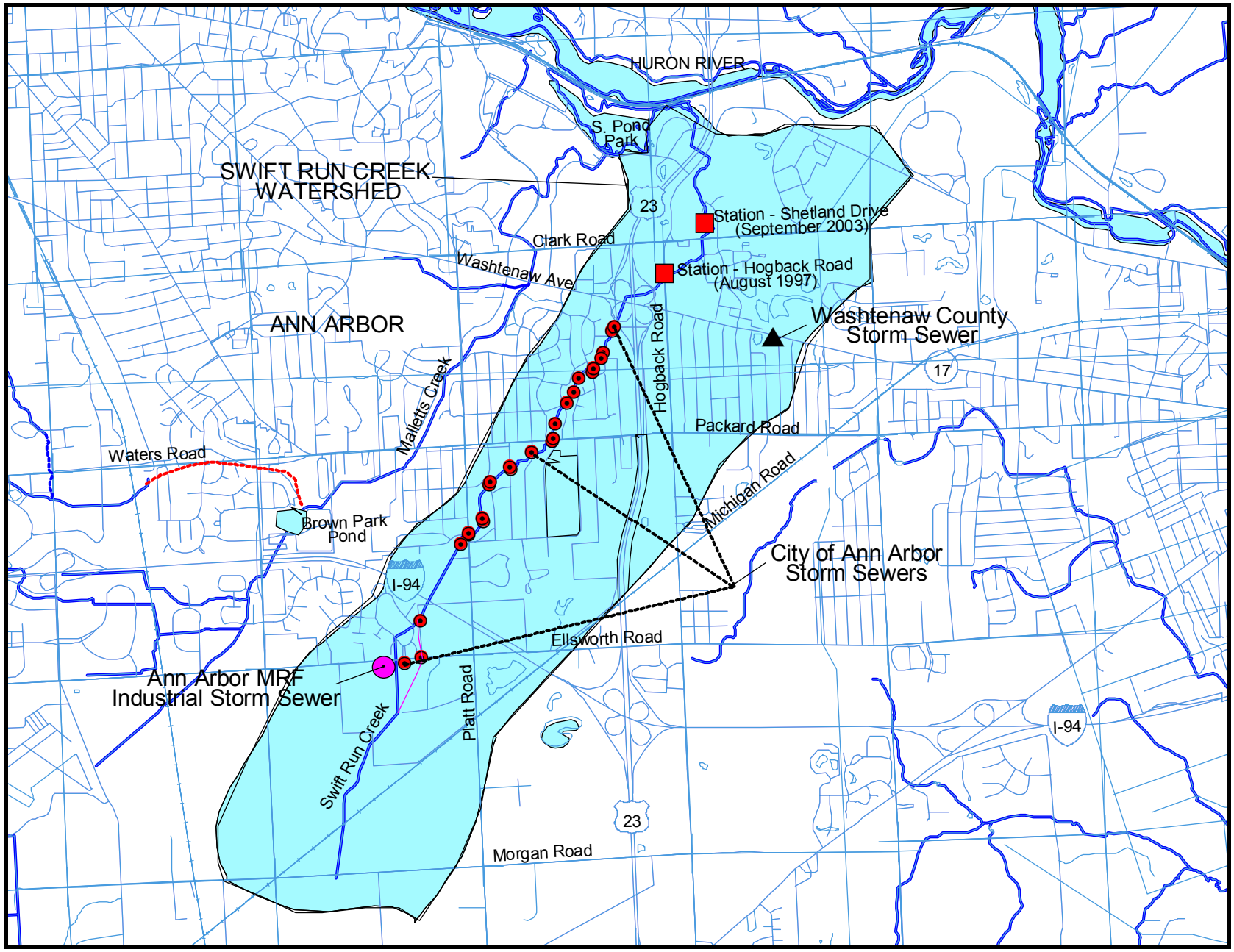

Figure 2. Washtenaw County Phase I storm sewer outfall, city of Ann Arbor managed storm sewers, industrial storm sewer, and biological community assessment sites (August 1997 and September 2003). Source: Scott Wade – (LTI. 2003a).

Table 1. Industrial storm water NPDES permitted outfall tributary to the Swift Run Creek watershed (Source: MDEQ/WB NPDES permit Management System).

FACILITY NAME	PERMIT NUMBER	DESIGN FLOW	LATITUDE (decimal degrees)	LONGITUDE (decimal degrees)
Ann Arbor MRF	MIS410029	unknown	42.2275	-83.7147

Table 2. Washtenaw County Phase I – MS4 Program storm sewer outfalls in the Swift Run Creek watershed managed by the city of Ann Arbor and Washtenaw County (Source: Scott Wade – LTI. 2003a).

Storm Water NPDES Permits (Phase 1 – MS4 Program):

- Washtenaw County **(1 outfall)**
- City of Ann Arbor **(25 outfalls)**

Table 3. Land use categories and TSS loads in the Swift Run Creek watershed, Washtenaw County, Michigan (Source: Scott Wade – LTI [2003a] using 2002 [Ann Arbor] and 1998 [Township] land use coverages).

Source Category	Acres	Estimate Current TSS (pounds/year)*	TMDL TSS Target Load TSS (pounds/year)
WLA Components:			
NPDES Non-Storm Water TSS Load		None	None
Urban/Industrial/Built-Up			
Residential	678	138,943	138,943
Commercial and Service	627	185,514	185,514
Industrial	13	9,861	5,295 (46% reduction)
Transportation/Comm/Util.	600	177,526	177,526
Subtotal:		511,844	507,278 (<1% reduction)
WLA Total:	1,918	511,844	507,278 **(WLA)**
LA Components:			
Agricultural Land			
Cropland	349	23,868	13,168 (45% reduction)
(Background Sources)			
Forested/Shrub/Open Land			
Open Land/Shrub/Range Land	702	16,886	16,886
Water Body			
Lake/Reservoir	9	191	191
LA Subtotal:	1,541	40,945	30,245 **(LA)**
Overall Totals:	2,978	552,789	537,523 (overall 3% reduction)

**TSS load estimates based on PLoad Version 3 model (USEPA, 2001), land use acres derives from 2002 land use database coverage for Ann Arbor, 1998 land use coverage for the townships, and a mean annual rainfall value of 34 inches,*

APPENDIX F

AGENCY CONTACT LETTERS

TABLE OF CONTENTS

HUBBELL, ROTH & CLARK, INC
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April 9, 2019

Bay Mills Indian Community
12140 W. Lakeshore Drive
Brimley, MI 49715

Attn: Paula Carrick, THPO

Re: Washtenaw County 2019 SRF Project Plan Amendment

HRC Job No. 20190134

Dear Ms. Carrick:

Washtenaw County Water Resources Commissioner is providing an amendment to the Washtenaw County 2017 SRF Project Plan previously submitted. This is a follow up letter from the one sent to you on June 7, 2017 about the updated list of 21 projects. For the 2019 amendment, there are a total of 14 projects including:

Ten projects from the previous 2017 SRF plan re-inserted:

- Briarwood Mall Pond
- **Churchill Park/Eisenhower ROW Basin (amended slightly)**
- Detroit Street Brick Rd Stormwater Management
- Huron Hills Golf Course Stormwater Improvements
- Lawton Park Stormwater Basin
- Mallets Streambank Stabilization Phase II
- Millers Creek Channel Modification - Reach 5
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- Traver Creek Tributary Streambank Stabilization

An addition of one project from the 2010 plan:

- Swift Run MDOT

An addition of one project from the 2011 plan:

- Springwater Phase IV Stormwater Improvements

Two new additional projects:

- Carpenter Road Drain Pond Retrofit (Cole Blvd and Hillside Drive)
- Miller Drain/Upper Paint Creek (Glory Lane)

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 an 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 new proposed projects could impact religious or culturally significant tribal lands in the vicinity of the project. A map of the project areas is attached. The twelve projects being re-inserted/added from the 2017, 2010 and 2011 plans were already sent for your review

and do not need to be reviewed again. However, the two new projects added on and the amended Churchill Park project do need to be reviewed.

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.

Prasad Gullapalli, P.E.
Staff Engineer

Attachment

pc: WCWRC; Harry Sheehan
HRC; J. Burton, A. Allen

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April 9, 2019

Grand Traverse Band of Ottawa and Chippewa Indians
2605 NW Bayshore Drive
Peshawbetown, MI 49682

Attn: Cindy Winslow

Re: Washtenaw County 2019 SRF Project Plan Amendment

HRC Job No. 20190134

Dear Ms. Winslow:

Washtenaw County Water Resources Commissioner is providing an amendment to the Washtenaw County 2017 SRF Project Plan previously submitted. This is a follow up letter from the one sent to you on June 7, 2017 about the updated list of 21 projects. For the 2019 amendment, there are a total of 14 projects including:

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HUBBELL, ROTH & CLARK, INC.

Prasad Gullapalli, P.E.
Staff Engineer

Attachment

pc: WCWRC; Harry Sheehan
HRC; J. Burton, A. Allen

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April 9, 2019

Match-e-be-nash-shee-wish Gun Lake Band of Potawatomi Indians
2872 Mission Drive
Shelbyville, MI 49344

Attn: Heather Bush

Re: Washtenaw County 2019 SRF Project Plan Amendment

HRC Job No. 20190134

Dear Ms. Bush:

Washtenaw County Water Resources Commissioner is providing an amendment to the Washtenaw County 2017 SRF Project Plan previously submitted. This is a follow up letter from the one sent to you on June 7, 2017 about the updated list of 21 projects. For the 2019 amendment, there are a total of 14 projects including:

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Very truly yours,
HUBBELL, ROTH & CLARK, INC.

Prasad Gullapalli, P.E.
Staff Engineer

Attachment

pc: WCWRC; Harry Sheehan
HRC; J. Burton, A. Allen

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April 9, 2019

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

Attn: Earl Meshigaud

Re: Washtenaw County 2019 SRF Project Plan Amendment

HRC Job No. 20190134

Dear Mr. Meshigaud:

Washtenaw County Water Resources Commissioner is providing an amendment to the Washtenaw County 2017 SRF Project Plan previously submitted. This is a follow up letter from the one sent to you on June 7, 2017 about the updated list of 21 projects. For the 2019 amendment, there are a total of 14 projects including:

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Prasad Gullapalli, P.E.
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pc: WCWRC; Harry Sheehan
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April 9, 2019

Keweenaw Bay Indian Community
16429 Bear Town Road
Baraga, MI 49908

Attn: Gary Loonsfoot Jr., THPO

Re: Washtenaw County 2019 SRF Project Plan Amendment

HRC Job No. 20190134

Dear Mr. Loonsfoot:

Washtenaw County Water Resources Commissioner is providing an amendment to the Washtenaw County 2017 SRF Project Plan previously submitted. This is a follow up letter from the one sent to you on June 7, 2017 about the updated list of 21 projects. For the 2019 amendment, there are a total of 14 projects including:

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Prasad Gullapalli, P.E.
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Attachment

pc: WCWRC; Harry Sheehan
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April 9, 2019

Lac Vieux Desert Band of Lake Superior Chippewa Indians
P.O. Box 249
Watersmeet, MI 49908
Attn: Giiwegiizhigookway Martin, THPO

Re: Washtenaw County 2019 SRF Project Plan Amendment

HRC Job No. 20190134

Dear Ms. Martin:

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HUBBELL, ROTH & CLARK, INC.

Prasad Gullapalli, P.E.
Staff Engineer

Attachment

pc: WCWRC; Harry Sheehan
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Lansing

April 9, 2019

Little River Band of Ottawa Indians
2608 Government Center Drive
Manistee, MI 49660

Attn: Jay Sam, Director

Re: Washtenaw County 2019 SRF Project Plan Amendment

HRC Job No. 20190134

Dear Mr. Sam:

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Prasad Gullapalli, P.E.
Staff Engineer

Attachment

pc: WCWRC; Harry Sheehan
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April 9, 2019

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

Attn: Wes Andrews

Re: Washtenaw County 2019 SRF Project Plan Amendment

HRC Job No. 20190134

Dear Mr. Andrews:

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Prasad Gullapalli, P.E.
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Attachment

pc: WCWRC; Harry Sheehan
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April 9, 2019

Nottawaseppi Band of Huron Potawatomi
1485 Mno-Bmadzewen Way
Fulton, MI 49052

Attn: Mon-ee Zapata, Cultural Specialist

Re: Washtenaw County 2019 SRF Project Plan Amendment

HRC Job No. 20190134

Dear Ms. Zapatta:

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Prasad Gullapalli, P.E.
Staff Engineer

Attachment

pc: WCWRC; Harry Sheehan
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April 9, 2019

Pokagon Band of Potawtomi
58620 Sink Road
Dowagiac, MI 49047

Attn: Marcus Winchester, THPO

Re: Washtenaw County 2019 SRF Project Plan Amendment

HRC Job No. 20190134

Dear Mr. Winchester:

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Prasad Gullapalli, P.E.
Staff Engineer

Attachment

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April 9, 2019

Saginaw Chippewa Indian Tribe of MI
6650 E. Broadway
Mt. Pleasant, MI 48858

Attn: William Johnson, Interim THPO

Re: Washtenaw County 2019 SRF Project Plan Amendment

HRC Job No. 20190134

Dear Mr. Johnson:

Washtenaw County Water Resources Commissioner is providing an amendment to the Washtenaw County 2017 SRF Project Plan previously submitted. This is a follow up letter from the one sent to you on June 7, 2017 about the updated list of 21 projects. For the 2019 amendment, there are a total of 14 projects including:

Ten projects from the previous 2017 SRF plan re-inserted:

- Briarwood Mall Pond
- **Churchill Park/Eisenhower ROW Basin (amended slightly)**
- Detroit Street Brick Rd Stormwater Management
- Huron Hills Golf Course Stormwater Improvements
- Lawton Park Stormwater Basin
- Mallets Streambank Stabilization Phase II
- Millers Creek Channel Modification - Reach 5
- Seventh (Scio Church to Greenview) Stormwater Improvement
- Street Tree Planting (FY2016-FY2020)
- Traver Creek Tributary Streambank Stabilization

An addition of one project from the 2010 plan:

- Swift Run MDOT

An addition of one project from the 2011 plan:

- Springwater Phase IV Stormwater Improvements

Two new additional projects:

- Carpenter Road Drain Pond Retrofit (Cole Blvd and Hillside Drive)
- Miller Drain/Upper Paint Creek (Glory Lane)

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 an 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 new proposed projects could impact religious or culturally significant tribal lands in the vicinity of the project. A map of the project areas is attached. The twelve projects being re-inserted/added from the 2017, 2010 and 2011 plans were already sent for your review

and do not need to be reviewed again. However, the two new projects added on and the amended Churchill Park project do need to be reviewed.

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.

Prasad Gullapalli, P.E.
Staff Engineer

Attachment

pc: WCWRC; Harry Sheehan
HRC; J. Burton, A. Allen

HUBBELL, ROTH & CLARK, INC
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Jesse B. VanDeCreek
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Michael C. MacDonald
James F. Burton
Charles E. Hart
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Jesse M. Morgan

HUBBELL, ROTH & CLARK, INC.
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OTHER OFFICE LOCATIONS
Delhi Township
Detroit
Grand Rapids
Howell
Jackson
Kalamazoo
Lansing

April 9, 2019

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

Attn: Colleen Medicine

Re: Washtenaw County 2019 SRF Project Plan Amendment

HRC Job No. 20190134

Dear Ms. Medicine:

Washtenaw County Water Resources Commissioner is providing an amendment to the Washtenaw County 2017 SRF Project Plan previously submitted. This is a follow up letter from the one sent to you on June 7, 2017 about the updated list of 21 projects. For the 2019 amendment, there are a total of 14 projects including:

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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 an 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 new proposed projects could impact religious or culturally significant tribal lands in the vicinity of the project. A map of the project areas is attached. The twelve projects being re-inserted/added from the 2017, 2010 and 2011 plans were already sent for your review

and do not need to be reviewed again. However, the two new projects added on and the amended Churchill Park project do need to be reviewed.

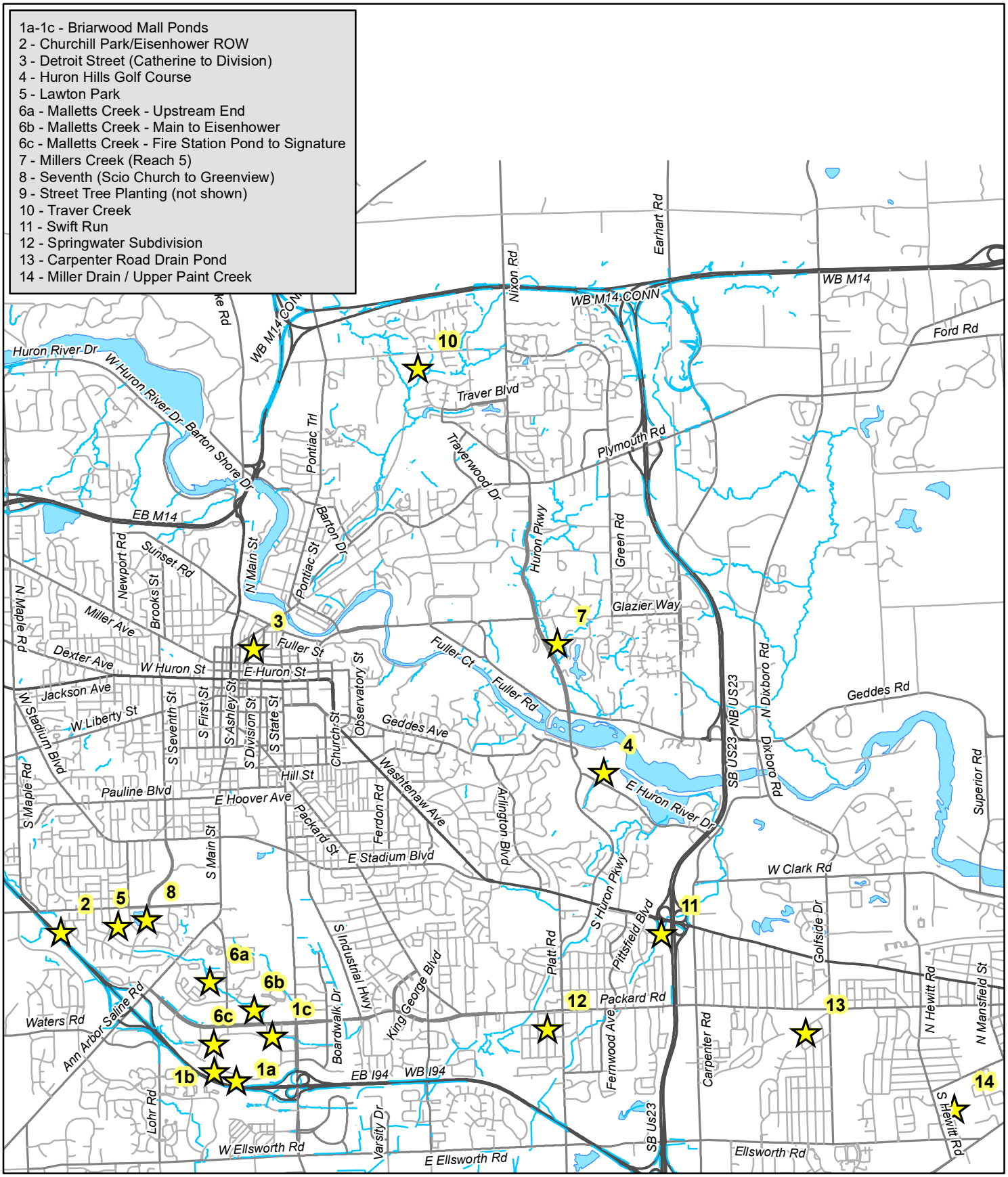
Please inform us of your findings at your earliest convenience. If you have any questions or require any additional information, please contact the undersigned.

Very truly yours,
HUBBELL, ROTH & CLARK, INC.

Prasad Gullapalli, P.E.
Staff Engineer

Attachment

pc: WCWRC; Harry Sheehan
HRC; J. Burton, A. Allen



Overall Project Locations
Project Plan Amendment 2019

Figure 1

N
W E
S

0 0.7 1.4 Miles

HRC
HUBBELL, ROTH & CLARK, INC
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Document Path: Y:\2019\01\2019\0134\03_Studies\Working\GIS\OverallProjectLocations.mxd

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Delhi Township
Detroit
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Jackson
Kalamazoo
Lansing

April 10, 2019

Jackson District Office
301 East Louis Glick Highway
Jackson, MI 49201-1556

Attn: Donna Cervelli

Re: Washtenaw County 2019 SRF Project Plan Update HRC Job No. 20190134

Dear Ms. Cervelli:

Washtenaw County Water Resources Commissioner is providing an amendment to the Washtenaw County 2017 SRF Project Plan previously submitted. This is a follow up to the letter sent to you on April 5, 2017 about the updated list of 21 project sites. For the 2019 amendment, there are a total of 14 projects including:

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- Miller Drain/Upper Paint Creek (Glory Lane)

Please see the enclosed map for your reference of all sites. 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.

Prasad Gullapalli, P.E.
Staff Engineer

Attachment

pc: WCWRC; Harry Sheehan
HRC; J. Burton, A. Allen

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April 10, 2019

Jackson District Office
301 East Louis Glick Highway
Jackson, MI 49201-1556

Attn: Luke Golden

Re: Washtenaw County 2019 SRF Project Plan Update HRC Job No. 20190134

Dear Mr. Golden:

Washtenaw County Water Resources Commissioner is providing an amendment to the Washtenaw County 2017 SRF Project Plan previously submitted. This is a follow up to the letter sent to you on April 5, 2017 about the updated list of 21 project sites. For the 2019 amendment, there are a total of 14 projects including:

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Very truly yours,

HUBBELL, ROTH & CLARK, INC.

Prasad Gullapalli, P.E.
Staff Engineer

Attachment

pc: WCWRC; Harry Sheehan
HRC; J. Burton, A. Allen

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April 10, 2019

Jackson District Office
301 East Louis Glick Highway
Jackson, MI 49201-1556

Attn: Michael Van Loan

Re: Washtenaw County 2019 SRF Project Plan Update HRC Job No. 20190134

Dear Mr. Van Loan:

Washtenaw County Water Resources Commissioner is providing an amendment to the Washtenaw County 2017 SRF Project Plan previously submitted. This is a follow up to the letter sent to you on April 5, 2017 about the updated list of 21 project sites. For the 2019 amendment, there are a total of 14 projects including:

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HUBBELL, ROTH & CLARK, INC.

Prasad Gullapalli, P.E.
Staff Engineer

Attachment

pc: WCWRC; Harry Sheehan
HRC; J. Burton, A. Allen

MICHIGAN STATE UNIVERSITY | Extension

Information Agreement

The Michigan Natural Features Inventory (MNFI) is a member of the Natural Heritage Program Network and is part of Michigan State University Extension. MNFI is an organization of professionals dedicated to the conservation of Michigan's special natural features. MNFI has the responsibility for inventorying and collecting information about the state's "elements of biological diversity". These data are used to guide conservation and land management activities throughout the state.

MNFI manages an ongoing and continuously updated information and research database. The database is proprietary and the most comprehensive single source of existing information on Michigan's endangered, threatened, or otherwise significant plant and animal species, natural plant communities, and other natural features. This database cannot provide a definitive statement on the presence, absence, or condition of the natural features in any given locality, since most sites have not been specifically or thoroughly surveyed. Furthermore, plant and animal populations and natural communities change with time. Therefore, the information services provided should not be regarded as a complete statement on the occurrence of special natural features of the area in question. In many cases the information may require the interpretation of a trained scientist.

The recipient(s) of the information understand that state endangered and threatened species are protected under state law (Act 451 of 1994, the Natural Resources and Environmental Protection Act, Part 365, Endangered Species Protection). Any questions, observations, new findings, violations or permitting of project activities should be conducted with the Michigan Department of Natural Resources, Wildlife Division. Contact the Endangered Species Coordinator at (517) 284-6194. The recipient(s) of the information understand that federally endangered and threatened species are protected under federal law (Endangered Species Act of 1973). Any questions, observations, new findings, violations or permitting of project activities should be conducted with the U.S. Fish and Wildlife Service in East Lansing. Their phone number is (517) 351-2555. Recipients of the information are responsible for ensuring the protection of protected species before project activities begin.

MNFI is a not-for-profit entity and fees for the data are turned back into database maintenance and program support. The costs for information can be obtained on our website MNFI.ANR.MSU.EDU under the services heading. By acceptance of the information services made available through MNFI, the recipient understands that access to the information is provided for primary use only. MNFI requests that the user respect the confidential and sensitive nature of the information and restrict access to only those individuals requiring the information for the primary use. There should be no redistribution of the information. Distribution of information regarding locations of many rare species represents a threat to their protection. Additionally, since the information is constantly being updated MNFI requests that any information service provided by MNFI is destroyed upon completion of the primary use. This information should be considered valid for one year only.

The user should identify MNFI as information contributors on any map or publication using MNFI information, as follows: **Michigan Natural Features Inventory. [Year]. Biotics 5 - Michigan's Natural Heritage Database. Lansing, Michigan. (Accessed: Month Day, Year).** Abbreviations are acceptable on maps if referenced in full on accompanying documents.

MSU EXTENSION

Michigan Natural Features Inventory

P.O. Box 13036
Lansing, MI 48901

(517) 284-6200
fax: (517) 373-9566

mnfi.anr.msu.edu

Rare Species Review #2367 - Washtenaw County Water Resources Commissioner SRF Project Plan

☑ Standard turn around

☐ Eight-day turn around

Project or primary use of Information: Review of data for potential impacts to protected and rare species

Description of information: For the intended area and 1.5 miles surrounding.

Ashley Allen
Recipient (Please Print)

Ashley Allen
Signature

Hubbell, Roth + Clark, Inc.
Organization/Association

4-11-19
Date

Allen, Ashley

From: Sanders, Mike (DNR) <SandersM1@michigan.gov>
Sent: Thursday, April 25, 2019 11:53 AM
To: Allen, Ashley
Subject: RE: Rare Species Review Request
Attachments: RSR #2367 Response Letter.pdf; RSR #2367 Response Letter Comments.pdf; RSR_2367 _Section 7 Comments -Washtenaw County.pdf

Hi Ashley,

Please find our response letter for Rare Species Review #2367 in Washtenaw County, Michigan.
Also included are comments for projects involving federal funding or a federal agency authorization.

Please let me know if you have questions or comments.

Thank you,

Mike Sanders

Michael A. Sanders
Environmental Review Specialist/Zoologist
Michigan Natural Features Inventory
MSU Extension Service
PO Box 13036
Lansing, MI 48901
Office: 517-284-6215
Cell: 517-980-5632
Sander75@msu.edu

From: Allen, Ashley <AAllen@hrcengr.com>
Sent: Monday, April 8, 2019 2:43 PM
To: mnfi@msu.edu
Cc: Gullapalli, Prasad <PGullapalli@hrcengr.com>; Harry Sheehan <sheehanh@washtenaw.org>
Subject: Rare Species Review Request

Good afternoon,

Hubbell, Roth & Clark Inc. (HRC) is presently working with the Washtenaw County Water Resource Commissioner to amend the current 2017 SRF Project Plan for improvements in mitigating non-point source pollution. The 2017 Plan had 21 total sites and the new 2019 Amendment now has 14 total sites. We are writing in request of a Rare Species Review for the new projects added.

Ten projects are being re-inserted from the 2017 SRF Plan with one slight amendment to Churchill Park/Eisenhower ROW Basin project. An addition of one project from the 2010 plan, an addition of one project from the 2011 project plan, and two new projects are being added.

The new project locations can be found at Township 03 S, Range 06 E Sections, 12; and Township 03 S, Range 07 E, Section 07; and Township 03 S, Range 05 E, SEC 01.

- 2017 Amended Project – Churchill Park/Eisenhower ROW Basin: Barn property next to 5 acres of empty lot are currently at site (T3S, R5E, SEC 1)
- New project – Carpenter Road Drain Pond Retrofit: Drain, basin, siphon, and ponds are currently at project site (T3S, R6E, SEC 12)
- New project – Miller Drain/Upper Paint Creek: Streambank stabilization in drain (T3S, R7E, SEC 7)

Please let us know if any additional information is needed or if you have any questions.

Thanks,

Ashley Allen
Staff Analyst – Environmental Engineering Department
Phone: (248) 454-6300
Direct: (248) 454-6832
Cell Phone: (248) 464-7834
Email: aallen@hrcengr.com
Hubbell, Roth & Clark, Inc.
555 Hulet Dr.
Bloomfield Hills, MI 48303
www.hrcengr.com

HUBBELL, ROTH & CLARK, INC
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Engineering. Environment. Excellence.

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MICHIGAN STATE UNIVERSITY | Extension

Ashley Allen
Hubbell, Roth & Clark, Inc.
555 Hulet Drive
PO Box 824
Bloomfield Hills, MI 48303-0824

April 25, 2019

Re: Rare Species Review #2367 – Washtenaw County Water Resource Commissioner, 2019 SRF Project Plan Amendments, Washtenaw County, MI.

Ms. Allen,

The location for the proposed project was checked against known localities for rare species and unique natural features, which are recorded in the Michigan Natural Features Inventory (MNFI) natural heritage database. This continuously updated database is a comprehensive source of existing data on Michigan's endangered, threatened, or otherwise significant plant and animal species, natural plant communities, and other natural features. Records in the database indicate that a qualified observer has documented the presence of special natural features. The absence of records in the database for a site may mean that the site has not been surveyed. The only way to obtain a definitive statement on the status of natural features is to have a competent biologist perform a complete field survey.

Under Act 451 of 1994, the Natural Resources and Environmental Protection Act, Part 365, Endangered Species Protection, "a person shall not take, possess, transport, …fish, plants, and wildlife indigenous to the state and determined to be endangered or threatened," unless first receiving an Endangered Species Permit from the Michigan Department of Natural Resources (MDNR), Wildlife Division. Responsibility to protect endangered and threatened species is not limited to the lists below. Other species may be present that have not been recorded in the database.

Several rare natural features have been documented within 1.5-miles of the project sites and **it is possible** that negative impacts will occur. This response reflects a desktop review of the database and MNFI cannot fully evaluate this project without visiting the area. MNFI offers several levels of Rare Species Reviews, including field surveys which I would be happy to discuss with you.

Sincerely,

Michael A. Sanders

Michael A. Sanders
Environmental Review Specialist/Zoologist
Michigan Natural Features Inventory

MSU EXTENSION

Michigan Natural Features Inventory

PO Box 13036
Lansing MI 48901

(517) 284-6200
Fax (517) 373-9566

mnfi.anr.msu.edu

Comments for Rare Species Review #2367:

It is important to note that it is the applicant's responsibility to comply with both state and federal threatened and endangered species legislation. Therefore, if a state listed species occurs at a project site, and you think you need an endangered species permit please contact: Casey Reitz, DNR-Wildlife Division, 517-284-6210, or ReitzC@michigan.gov. If a federally listed species is involved and, you think a permit is needed, please contact Carrie Tansy, Endangered Species Program, U.S. Fish and Wildlife Service, East Lansing office, 517-351-8375, or Carrie_Tansy@fws.gov.

Please consult MNFI's Rare Species Explorer for additional information regarding the listed species.

Table 1: Occurrences threatened and endangered species within 1.5 miles of RSR #2367

ELCAT	SNAME	SCOMNAME	USESA	SPROT	G_RANK	S_RANK	FIRSTOBS	LASTOBS
Animal	*Epioblasma triquetra*	Snuffbox	LE	E	G3	S1S2	1958	1958-05-17
Animal	*Chrosomus erythrogaster*	Southern redbelly dace		E	G5	SH	1922	1922-05-08
Animal	*Clonophis kirtlandii*	Kirtland's snake		E	G2	S1	1902	1902-07
Animal	*Cryptotis parva*	Least shrew		T	G5	S1S2	1902	1944-10-25
Animal	*Cyclonaias tuberculata*	Purple wartyback		T	G5	S2	1903	1997-04
Animal	*Cryptotis parva*	Least shrew		T	G5	S1S2	1941	1941-10-24
Animal	*Chrosomus erythrogaster*	Southern redbelly dace		E	G5	SH		1973-05-09
Animal	*Myotis sodalis*	Indiana bat	LE	E	G2	S1	1946	1965-05-11
Animal	*Acris blanchardi*	Blanchard's cricket frog		T	G5	S2S3	1950	1950-05-20
Animal	*Euphyes dukesi*	Dukes' skipper		T	G3	S2	2002-07-30	2002-07-30
Animal	*Noturus stigmosus*	Northern madtom		E	G3	S1	1903-10-29	1903-10-29
Animal	*Chrosomus erythrogaster*	Southern redbelly dace		E	G5	SH	1912-03-31	1922-05-11
Animal	*Euphyes dukesi*	Dukes' skipper		T	G3	S2	2005-07-12	2005-07-28
Animal	*Ammodramus henslowii*	Henslow's sparrow		E	G4	S3	2007-06-06	2007-06-29
Animal	*Falco peregrinus*	Peregrine falcon		E	G4	S3	2006	2018
Animal	*Ligumia recta*	Black sandshell		E	G4G5	S1?	1958-05-17	1958-05-17
Animal	*Alasmidonta viridis*	Slippershell		T	G4G5	S2S3	1925-07-17	1925-07-17
Animal	*Alasmidonta viridis*	Slippershell		T	G4G5	S2S3		
Animal	*Lampsilis fasciola*	Wavyrayed lampmussel		T	G5	S2	1903	1958
Animal	*Gastrocopta holzingeri*	Lambda snaggletooth		E	G5	S1	1942	1942
Animal	*Cygnus buccinator*	Trumpeter swan		T	G4	S3	2016-03-29	2018-05-28
Animal	*Euphyes dukesi*	Dukes' skipper		T	G3	S2	1956	1962
Animal	*Cygnus buccinator*	Trumpeter swan		T	G4	S3	2017-04-12	2017-09-25
Animal	*Cygnus buccinator*	Trumpeter swan		T	G4	S3	2017-08-23	2017-08-23
Plant	*Populus heterophylla*	Swamp or Black cottonwood		E	G5	S1	1919	1980-05
Plant	*Carex lupuliformis*	False hop sedge		T	G4	S2	1926	1926-07-21

Plant	*Gentiana alba*	White gentian		E	G4	S1	1926	1926-09-29
Plant	*Eupatorium sessilifolium*	Upland boneset		T	G5	S1	1937	1937-09-17
Plant	*Dichanthelium leibergii*	Leiberg's panic grass		T	G4	S2	1995-07-24	2001-07-20
Plant	*Hydrastis canadensis*	Goldenseal		T	G3G4	S2	1935	1935-05-23
Plant	*Muhlenbergia richardsonis*	Mat muhly		T	G5	S2	1979	1981-07-24
Plant	*Eupatorium sessilifolium*	Upland boneset		T	G5	S1	1997-07-24	2018-08-06
Plant	*Galearis spectabilis*	Showy orchis		T	G5	S2	1869	1894-05-23
Plant	*Dichanthelium leibergii*	Leiberg's panic grass		T	G4	S2	1938	1938-06-02
Plant	*Hydrastis canadensis*	Goldenseal		T	G3G4	S2	1870	1926-06-04
Plant	*Silphium laciniatum*	Compass plant		T	G5	S1S2	1924	1928-06-27
Plant	*Morus rubra*	Red mulberry		T	G5	S2	1880	1880-05-18
Plant	*Hydrastis canadensis*	Goldenseal		T	G3G4	S2	1950-05	2018-06-13
Plant	*Cypripedium candidum*	White lady slipper		T	G4	S2	1940	1940-06-09
Plant	*Linum virginianum*	Virginia flax		T	G4G5	S2	1862	1862-08-03
Plant	*Gentiana alba*	White gentian		E	G4	S1	1906	1906
Plant	*Trillium sessile*	Toadshade		T	G4G5	S2S3	1924	1924
Plant	*Panax quinquefolius*	Ginseng		T	G3G4	S2S3	1938	1980
Plant	*Hydrastis canadensis*	Goldenseal		T	G3G4	S2	1912	1912-07-19
Plant	*Poa paludigena*	Bog bluegrass		T	G3	S2	1938	1938-06-05
Plant	*Dichanthelium leibergii*	Leiberg's panic grass		T	G4	S2	1996	1996-06-14
Plant	*Hydrastis canadensis*	Goldenseal		T	G3G4	S2	1937-05-17	1974-05-07
Plant	*Panax quinquefolius*	Ginseng		T	G3G4	S2S3	1867	1867
Plant	*Gentianella quinquefolia*	Stiff gentian		T	G5	S2	1860	1924
Plant	*Cypripedium candidum*	White lady slipper		T	G4	S2	1947	1984-06-17
Plant	*Endodeca serpentaria*	Virginia snakeroot		T	G4	S2	1909	1962-06
Plant	*Hydrastis canadensis*	Goldenseal		T	G3G4	S2	1863	2000-09-07
Plant	*Polemonium reptans*	Jacob's ladder		T	G5	S2	1982	1982-05-20
Plant	*Cypripedium candidum*	White lady slipper		T	G4	S2	1960-pre?	1960-pre?
Plant	*Dichanthelium leibergii*	Leiberg's panic grass		T	G4	S2	1996-06-14	2001-07-16
Plant	*Zizania aquatica*	Wild rice		T	G5	S2S3	1909	1918-08-10
Plant	*Chelone obliqua*	Purple turtlehead		E	G4	S1	1995-09-30	2001-10-22
Plant	*Dichanthelium leibergii*	Leiberg's panic grass		T	G4	S2	1983-09-19	1983-09-19
Plant	*Justicia americana*	Water willow		T	G5	S2	2018-09-07	2018-09-07
Plant	*Hydrastis canadensis*	Goldenseal		T	G3G4	S2	1994	1994-05-14
Plant	*Galearis spectabilis*	Showy orchis		T	G5	S2	1880	1891-05-28
Plant	*Silphium perfoliatum*	Cup plant		T	G5	S2	1919	1920-07-24

Plant	*Cypripedium candidum*	White lady slipper		T	G4	S2	1971	1981-09-02
Plant	*Sanguisorba canadensis*	Canadian burnet		E	G5	S1	1924	2001-09-24
Plant	*Gentiana alba*	White gentian		E	G4	S1	1924	1924
Plant	*Gentiana puberulenta*	Downy gentian		E	G4G5	S1	1861	1867
Plant	*Hydrastis canadensis*	Goldenseal		T	G3G4	S2	1898	2018-08-06
Plant	*Valeriana edulis var. ciliata*	Edible valerian		T	G5T3	S2	1947	1981-07-24
Plant	*Valeriana edulis var. ciliata*	Edible valerian		T	G5T3	S2	1860	1860
Plant	*Asclepias sullivantii*	Sullivant's milkweed		T	G5	S2	2001-07-18	2013-06-07
Plant	*Morus rubra*	Red mulberry		T	G5	S2	2000-10-27	2000-10-27
Plant	*Trillium sessile*	Toadshade		T	G4G5	S2S3	1999-05	1999-05
Plant	*Spiranthes ovalis*	Lesser ladies'-tresses		T	G5?	S1	1997-10-03	1997-10-03
Plant	*Gentianella quinquefolia*	Stiff gentian		T	G5	S2	1997-10-20	1997-10-20
Plant	*Endodeca serpentaria*	Virginia snakeroot		T	G4	S2	2008-06-17	2008-06-17
Plant	*Spiranthes ovalis*	Lesser ladies'-tresses		T	G5?	S1	2011-10-11	2011-10-11
Plant	*Chelone obliqua*	Purple turtlehead		E	G4	S1		
Plant	*Panax quinquefolius*	Ginseng		T	G3G4	S2S3	2011-07-03	2011-07-03
Plant	*Agrimonia rostellata*	Beaked agrimony		T	G5	S2	2018-07-24	2018-08-23
Plant	*Asclepias purpurascens*	Purple milkweed		T	G5?	S2	2001-06-18	2018-06-28
Plant	*Justicia americana*	Water willow		T	G5	S2	2018-09-07	2018-09-07

Of concern: See supporting comments document.

Table 2: Occurrences of special concern species & natural communities within 1.5 miles of RSR #2367

ELCAT	SNAME	SCOMNAME	USESA	SPROT	G_RANK	S_RANK	FIRSTOBS	LASTOBS
Animal	*Regina septemvittata*	Queen snake		SC	G5	S2S3	2017-09-16	2017-09-16
Animal	*Thamnophis butleri*	Butler's garter snake		SC	G4	S4	2016-05-28	2016-05-28
Animal	*Sistrurus catenatus*	Eastern massasauga	LT	SC	G3	S3	1904	2018-08-02
Animal	*Nicrophorus americanus*	American burying beetle	LE	X	G2G3	SH		1916-08-07
Animal	*Pyrgulopsis letsoni*	Gravel pyrg		SC	GU	SH	1945	1946-11
Animal	*Microtus pinetorum*	Woodland vole		SC	G5	S3S4	1921	1921-07-15
Animal	*Terrapene carolina carolina*	Eastern box turtle		SC	G5T5	S2S3	1900	1900
Animal	*Calephelis mutica*	Swamp metalmark		SC	G3	S1	1930	1930
Animal	*Battus philenor*	Pipevine swallowtail		SC	G5	S2S3	1931	2015-08-27
Animal	*Alasmidonta marginata*	Elktoe		SC	G4	S3?	1924-10-04	1977
Animal	*Villosa iris*	Rainbow		SC	G5Q	S3	1903-10-30	1977
Animal	*Noturus miurus*	Brindled madtom		SC	G5	S2	1936-09-11	1936-09-11

Animal	*Noturus miurus*	Brindled madtom		SC	G5	S2	1972-10-03	1972-10-03
Animal	*Etheostoma spectabile*	Orangethroat darter		SC	G5	S1	1920-05-01	1920-05-01
Animal	*Etheostoma spectabile*	Orangethroat darter		SC	G5	S1	1922-05-11	1922-05-11
Animal	*Sistrurus catenatus*	Eastern massasauga	LT	SC	G3	S3	2003-08-29	2003-08-29
Animal	*Ammodramus savannarum*	Grasshopper sparrow		SC	G5	S4	2003	2008-06-20
Animal	*Utterbackia imbecillis*	Paper pondshell		SC	G5	S2S3	1916-10	1916-10
Animal	*Utterbackia imbecillis*	Paper pondshell		SC	G5	S2S3	1917	1945-10-31
Animal	*Utterbackia imbecillis*	Paper pondshell		SC	G5	S2S3	1922-10	1945-09-09
Animal	*Utterbackia imbecillis*	Paper pondshell		SC	G5	S2S3	1946-11	1946-11
Animal	*Ptychobranchus fasciolaris*	Kidney shell		SC	G4G5	S2	1903	1971-pre
Animal	*Ptychobranchus fasciolaris*	Kidney shell		SC	G4G5	S2	1958-05-17	1958-05-17
Animal	*Ptychobranchus fasciolaris*	Kidney shell		SC	G4G5	S2	1945-09-09	1945-09-09
Animal	*Pleurobema sintoxia*	Round pigtoe		SC	G4G5	S3	1898-08-26	1898-08-26
Animal	*Oxyloma peoriense*	Depressed ambersnail		SC	G4G5	SNR		
Animal	*Sphaerium fabale*	River fingernail clam		SC	G5	SNR		
Animal	*Ventridens suppressus*	Flat dome		SC	G5	SNR	1943-08-23	1943-08-23
Animal	*Mesomphix cupreus*	Copper button		SC	G5	S1	1943-05-26	1943-05-26
Animal	*Mesomphix cupreus*	Copper button		SC	G5	S1	1944-05-16	1944-05-16
Animal	*Mesomphix cupreus*	Copper button		SC	G5	S1	1925-06-28	1925-06-28
Animal	*Mesomphix cupreus*	Copper button		SC	G5	S1	1943-05-09	1943-05-09
Animal	*Mesomphix cupreus*	Copper button		SC	G5	S1	1925	1925
Animal	*Mesomphix cupreus*	Copper button		SC	G5	S1	1932-05-01	1932-05-01
Animal	*Mesomphix cupreus*	Copper button		SC	G5	S1		
Animal	*Myotis septentrionalis*	Northern long-eared bat	LT	SC	G1G2	S1	1902-03-01	2003-07-09
Animal	*Myotis lucifugus*	Little brown bat		SC	G3	S1	1948-08-16	1992-08-23
Animal	*Regina septemvittata*	Queen snake		SC	G5	S2S3	2015-05-08	2015-05-08
Animal	*Sistrurus catenatus*	Eastern massasauga	LT	SC	G3	S3	1904	1904
Animal	*Lasmigona compressa*	Creek heelsplitter		SC	G5	S3		
Animal	*Lasmigona compressa*	Creek heelsplitter		SC	G5	S3	1923	1978-11-17
Animal	*Lasmigona costata*	Flutedshell		SC	G5	SNR	1895-08-25	1895-08-25
Animal	*Bombus affinis*	Rusty-patched bumble bee	LE	SC	G1	SNR	1988-07-28	1988-09-25
Animal	*Bombus affinis*	Rusty-patched bumble bee	LE	SC	G1	SNR	1917-09-06	1999-09-19
Animal	*Bombus affinis*	Rusty-patched bumble bee	LE	SC	G1	SNR	1983-05-29	1983-05-29
Animal	*Bombus pensylvanicus*	American bumble bee		SC	G3G4	SNR	1901-10-05	1936-05-15

Animal	*Bombus pensylvanicus*	American bumble bee		SC	G3G4	SNR	1929	1929
Animal	*Bombus auricomus*	Black and gold bumble bee		SC	G4G5	SNR	1901-07-16	1901-07-16
Animal	*Spiza americana*	Dickcissel		SC	G5	S3	2017-06-23	2017-06-23
Animal	*Bombus pensylvanicus*	American bumble bee		SC	G3G4	SNR	1914-05-22	1933-08-05
Animal	*Bombus auricomus*	Black and gold bumble bee		SC	G4G5	SNR	2010-06-25	2010-06-25
Community	Wet Prairie	Wet Prairie, Midwest Type			G3	S1	1968	1981-07-08
Plant	*Graphephorum melicoides*	Purple false oats		SC	G4	SNR	1892-08-04	1892-09-01
Plant	*Geum virginianum*	Pale avens		SC	G5	S1S2	1915	1915-07-14
Plant	*Paronychia fastigiata*	Low-forked chickweed		X	G5	SX	1909	1909-08-21
Plant	*Tradescantia virginiana*	Virginia spiderwort		SC	G5	S2	1918	1918-05-21
Plant	*Carex trichocarpa*	Hairy-fruited sedge		SC	G4	S2	1995-08-05	2004-07-04
Plant	*Hybanthus concolor*	Green violet		SC	G5	S3	1984	1984
Plant	*Lechea minor*	Least pinweed		X	G5	S1	1924-PRE	1924-PRE
Plant	*Carex trichocarpa*	Hairy-fruited sedge		SC	G4	S2	1996-06-20	1996-06-20
Plant	*Hybanthus concolor*	Green violet		SC	G5	S3	1870	1919-06-01
Plant	*Trichophorum clintonii*	Clinton's bulrush		SC	G4	S3	1935	1935-05-22
Plant	*Scleria triglomerata*	Tall nut rush		SC	G5	S3	1838	1838-06-27
Plant	*Euonymus atropurpureus*	Wahoo		SC	G5	S3	1992	1992-10-17
Plant	*Helianthus hirsutus*	Whiskered sunflower		SC	G5	S3	1868	1868-09-16
Plant	*Angelica venenosa*	Hairy angelica		SC	G5	S3		1924-PRE
Plant	*Jeffersonia diphylla*	Twinleaf		SC	G5	S3	1924	1924
Plant	*Lithospermum latifolium*	Broad-leaved puccoon		SC	G4	S2	1838	1868-09
Plant	*Geum virginianum*	Pale avens		SC	G5	S1S2	1895	1895-08-20
Plant	*Hybanthus concolor*	Green violet		SC	G5	S3	1919	1919-05-31
Plant	*Carex trichocarpa*	Hairy-fruited sedge		SC	G4	S2	1937	1937-07-05
Plant	*Astragalus neglectus*	Cooper's milk vetch		SC	G4	S3	1928	1930-06-24
Plant	*Penstemon pallidus*	Pale beard tongue		SC	G5	SX	1921	1936-06-07
Plant	*Echinacea purpurea*	Purple coneflower		X	G4	SX	1868	1868-09-01
Plant	*Carex amphibola*	Sedge		SC	G5	SNR	1938-06-02	1938-06-02
Plant	*Symphyotrichum praealtum*	Willow aster		SC	G5	S3	2001-09-13	2001-09-13
Plant	*Symphyotrichum praealtum*	Willow aster		SC	G5	S3	2004-09-29	2004-09-29
Plant	*Viburnum prunifolium*	Black haw		SC	G5	S3	2013-11-05	2013-11-05
Plant	*Lithospermum latifolium*	Broad-leaved puccoon		SC	G4	S2	2018-06-14	2018-06-14
Plant	*Collinsia verna*	Blue-eyed Mary		SC	G5	SNR	1860-00-00	1894-05-20
Plant	*Conioselinum chinense*	Hemlock-parsley		SC	G5	SNR	1879-09-09	1937-09-17

Plant	*Conioselinum chinense*	Hemlock-parsley		SC	G5	SNR	1898-09-29	1937-09-24
Plant	*Conioselinum chinense*	Hemlock-parsley		SC	G5	SNR	1857-09-25	1857-09-25
Plant	*Conioselinum chinense*	Hemlock-parsley		SC	G5	SNR	1924-10-30	1924-10-30
Plant	*Corispermum americanum*	American bugseed		SC	G5?	SNR	2011-09-05	2011-09-05
Plant	*Potentilla canadensis*	Canada cinquefoil		SC	G5	SNR	1959-05-22	1959-05-22
Plant	*Sporobolus heterolepis*	Prairie dropseed		SC	G5	S3	2013-10-21	2013-10-21
Plant	*Strophostyles helvula*	Trailing wild Bean		SC	G5	S3	1924	1924
Plant	*Jeffersonia diphylla*	Twinleaf		SC	G5	S3	1861	2018-05-16

Of concern: See supporting comments document.

Special concern species and natural communities are not protected under endangered species legislation, but efforts should be taken to minimize any or all impacts. Species classified as special concern are species whose numbers are getting smaller in the state. If these species continue to decline they would be recommended for reclassification to threatened or endangered status.

Codes to accompany Tables:

State Protection Status Code Definitions (SPROT)
E: Endangered
T: Threatened
SC: Special concern

Federal Protection Status Code Definitions (USESA)
LE = listed endangered
LT = listed threatened
LELT = partly listed endangered and partly listed threatened
PDL = proposed delist
E(S/A) = endangered based on similarities/appearance
PS = partial status (federally listed in only part of its range)
C = species being considered for federal status

Global Heritage Status Rank Definitions (GRANK)
The priority assigned by NatureServe's national office for data collection and protection based upon the element's status throughout its entire world-wide range. Criteria not based only on number of occurrences; other critical factors also apply. Note that ranks are frequently combined.
G1 = critically imperiled globally because of extreme rarity (5 or fewer occurrences range-wide or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.
G2 = imperiled globally because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extinction throughout its range.
G3: Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range (e.g. a single western state, a physiographic region in the East) or because of other factor(s) making it vulnerable to extinction throughout its range; in terms of occurrences, in the range of 21 to 100.
G4: Apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery.
G5: Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.
Q: Taxonomy uncertain

State Heritage Status Rank Definitions (SRANK)
The priority assigned by the Michigan Natural Features Inventory for data collection and protection based upon the element's status within the state. Criteria not based only on number of occurrences; other critical factors also apply. Note that ranks are frequently combined.
S1: Critically imperiled in the state because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extirpation in the state.
S2: Imperiled in state because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extirpation from the state.
S3: Rare or uncommon in state (on the order of 21 to 100 occurrences). S4 = apparently secure in state, with many occurrences.
S5 = demonstrably secure in state and essentially ineradicable under present conditions. SX = apparently extirpated from state.

Rare Species Review #2367 – Supporting Comments
Washtenaw County Water Resource Commissioner
2019 SRF Project Plan
Hubbell, Roth & Clark, Inc.
April 25, 2019

2019 SRF Project Plan Improvement Sites

Briarwood Mall Ponds – No concerns.

Churchill Park/Eisenhower ROW –

Northern long-eared bat – the federally threatened and state special concern (SC) Northern long-eared bat (*Myotis septentrionalis*) has been known to occur in the area. Northern long-eared bat numbers in the north eastern United States have declined up to 99 percent in recent years. Loss or degradation of summer habitat, wind turbines, disturbance to hibernacula, predation, and pesticides have contributed to this decline. However, no other threat has been as severe to the decline as White-nose Syndrome (WNS). WNS is a fungus that thrives in the cold, damp conditions in caves and mines where bats hibernate. The disease is believed to disrupt the hibernation cycle by causing bats to repeatedly awake thereby depleting vital energy reserves. This species was federally listed in May 2015 primarily due to the threat from WNS. This activity occurs within the US Fish and Wildlife Service's designated White-Nose Syndrome zone.

Also called northern bat or northern myotis, this bat is distinguished from other *Myotis* species by its long ears. In Michigan, northern long-eared bats hibernate in abandoned mines and caves in the Upper Peninsula; they also commonly hibernate in the Tippy Dam spillway in Manistee County. This species is a regional migrant with migratory distance largely determined by locations of suitable hibernacula sites.

Northern long-eared bats typically roost and forage in forested areas. During the summer, these bats roost singly or in colonies underneath bark, in cavities or in crevices of both living and dead trees. Roost trees are selected based on the suitability to retain bark or provide cavities or crevices. Common roost trees in southern Lower Michigan include species of ash, elm and maple. Foraging occurs primarily in areas along woodland edges, woodland clearings and over small woodland ponds. Moths, beetles and small flies are common food items. Like all temperate bats this species typically produces only 1-2 young per year.

Management and Conservation: when there are known roost trees or hibernacula in the project area, we encourage you to conduct tree-cutting activities and prescribed burns in forested areas during October 1 through March 31 when possible, but you are not required by the ESA to do so. When that is not possible, we encourage you to remove trees prior to June 1 or after July 31, as that will help to protect young bats that may be in forested areas but are not yet able to fly. The USFWS has prepared a dichotomous key to help determine if this action may cause prohibited take of this bat. Please consult the USFWS Endangered Species Page for more information.

Little brown bat - the state special concern (SC) little brown bat (*Myotis lucifugus*) has been known to occur in the area. The little brown bat is formerly one of the most common bats found in the Great Lakes region, but like other cave hibernating bats, it is susceptible to White Nose Syndrome (a fatal fungal infection) and populations in Michigan are undergoing a rapid decline. This small mammal weighs 0.2-0.4 ounces (6-12 grams) and measures only 3.1-3.7 inches (80-95mm) from head to tail. Using echolocation, little brown bats feed primarily on aquatic insects such as stoneflies and mayflies. Typical summer foraging sites include forest edges, along lakes and streams and occasionally over small cultivated fields.

Males and females normally spend the summers in separate locations, coming together in early fall for courtship and mating. Little brown bats over-winter in caves, mines, and sometimes in hollow trees. Females leave their hibernacula in spring and form small groups that move to summer roosts to bear and nurse their young. Female are faithful to these nursing sites typically using them year after year. Young are born from early June through early July. Very little is known

about the summer habits of males, but they commonly appear in caves, forests and manmade dwellings during this time. Exterminators kill hundreds of bats each year for roosting in homes and other manmade structures.

Management and Conservation - the following are options for managing habitat for bats: Retain trees with loose, scrappy bark such as shagbark hickory (*Carya ovata*) to provide roosting sites. Maintain wooded corridors and riparian areas and streams along streams, rivers, lakes and ponds. Retain abandoned mines for hibernation and minimize the use of insecticides as their broad can seriously impact bats. While predation is not a problem, hundreds of little brown bats are killed each year by exterminators for taking roost in homes or other human dwellings. This is unnecessary, as sealing access sites after bats have left for the night is much cheaper, safe, and effective.

Willow aster – the state special concern (SC) willow aster *(Symphyotrichum praealtum)* has been known to occur in the area. Willow aster occurs in fields, thickets, and remnant lakeplain prairies, occasionally in weedy successional openings. Flowering occurs August to October. Survey guidelines - random meander search covering areas that appear likely to have rare taxa, based on habitat and the judgment of the investigator.

Management and Conservation: maintain natural hydrological regime for this species. Prescribed fire may be necessary to conserve populations.

Detroit Street (Catherine to Division) – No concerns.

Huron Hills Golf Course – No concerns.

Lawton Park –

Little brown bat - the state special concern (SC) little brown bat has been known to occur in the area. See comments above.

Malletts Creek – Upstream end –

Little brown bat - the state special concern (SC) little brown bat has been known to occur in the area. See comments above.

Malletts Creek – Main to Eisenhower –

Little brown bat - the state special concern (SC) little brown bat has been known to occur in the area. See comments above.

Mallets Creek – Fire Station Pond to Signature –

Little brown bat - the state special concern (SC) little brown bat has been known to occur in the area. See comments above.

Millers Creek (Reach 5) –

Little brown bat - the state special concern (SC) little brown bat has been known to occur in the area. See comments above.

Northern long-eared bat – the federally threatened and state special concern (SC) Northern long-eared bat has been known to hibernate and roost near the project site. See comments above.

Mat muhly - the state threatened mat muhly (*Muhlenbergia richardsonis*) has been known to occur in the area. This species is a very slender, wiry, warm season grass that grows in loose to dense tufts or mats that are 2-6 cm tall. In southern Michigan, this species inhabits prairie fens, and in northern Michigan, it is found in alvar communities. Alvar is

a globally rare, prairie-like grass community that forms a thin turf of vegetation over limestone and dolomite bedrock. Mat muhly flowers from July through September. Fire is a key component of this species' ecology.

Management and Conservation: this species requires protection of hydrology, groundwater source, and natural disturbance regime. It also benefits from fen management that includes prescribed fire and brush removal, which maintains open habitat and reduces competing woody vegetation. Control of invasive species is also important, especially glossy buckthorn, a common invader of its habitat. Where occurring in sensitive alvar habitat, conservation of hydrology and control of ORV use is also important.

White lady-slipper - the state threatened white lady-slipper *(Cypripedium candidum)* has been known to occur in the area. In Michigan, white lady-slipper occurs primarily in prairie fens and other marly, alkaline sites usually associated with groundwater seepage areas. Prairie fens are herb or herb-shrub wetlands on muck, through which flows groundwater rich in calcium and magnesium carbonates. Sedge meadows, mesic prairie plants, tamarack and dogwood are characteristic plants of fens. Fens are commonly found adjacent to lake and stream systems. White lady-slipper also occurs in wet prairies in southwestern Michigan (also its habitat in the thumb region), which is like its typical habitat--tallgrass prairie--outside Michigan. Flowering occurs in late April to May.

Management and Conservation: prevention of hydrological changes is a necessary prerequisite for maintaining viable fen habitat. This species benefits from fen management that includes prescribed fire and brush removal, which maintains open habitat and reduces competing woody vegetation. Control/remove invasive species, especially glossy buckthorn and purple loosestrife. Protect habitat from being drained and developed.

Seventh (Scio Church to Greenview) –

Little brown bat - the state special concern (SC) little brown bat has been known to occur in the area. See comments above.

Street Tree Planting – No concerns.

Traver Creek –

Little brown bat - the state special concern (SC) little brown bat has been known to occur in the area. See comments above.

Northern long-eared bat – the federally threatened and state special concern (SC) Northern long-eared bat has been known to hibernate and roost near the project site. See comments above.

Dukes' skipper – the state threatened Dukes' skipper *(Euphyes dukesi)* has been known to occur in the area. Dukes' skipper is found in Michigan in dense stands of the wide-leaf sedge, *Carex lacustris,* usually in association with forested swamps and brushy wetlands with sedges. Adults nectar on buttonbush *(Cephalanthus occidentalis)*, swamp milkweed *(Asclepias incarnata)*, and joe-pye-weed *(Eupatorium maculatum)*. In Michigan, the adult flight period is from late June to early August. The skipper flies low within sedges and is easily overlooked. They are rather slow flying. The best way to survey for this species is by conducting visual meander surveys which consists of checking for this species near larval food plants and on adult nectar sources such as button bush or swamp milkweed.

Management and Conservation: the primary threat to this species is the loss of the drainage or destruction of the wetland habitat on which it depends. Protection of known populations, both the habitat and the skippers themselves, is critical in Michigan. This would include protection from physical destruction of the habitat as well as from mowing and spraying. In addition, sites should be managed to enhance the quality and extent of the habitat. This could include restoring natural hydrological conditions to previously disturbed areas and selecting restoration sites that connect existing, isolated populations with suitable habitat.

Goldenseal - the state threatened goldenseal plant *(Hydrastis canadensis)* has been known to occur in the area. Goldenseal typically inhabits shady, rich, mesic forests, usually under a canopy of beech-sugar maple or oak-sugar maple. It also occurs in moist microhabitats near vernal pools, along streams, or on floodplains, often in moist sandy loam, clay loam, or even organic (muck) soils. Associated plants include basswood, ginseng, trillium, sweet cicely, wild ginger, plantain-leaved sedge, sugar maple, beech, blue-beech, leatherwood, and spicebush. This species flowers in early May and produces fruits through September in Michigan.

Management and Conservation: the plant likely requires maintenance of the overstory and moist, loamy soils and is susceptible to excessive canopy removal. Maintain healthy intact, mature forests and minimize forest fragmentation due to development. When possible, leave large tracts of unharvested forests and allow natural processes to operate unhindered. Although *H*. *canadensis* populations have been severely diminished through over-harvesting and habitat destruction, it is also a species that can be easily overlooked when obscured by the typical lush vegetation of its forest habitat. Several other state threatened plants often occur in the same habitat as goldenseal.

Eastern massasauga rattlesnake – although there are no documented occurrences, this area falls within Tier 1 Eastern massasauga rattlesnake (EMR) habitat as designated by the U.S. Fish & Wildlife Service (USFWS). Tier 1 Habitat represents areas known to be occupied by EMR or highly likely to be occupied. The federally threatened and state special concern Eastern massasauga rattlesnake *(Sistrurus catenatus)* is Michigan's only venomous snake and found in a variety of wetland habitats including bogs, fens, shrub swamps, wet meadows, marshes, moist grasslands, wet prairies, and floodplain forests. Eastern massasaugas occur throughout the Lower Peninsula but are not found in the Upper Peninsula. Populations in southern Michigan are typically associated with open wetlands, particularly prairie fens, while those in northern Michigan are better known from lowland coniferous forests, such as cedar swamps. These snakes normally overwinter in crayfish or small mammal burrows often close to the groundwater level and emerge in spring as water levels rise. During late spring, these snakes move into adjacent uplands they spend the warmer months foraging in shrubby fields and grasslands in search of mice and voles, their favorite food.

Often described as "shy and sluggish", these snakes avoid human confrontation and are not prone to strike, preferring to leave the area when they are threatened. However, like any wild animal, they will protect themselves from anything they see as a potential predator. Their short fangs can easily puncture skin and they do possess potent venom. Like many snakes, the first human reaction may be to kill the snake, but it is important to remember that all snakes play vital roles in the ecosystem. Some may eat harmful insects. Others like the massasauga consider rodents a delicacy and help control their population. Snakes are also a part of a larger food web and can provide food to eagles, herons, and several mammals.

Management and Conservation: any sightings of these snakes should be reported to the Michigan Department of Natural Resources, Wildlife Division. If possible, a photo of the live snake is also recommended.

Swift Run – No concerns.

Springwater Subdivision –

Little brown bat - the state special concern (SC) little brown bat has been known to occur in the area. See comments above.

Northern long-eared bat – the federally threatened and state special concern (SC) Northern long-eared bat has been known to hibernate and roost near the project site. See comments above.

Carpenter Road Drain Pond Retrofit –

Little brown bat - the state special concern (SC) little brown bat has been known to occur in the area. See comments above.

Miller Drain/Upper Paint Creek – No concerns.

Rare Species Review #2367
Section 7 Comments
Hubbell, Roth & Clark, Inc.
2019 SRF Project Plan
Washtenaw County Water Resource Commissioner
Washtenaw County, MI
April 25, 2019

For projects involving Federal funding or a Federal agency authorization

The following information is provided to assist you with Section 7 compliance of the Federal Endangered Species Act (ESA). The ESA directs all Federal agencies "to work to conserve endangered and threatened species. Section 7 of the ESA, called "Interagency Cooperation," is the means by which Federal agencies ensure their actions, including those they authorize or fund, do not jeopardize the existence of any listed species." The project falls within the range of seven (7) federally listed/proposed species which have been identified by the U.S. Fish and Wildlife Service (USFWS) to occur in Washtenaw County, Michigan:

Federally Endangered

Indiana bat - there appears to be suitable habitat throughout the overall project area. Indiana bats (*Myotis sodalis*) are found only in the eastern United States and are typically confined to the southern three tiers of counties in Michigan. Indiana bats that summer in Michigan winter in caves in Indiana and Kentucky. This species forms colonies and forages in riparian and mature floodplain habitats. Nursery roost sites are usually located under loose bark or in hollows of trees near riparian habitat. Indiana bats typically avoid houses or other artificial structures and typically roost underneath loose bark of dead elm, maple and ash trees. Other dead trees used include oak, hickory and cottonwood. Foraging typically occurs over slow-moving, wooded streams and rivers as well as in the canopy of mature trees. Movements may also extend into the outer edge of the floodplain and to nearby solitary trees. A summer colony's foraging area usually encompasses a stretch of stream over a half-mile in length. Upland areas isolated from floodplains and non-wooded streams are generally avoided.

Management and Conservation: the suggested seasonal tree cutting range for Indiana bat is between October 1 and March 31 (i.e., no cutting April 1-September 30). This applies throughout the Indiana bat range in Michigan.

Snuffbox mussel – there appears to be suitable habitat within the overall project area. The state and federally endangered snuffbox mussel (*Epioblasma triquetra*) inhabits rivers and streams with cobble, gravel, or sand bottoms in swift currents and usually is deeply buried in the substrate. Glochidia, the parasitic larval stage of the mussel, are released from May to mid-July. In Michigan, the only host fish known for snuffbox is the log perch (*Percina caprodes*). In other parts of their range the banded sculpin (*Cottus carolinae*) is also a known host. After completing the parasitic stage and reaching adulthood, snuffbox remain relatively sessile on the river bottom, living between 8-10 years. The best time to survey for snuffbox is April through September.

Management and Conservation: the snuffbox mussel is sensitive to river impoundment, siltation and disturbance, due to its requirement for clean, swift current and relative immobility as an adult. To maintain the current populations in Michigan, rivers need to be protected to reduce silt loading and run-off. Maintaining or establishing vegetated riparian buffers can aid in controlling many of the threats to mussels.

Control of zebra mussels is critical to preserving native mussels. And as with all mussels, protection of their hosts habitat is also crucial. Because the life cycle of the snuffbox is inherently linked with that of the logperch in Michigan, conservation and management of this fish species is needed to ensure that of the snuffbox.

Poweshiek skipperling – there appears to be suitable habitat within the overall project area. In Michigan, the state and federally endangered poweshiek skipperling *(Oarisma poweshiek)* inhabits alkaline wetlands known as fens. This habitat is characterized by scattered tamaracks, poison sumac, and dogwood clones with a ground cover of sedges and other herbaceous species. The poweshiek skipper has a single generation each year. Egg laying is believed to occur on sedges and rushes. Eggs are laid sometime around early July; larvae (caterpillar stage) hibernate through the winter on the underside of the blade of grass on which they have been feeding on. In early April, they resume feeding. Adult flight dates occur late June through the first three weeks of July.

Management and Conservation: the primary threat to the continued survival of this species is habitat loss and modification. Many of the wetland complexes occupied currently have been altered or drained for agriculture or development. Wetland alteration also can lead to invasion by exotic plant species such as glossy buckthorn (*Rhamnus frangula*), purple loosestrife (*Lythrum salicaria*), common buckthorn (*Rhamnus cathartica*), and the common reed (*Phragmites australis*). In addition, landscape-scale processes that may be important for maintaining suitable poweshiek habitat and/or creating new habitat, such as wildfires, fluctuations in hydrologic regimes, and flooding from beaver (*Castor canadensis*) activity, have been virtually eliminated or altered throughout the species' range. The widespread use of neonicotinoid pesticides could be a cause for the decline in this species as most sites are adjacent to, or downslope from, row crop agriculture.

Karner blue butterfly – there does not appear to be suitable habitat within the overall project area. The federally endangered and state threatened Karner blue butterfly *(Lycaeides melissa samuelis)* was historically found in open-canopied barrens communities, including oak and oak-pine savanna or barrens found prior to European settlement. Since their historical habitat suffers from fire suppression efforts, the butterfly often occurs in openings, old fields, and rights-of-way. Karner blue larvae feed exclusively on wild lupine (*Lupinus perennis*), an early successional species that can become abundant after appropriate disturbances. Adults visit a wide variety of flowering plants for nectar.

The Karner blue has two generations per year, with the later, or summer, generation typically having three to four times the number of adults as the earlier, or spring, brood. Adults are active most of the day, decreasing activity during midday and during cool, rainy weather. Females can live up to two weeks in the field, but typically live an average of five days. Peak flight dates are mid-May through early June and mid-July through early August, with stragglers found between.

Management and Conservation: recommendations for management of Karner blue butterfly habitat will be pertinent only if the host plant, wild lupine (*Lupinus perennis*) is present. If lupine is present the following guidelines should be followed: (1) mower blades should be set no lower than 6 inches; (2) mowing should not occur before August 15th (i.e. no spring mowing at all!); (3) no burning of habitat where lupine exists, and; (4) contact us if planting or logging will occur in lupine areas.

<u>Federally Threatened</u>

Northern long-eared bat – there appears to be suitable habitat within the overall project area. Numbers for

the federally threatened Northern long-eared bat (*Myotis septentrionalis*) in the north eastern United States have declined up to 99 percent in recent years. Loss or degradation of summer habitat, wind turbines, disturbance to hibernacula, predation, and pesticides have contributed to this decline. However, no other threat has been as severe to the decline as White-nose Syndrome (WNS). WNS is a fungus that thrives in the cold, damp conditions in caves and mines where bats hibernate. The disease is believed to disrupt the hibernation cycle by causing bats to repeatedly awake thereby depleting vital energy reserves. This species was federally listed in May 2015 primarily due to the threat from WNS. This activity occurs within the US Fish and Wildlife Service's designated White-Nose Syndrome zone.

Also called northern bat or northern myotis, this bat is distinguished from other *Myotis* species by its long ears. In Michigan, northern long-eared bats hibernate in abandoned mines and caves in the Upper Peninsula; they also commonly hibernate in the Tippy Dam spillway in Manistee County. This species is a regional migrant with migratory distance largely determined by locations of suitable hibernacula sites.

Northern long-eared bats typically roost and forage in forested areas. During the summer, these bats roost singly or in colonies underneath bark, in cavities or in crevices of both living and dead trees. Roost trees are selected based on the suitability to retain bark or provide cavities or crevices. Common roost trees in southern Lower Michigan include species of ash, elm and maple. Foraging occurs primarily in areas along woodland edges, woodland clearings and over small woodland ponds. Moths, beetles and small flies are common food items. Like all temperate bats this species typically produces only 1-2 young per year.

Management and Conservation: when there are known roost trees or hibernacula in the project area, we encourage you to conduct tree-cutting activities and prescribed burns in forested areas during October 1 through March 31 when possible, but you are not required by the ESA to do so. When that is not possible, we encourage you to remove trees prior to June 1 or after July 31, as that will help to protect young bats that may be in forested areas but are not yet able to fly. The USFWS has prepared a dichotomous key to help determine if this action may cause prohibited take of this bat. Please consult the USFWS Endangered Species Page for more information.

Eastern prairie fringed orchid – there does not appear to be suitable habitat within the overall project area. The federal threatened and state endangered prairie fringed orchid *(Platanthera leucophaea)* occurs in two distinct habitats in Michigan - wet prairies and bogs. It thrives best in the lakeplain wet or wet-mesic prairies that border Saginaw Bay and Lake Erie. This species frequently persists in degraded prairie remnants, ditches, railroad rights-of-ways, fallow agricultural fields, and similar habitats where artificial disturbance creates a moist mineral surface conducive to germination. Unlike many other *Platanthera* species, *P. leucophaea* is long-lived, with individuals documented to live more than 30 years. Flowering occurs during late June through early July. The white blossoms produce a heavy fragrance at dusk that attracts many moths, including the primary pollinators of *P. leucophaea*, hawkmoths (Lepidoptera: Sphingidae). Hawkmoths are likely co-adapted pollinators, since their tongues are long enough to reach the nectar that lies deep in the spur of the flower. Capsules mature in September, releasing hundreds of thousands of airborne seeds. Plants may not flower every year but frequently produce only a single leaf above ground, possibly even becoming dormant when conditions are unsuitable, such as the onset of drought.

Management and Conservation: this species requires the maintenance of natural hydrological cycles and open habitat. Activities such as shrub removal are likely to benefit the species, but other management such as prescribed fire is not well understood. Caution and proper monitoring should be employed if using

prescribed fire in occupied habitat. Spring fires should be conducted prior to emergence (mid-April). Poaching is also a threat.

Eastern massasauga rattlesnake (EMR) – portions of the overall project area fall within Tier 1 EMR habitat as designated by the US Fish and Wildlife Service. Tier 1 habitat are areas known to be occupied or highly likely to be occupied by EMR. The federally threatened and state special concern Eastern massasauga rattlesnake *(Sistrurus catenatus)* is Michigan's only venomous snake is found in a variety of wetland habitats including bogs, fens, shrub swamps, wet meadows, marshes, moist grasslands, wet prairies, and floodplain forests. Eastern massasaugas occur throughout the Lower Peninsula but are not found in the Upper Peninsula. Populations in southern Michigan are typically associated with open wetlands, particularly prairie fens, while those in northern Michigan are better known from lowland coniferous forests, such as cedar swamps. These snakes normally overwinter in crayfish or small mammal burrows often close to the groundwater level and emerge in spring as water levels rise. During late spring, these snakes move into adjacent uplands they spend the warmer months foraging in shrubby fields and grasslands in search of mice and voles, their favorite food.

Often described as "shy and sluggish", these snakes avoid human confrontation and are not prone to strike, preferring to leave the area when they are threatened. However, like any wild animal, they will protect themselves from anything they see as a potential predator. Their short fangs can easily puncture skin and they do possess potent venom. Like many snakes, the first human reaction may be to kill the snake, but it is important to remember that all snakes play vital roles in the ecosystem. Some may eat harmful insects. Others like the massasauga consider rodents a delicacy and help control their population. Snakes are also a part of a larger food web and can provide food to eagles, herons, and several mammals.

Management and Conservation: any sightings of these snakes should be reported to the Michigan Department of Natural Resources, Wildlife Division. If possible, a photo of the live snake is also recommended.

USFWS Section 7 Consultation Technical Assistance can be found at:

https://www.fws.gov/midwest/endangered/section7/s7process/index.html

The website offers step-by-step instructions to guide you through the Section 7 consultation process with prepared templates for documenting "no effect." as well as requesting concurrence on "may affect, but not likely to adversely affect" determinations.

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# 17-289

a. Project Name: Washtenaw County SRF Project Plan Amendment 2019
b. Project Address (if available): 705 N. Zeeb Rd, PO Box 8645, Ann Arbor MI 48107-8645
c. Municipal Unit: Water Resources 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*.): Environmental Protection Agency
e. State Agency (if applicable), Contact Name and Mailing Address: See Attachment
f. Consultant or Applicant Contact Information (if applicable) *including mailing address*: See Attachment

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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 East, Saline, Ypsilanti West
b. Township: Many Range: many Section: many
c. Description of width, length and depth of proposed ground disturbing activity: See Attachment
d. Previous land use and disturbances: See Attachment
e. Current land use and conditions: See Attachment
f. Does the landowner know of any archaeological resources found on the property? ☐ YES ☒ NO
   Please describe: See Attachment

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 Attachment
b. Provide a localized map indicating the location of the project; road names must be included and legible.
c. On the above-mentioned map, identify the APE.
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 Attachment

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: See Attachment
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: See Attachment
c. Based on the information contained in "b", please choose one:
   - ☐ Historic Properties Present in the APE
   - ☒ No Historic Properties Present in the APE
d. Describe the condition, previous disturbance to, and history of any historic properties located in the APE: N/A

V. PHOTOGRAPHS

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

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

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, Cultural Resources Management and Planning Section,
735 East Michigan Avenue, P.O. Box 30044, Lansing, MI 48909

HUBBELL, ROTH & CLARK, INC
CONSULTING ENGINEERS SINCE 1915

MAILING: PO Box 824
Bloomfield Hills, MI 48303-0824
SHIPPING: 555 Hulet Drive
Bloomfield Hills, MI 48302-0360
PHONE: 248-454-6300
WEBSITE: hrcengr.com

Re: Washtenaw County HRC Job No. 20190134
Huron River 2019 SRF Project Plan Amendment

SHPO Application Attachment

Ladies and Gentlemen:

Hubbell, Roth & Clark Inc. (HRC) is presently working with the Washtenaw County Water Resource Commissioner to amend the 2017 Project Plan for improvements in mitigating non-point source pollution. The original 2017 plan included 21 total projects. However, the 2019 amendment will include a total of 14 projects:

Ten projects from the previous 2017 SRF plan re-inserted:

- Briarwood Mall Pond
- **Churchill Park/Eisenhower ROW Basin (amended slightly)**
- Detroit Street Brick Rd Stormwater Management
- Huron Hills Golf Course Stormwater Improvements
- Lawton Park Stormwater Basin
- Mallets Streambank Stabilization Phase II
- Millers Creek Channel Modification - Reach 5
- Seventh (Scio Church to Greenview) Stormwater Improvement
- Street Tree Planting (FY2016-FY2020)
- Traver Creek Tributary Streambank Stabilization

An addition of one project from the 2010 plan:

- Swift Run MDOT

An addition of one project from the 2011 plan:

- Springwater Phase IV Stormwater Improvements

Two new additional projects:

- Carpenter Road Drain Pond Retrofit (Cole Blvd and Hillside Drive)
- Miller Drain/Upper Paint Creek (Glory Lane)

This will include several projects at various locations throughout the City of Ann Arbor, Ypsilanti and Pittsfield Twp. The eleven projects being re-inserted/added from the 2017, 2010 and 2011 plans were already reviewed by SHPO and do not need to be reviewed again. However, the two new projects added on and the amended Churchill Park project do need to be reviewed by SHPO.

These projects may include coordination with and execution of road resurfacing/reconstruction projects; 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 improve 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 Revolving Loan Section (MDEQ-RLS) 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:

State Agency Contact:
Mr. Eric Pocan
MDEQ, Revolving Loan Section
Resource Management Division
525 W. Allegan
PO Box 30241
Lansing, Michigan 48909-7741

Applicant Contact Person
Mr. Harry Sheehan, Deputy of Environmental Services
Washtenaw County Water Resources
705 N. Zeeb Road
PO Box 8645
Ann Arbor, MI 48107-8645

Consultant Contact Person
Mr. Prasad Gullapalli, P.E.
Hubbell, Roth & Clark, Inc.
555 Hulet Dr.
Bloomfield Hills, MI 48303

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

II. GROUND DISTURBING ACTIVITY:

The work will occur at 14 locations around the City of Ann Arbor, Pittsfield Twp, and Ypsilanti as shown in the attached map. The work involves various ground disturbing activities for stormwater improvements at each of these locations with excavation to depths of up to 10-feet.

Prior to development, the land was mostly categorized as oak savanna, mesic forest, wooded tundra, temperate mixed forest and agricultural. Currently, the land is categorized as urban and used accordingly.

The applicant is unaware of any archaeological resources found at the various project sites. The following resources were used for research to determine the possible location of archaeological resources:

1) Michigan State Housing Development Authority Archaeology page (http://www.michigan.gov/mshda/0,4641,7-141-54317_19320_54320---,00.html)
2) Wikipedia's Archaeological sites in Michigan page (https://en.wikipedia.org/wiki/Category:Archaeological_sites_in_Michigan)

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 14 projects that will be presented in this year's Project Plan are listed herein. The location of each site can be found on the attached map.

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 stormwater quality.

Site #2: Churchill Park/Eisenhower ROW – Flood mitigation with stormwater detention basins (T3S, R5E, SEC 1)

Site #13: Carpenter Rd Drain Pond – Streambank Stabilization / Water Quality BMP (T3S, R6E, SEC 12)

Site #14: Miller Drain/Upper Paint Creek – Streambank Stabilization / Water Quality BMP (T3S, R7E, SEC 7)

Description of the APE:

The Area of Potential Effects (APE) is limited to the specific areas identified above. Given the projects involved in this type of construction, boundaries are 250-feet around areas delineated 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 physical, visual and auditory impacts necessary for urban redevelopment and construction. Proper signage and traffic controls will be installed prior to any work.
A research appointment is being scheduled to review archeological.

IV. IDENTIFICATION OF HISTORIC PROPERTIES:

The previous 2017 letter included research conducted for all project areas at that time. The amended Churchill site and the two new projects added to the 2019 Amendment Plan have been reviewed as well. No historic properties were located within the APE. Research was performed to determine the location of historical features. This included using the National Park Service's (NPS) U.S. Department of the Interior National Register of Historic Places Map (https://www.nps.gov/maps/full.html?mapId=7ad17cc9-b808-4ff8-a2f9-a99909164466), NPS's Listing of National Historic Landmarks by State (https://www.nps.gov/nhl/find/statelists/mi/MI.pdf), and Michigan State Housing Development Authority's SHPO page (http://www.michigan.gov/mshda/0,4641,7-141-54317_19320---,00.html).

Since the project sites are all paved areas, creek corridors, and green spaces, no historic properties/structures will be affected. While there are no historic properties located within the APE, the following are the proposed project sites (from the list above) which are listed as having historic properties/districts nearby:

Proposed Project Site No. 3 (Detroit Street) has existing brick pavers which will be replaced in kind to maintain a similar appearance. The project area is near the following historic properties:

- Michigan Central Railroad Depot, National Register listed, Reference #75000963
- Main Street Post Office, National Register listed, Reference #78001512

Proposed Project Site No. 18 (Street Tree Planting) involves planting and maintaining trees throughout the city. Specific locations are not specified, but all will be within public property and are not anticipated to impact any historic sites.

All the other sites listed in Section III above are not located within/near to any historic districts/properties. The proposed work completed within/near to the historic districts/properties will occur within the existing road rights-of-way, and the aesthetic and historic feel of the neighborhood will not be impacted by this work.

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 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.

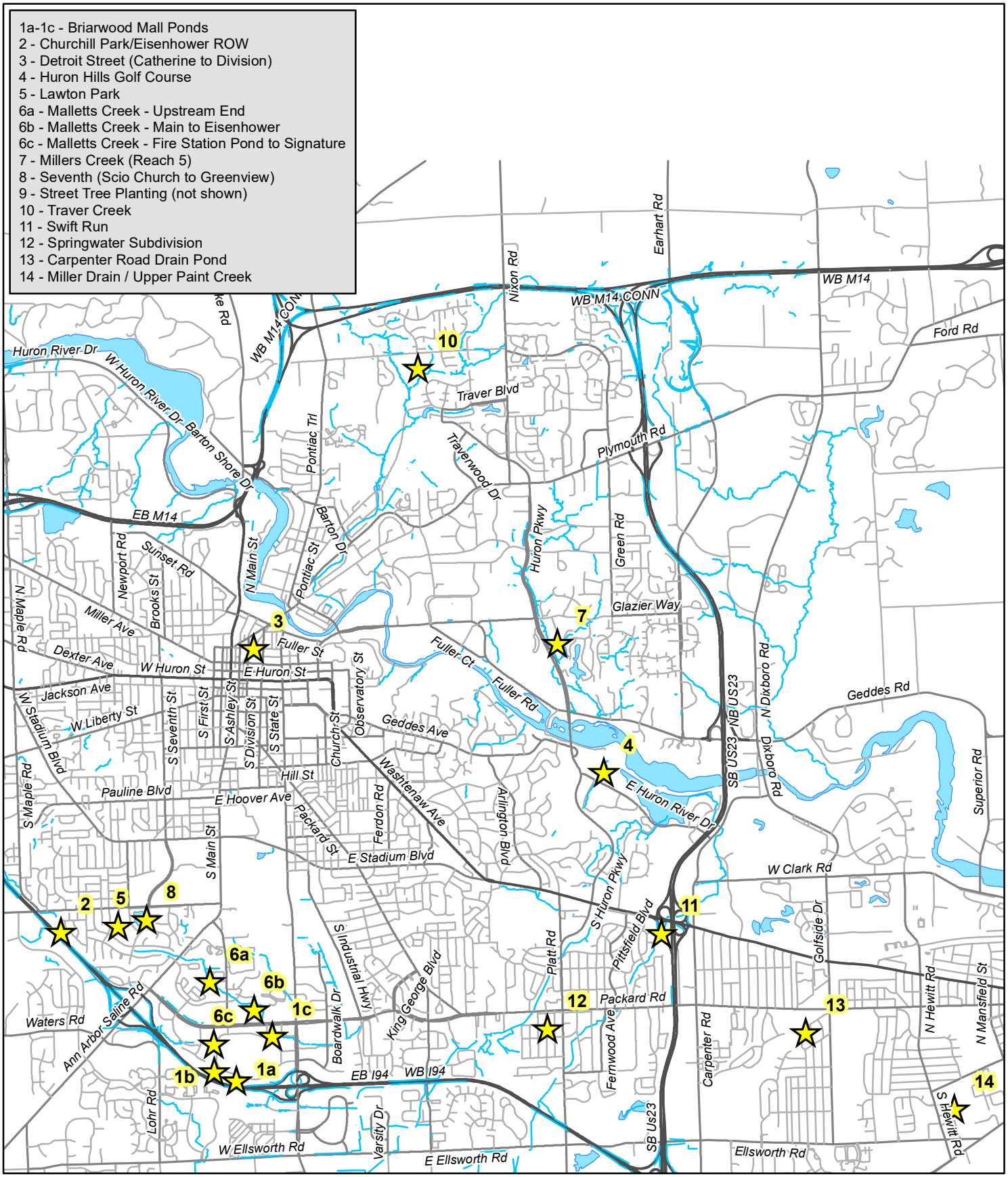
There will be minimal ground disturbance and the streetscape view of the site will be improved by the additional natural features and improved stormwater quality. All areas will either be restored to their existing conditions or include additional natural features. The pre and post-construction climate 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 typical construction practices. 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 #2 – Churchill Park/Eisenhower

Site #13 – Carpenter Road Drain Project

Site #14 – Miller Drain/Upper Paint Creek



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Overall Project Locations
Project Plan Amendment 2019

Figure 1

0 0.7 1.4 Miles

HRC
HUBBELL, ROTH & CLARK, INC
CONSULTING ENGINEERS SINCE 1915

Document Path: Y:\2019\01\2019\0134\03_Studies\Working\GIS\OverallProjectLocations.mxd

APE Areas

USGS
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U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

The National Map
US Topo

YPSILANTI WEST QUADRANGLE
MICHIGAN-WASHTENAW CO.
7.5-MINUTE SERIES

Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and 1 000-meter grid: Universal Transverse Mercator, Zone 17T
10 000-foot ticks: Michigan Coordinate System of 1983 (south zone)

This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery....NAIP, October 2014
Roads.... U.S. Census Bureau, 2015 - 2016
Names....GNIS, 2016
Hydrography....National Hydrography Dataset, 2014
Contours....National Elevation Dataset, 1999
Boundaries....Multiple sources; see metadata file 1972 - 2016
Public Land Survey System....BLM, 2016
Wetlands....FWS National Wetlands Inventory 1977 - 2014

MN
7° 1'
125 MILS
GN
1° 48'
32 MILS

UTM GRID AND 2017 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

U.S. National Grid
100,000-m Square ID
KG
Grid Zone Designation
17T

SCALE 1:24 000

KILOMETERS: 1 0.5 0 1 2
METERS: 1000 500 0 1000 2000
MILES: 1 0.5 0 1
FEET: 1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000

CONTOUR INTERVAL 10 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the National Geospatial Program US Topo Product Standard, 2011.
A metadata file associated with this product is draft version 0.6.19

MICHIGAN
QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

1 Ann Arbor West
2 Ann Arbor East
3 Denton
4 Saline
5 Ypsilanti East
6 Macon
7 Milan
8 Maybee

ADJOINING QUADRANGLES

ROAD CLASSIFICATION

Expressway
Secondary Hwy
Ramp
Local Connector
Local Road
4WD
Interstate Route
US Route
State Route

YPSILANTI WEST, MI
2017

7643016371910
NSN. 7643016371910
NGA REF NO. USGSX24K50171

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

The National Map
US Topo

ANN ARBOR WEST QUADRANGLE
MICHIGAN-WASHTENAW CO.
7.5-MINUTE SERIES

Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and
1 000-meter grid: Universal Transverse Mercator, Zone 17T
10 000-foot ticks: Michigan Coordinate System of 1983 (south zone)

This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery.....NAIP, October 2014
Roads..... U.S. Census Bureau, 2015 - 2016
Names.....GNIS, 2016
Hydrography.....National Hydrography Dataset, 2014
Contours.....National Elevation Dataset, 2007
Boundaries.....Multiple sources; see metadata file 1972 - 2016
Public Land Survey System.....BLM, 2016
Wetlands.....FWS National Wetlands Inventory 1977 - 2014

MN
GN
6° 57′
123 MILS
1° 54′
34 MILS

UTM GRID AND 2017 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

U.S. National Grid
100,000-m Square ID
KG
Grid Zone Designation
17T

SCALE 1:24 000

KILOMETERS 1 0.5 0 1 2
METERS 1000 500 0 1000 2000
MILES 1 0.5 0 1
FEET 1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000

CONTOUR INTERVAL 10 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the National Geospatial Program US Topo Product Standard, 2011.
A metadata file associated with this product is draft version 0.6.19

MICHIGAN
QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

1 Pinckney
2 Hamburg
3 South Lyon
4 Dexter
5 Ann Arbor East
6 Bridgewater
7 Saline
8 Ypsilanti West

ADJOINING QUADRANGLES

ROAD CLASSIFICATION

Expressway
Secondary Hwy
Ramp
Local Connector
Local Road
4WD
Interstate Route
US Route
State Route

ANN ARBOR WEST, MI
2017

7643016370645
NSN. 7643016370645
NGA REF NO. USGS X24K1063

MICHIGAN ARCHAEOLOGICAL SITE FILE
CONFIDENTIAL-NOT FOR PUBLIC DISTRIBUTION

Name: 20WA23 **Site Number:** 20WA23

Other Names:

County: Washtenaw

Township: Ypsilanti

Region: Southeast Michigan **River Basin:** Huron

Map: Ypsilanti West Quadrangle, 7.5' USGS

Township	Range	Section	Quarter
03S	07E	08	W1/2

Longitude:

Latitude:

Narrative Description: This site was originally recorded as a Hindsdale Reference.

In 1997, Andrews Cultural Resources conducted a phase I survey of the site area and found no field evidence indicating the presence of a cemetery.

Information Sources: Recon. Level Survey (Meets Fed. S&G), Hinsdale Reference

Field Evidence: Not field verified

Period	Date	Culture	Function
prehistoric period		Native American	cemetery
prehistoric period		Native American	village

Field Work Summary: Aug, 1997: Andrews Cultural Resources (Wesley Andrews)

Collections:

Publications:

Author	Year	Title	Publisher
Andrews, Eleanor	1997	Phase I Archaeological Site Location Survey of a Parcel Proposed for Development in Ypsilanti Township, Washtenaw County, Michigan	Andrews Cultural Resources
Hinsdale, Wilbert B.	1931	Archaeological Atlas of Michigan.	Michigan Handbook Series
		Ypsilanti West Quadrangle, 7.5' USGS	

Other Documentation:

NRHP Status: More Information Needed/Unevaluated

Evaluation	Date of Evaluation	Evaluation Comment

MICHIGAN ARCHAEOLOGICAL SITE FILE
CONFIDENTIAL-NOT FOR PUBLIC DISTRIBUTION

Ownership: principal investigator, Surveyor

Projects: ER97-1020

Record Created: 4/3/2015 **Record Last Modified:** 6/5/2018

By: # SA_MiSHPO_CRM

MICHIGAN ARCHAEOLOGICAL SITE FILE
CONFIDENTIAL-NOT FOR PUBLIC DISTRIBUTION

Name: 20WA322 **Site Number:** 20WA322

Other Names:

County: Washtenaw

Township: Ypsilanti

Region: Southeast Michigan **River Basin:** Huron

Map: Ypsilanti West Quadrangle, 7.5' USGS

Township	Range	Section	Quarter
03S	07E	07	NE-SE

Longitude:

Latitude:

Narrative Description: This site consists of one Bayport chert flake recovered from a shovel test.

Information Sources: Recon. Level Survey (Meets Fed. S&G)

Field Evidence: Positive shovel-test(s), Find spot

Period	Date	Culture	Function
prehistoric period		Native American	

Field Work Summary: Aug., 1997: Andrews Cultural Resources (W. Andrews)

Collections:

Publications:

Author	Year	Title	Publisher
Andrews, Eleanor	1997	Phase I Archaeological Site Location Survey of a Parcel Proposed for Development in Ypsilanti Township, Washtenaw County, Michigan	Andrews Cultural Resources
		Ypsilanti West Quadrangle, 7.5' USGS	

Other Documentation:

NRHP Status: Not Eligible for Listing in the National Register of Historic Places

Evaluation	Date of Evaluation	Evaluation Comment
determined NR ineligible by staff	5/24/2000	

Ownership: principal investigator, Surveyor

Projects: ER97-1020, B00-68

Record Created: 4/3/2015 **Record Last Modified:** 6/5/2018

By: # SA_MiSHPO_CRM

MICHIGAN ARCHAEOLOGICAL SITE FILE
CONFIDENTIAL-NOT FOR PUBLIC DISTRIBUTION

Name: Hubbell **Site Number:** 20WA165

Other Names:

County: Washtenaw

Township: Ypsilanti

Region: Southeast Michigan **River Basin:** Huron

Map: Ypsilanti West Quadrangle, 7.5' USGS

Township	Range	Section	Quarter
03S	07E	08	Center-SE-SW

Longitude:

Latitude:

Narrative Description: SURFACE SCATTER & FEATURES

Information Sources:

Field Evidence:

Period	Date	Culture	Function
Nineteenth Century			homestead
Woodland period		Native American	camp
Twentieth Century		American	homestead

Field Work Summary: 1991 EXCAV UMMA - JONES UMMA 1984 SURVEY STINSON UNKNOWN

Collections:

Publications:

Author	Year	Title	Publisher
		Ypsilanti West Quadrangle, 7.5' USGS	
Jones, Karin L.	1991	Report of Phase II Archaeological Survey of 20WA165, Ypsilanti, Michigan.	University of Michigan, Museum of Anthropology
Stinson, Wesley R.	1984	An Archaeological Survey of the Ypsilanti West Industrial Park.	

Other Documentation:

NRHP Status: Not Eligible for Listing in the National Register of Historic Places

Evaluation	Date of Evaluation	Evaluation Comment

Ownership:

Projects:

MICHIGAN ARCHAEOLOGICAL SITE FILE
CONFIDENTIAL-NOT FOR PUBLIC DISTRIBUTION

Record Created: 4/3/2015 **Record Last Modified:** 6/18/2018

By: # SA_MiSHPO_CRM

Andrews, Eleanor. 1997. Phase I Archaeological Site Location Survey of a Parcel Proposed for Development in Ypsilanti Township, Washtenaw County, Michigan ACR-9706. Andrews Cultural Resources.

Notes Shovel-testing and surface reconnaissance at 15m intervals covered 15 acres. The project area overlapped that of a previously recorded site, 20WA23, but no physical evidence of the site was present. Elsewhere, a single Bayport chert flake was found (20WA322).

Andrews, Eleanor. 1997. Phase I Archaeological Site Location Survey of a Parcel Proposed for Development in Ypsilanti Township, Washtenaw County, Michigan ACR-9706. Andrews Cultural Resources.

Notes Shovel-testing and surface reconnaissance at 15m intervals covered 15 acres. The project area overlapped that of a previously recorded site, 20WA23, but no physical evidence of the site was present. Elsewhere, a single Bayport chert flake was found (20WA322).

Hinsdale, Wilbert B. 1931. Archaeological Atlas of Michigan. 4. Michigan Handbook Series.

Notes This volume contains county by county descriptions of known archaeological sites, in addition to maps depicting mounds, earthworks, villages, burial grounds, garden beds, trails and copper mines. These data were compiled during the 1920's through extensive correspondence with people throughout the state, and from historical maps and documents. Very few of these sites were field verified, and many cannot be relocated today. The map symbols cover about a square mile, and are not always accurately placed.

Jones, Karin L. 1991. Report of Phase II Archaeological Survey of 20WA165, Ypsilanti, Michigan. University of Michigan, Museum of Anthropology.

Notes A Phase II testing of 20WA165, a prehistoric and historic site, was conducted in 1991. The site is located on lots 1 and 2 of the Ypsilanti West Industrial Park, Section 8, T03S R07E, in the township of Ypsilanti in Washtenaw County. The site is one acre in size. The historic component included in situ structural and occupational features, including a horse burial, but lack suitable habitation material for interpretation of human activities. The prehistoric component is possibly an occupation site or work area used during several time periods. Three sherds indicate a Woodland period cultural stage. The site is heavily disturbed. The author recommends no further mitigation is required.

Stinson, Wesley R. 1984. An Archaeological Survey of the Ypsilanti West Industrial Park.

Notes The area survey consisted of approximately 71 acres along both sides of Paint Creek between US-12 and I-94 in portions of Private Claims 680 and 690, T3S R7E, City of Ypsilanti, Washtenaw County. In cultivated areas with good surface visibility, surface survey was done along transects 15 m apart; where the ground surface was obscured, shovel-testing was done at 15 m intervals. One site, 20WA165, was discovered. The site contains both historic and prehistoric archaeological materials.

Ypsilanti West Quadrangle, 7.5' USGS

Ypsilanti West Quadrangle, 7.5' USGS

Ypsilanti West Quadrangle, 7.5' USGS

ER97-1020

Citation: Andrews, Eleanor. 1997. Phase I Archaeological Site Location Survey of a Parcel Proposed for Development in Ypsilanti Township, Washtenaw County, Michigan ACR-9706. Andrews Cultural Resources.

Notes; Shovel-testing and surface reconnaissance at 15m intervals covered 15 acres. The project area overlapped that of a previously recorded site, 20WA23, but no physical evidence of the site was present. Elsewhere, a single Bayport chert flake was found (20WA322).

ER-6635

Citation: Stinson, Wesley R. 1984. An Archaeological Survey of the Ypsilanti West Industrial Park.

Notes: The area survey consisted of approximately 71 acres along both sides of Paint Creek between US-12 and I-94 in portions of Private Claims 680 and 690, T3S R7E, City of Ypsilanti, Washtenaw County. In cultivated areas with good surface visibility, surface survey was done along transects 15 m apart; where the ground surface was obscured, shovel-testing was done at 15 m intervals. One site, 20WA165, was discovered. The site contains both historic and prehistoric archaeological materials.

Citation: Jones, Karin L. 1991. Report of Phase II Archaeological Survey of 20WA165, Ypsilanti, Michigan. University of Michigan, Museum of Anthropology.

Notes: A Phase II testing of 20WA165, a prehistoric and historic site, was conducted in 1991. The site is located on lots 1 and 2 of the Ypsilanti West Industrial Park, Section 8, T03S R07E, in the township of Ypsilanti in Washtenaw County. The site is one acre in size. The historic component included in situ structural and occupational features, including a horse burial, but lack suitable habitation material for interpretation of human activities. The prehistoric component is possibly an occupation site or work area used during several time periods. Three sherds indicate a Woodland period cultural stage. The site is heavily disturbed. The author recommends no further mitigation is required.

ER00-7.15.141155

Citation: Robertson, Charlie and Larry N. Stillwell. 2014. An Archaeological Field Reconnaissance of a Proposed Telecommunications Facility (Project No. 141155) in Ann Arbor, Washtenaw County, Michigan. 14FR251Mi. Archaeological Consultants of Ossian.

Notes: No archaeological sites were located in a survey of less than an acre at T3S, R6E, Section 06.

Used As: PUBLICATION

Citation: Robertson, Charlie and Larry N. Stillwell. 2015. An Archaeological Field Reconnaissance of a Proposed Telecommunications Facility (Project #141155) in Ann Arbor, Washtenaw County, Michigan. 15FR127Mi. Archaeological Consultants of Ossian.

Notes: No archaeological sites were identified in a survey of less than an acre at T03S, R06E, Section 06.

Used As: PUBLICATION

From: MSHDA-SHPOresearch <MSHDA-SHPOresearch@michigan.gov>
Sent: Tuesday, April 23, 2019 3:59:34 PM
To: Gullapalli, Prasad
Subject: RE: Research Appointment

Mr. Gullapalli,

Not to worry, I appreciate your patience and understanding with the situation. I have attached the archaeological site file info, bibliographies and ER abstracts/citations that you have listed. Please let me know if you think you will need anything else. I'm happy to help.

Respectfully,

Luke Pickrahn
Sec. 106 Student Assistant
Michigan State Historic Preservation Office
735 East Michigan Ave, Lansing, MI 48909
Phone: 517-241-6607

From: Gullapalli, Prasad <PGullapalli@hrcengr.com>
Sent: Tuesday, April 23, 2019 11:21 AM
To: Allen, Ashley <AAllen@hrcengr.com>; MSHDA-SHPOresearch <MSHDA-SHPOresearch@michigan.gov>
Subject: RE: Research Appointment

Good morning Luke,

I apologize for any confusion on the research appointment yesterday. I was able to perform some research using the topo maps in your office and found the following information:

Miller/Upper Paint Creek-
- ER-97-1020 showed no cultural resources found in the study area.
- The following were nearby
    - 20-WA-165
    - 20-WA-23
    - 20-WA-322
    - ER-6635 (is in the vicinity and includes existing sanitary sewer)

  A sanitary sewer has been built through this area so we anticipate previous ground disturbance. Please look through those records and let me know if you find anything.

Carpenter Rd-
- Work area is at an existing detention basin. It was constructed in 1996 based on our records so we do not think any sites will be disturbed. Seems clear.

Churchill-
- Nearby survey (ER00-7.15.14155) found no archeological sites. Seems clear.

Please let me know if I need to schedule another appointment for research in your office. We appreciate your help through this process.

Thanks.

Prasad Gullapalli, P.E.
Hubbell, Roth & Clark, Inc.
Direct: (248) 454-6323
Cell: (248) 535-3362
E-mail: pgullapalli@hrcengr.com
www.hrcengr.com

From: Allen, Ashley <AAllen@hrcengr.com>
Sent: Tuesday, April 16, 2019 11:32 AM
To: MSHDA-SHPOresearch <MSHDA-SHPOresearch@michigan.gov>
Cc: Gullapalli, Prasad <PGullapalli@hrcengr.com>
Subject: RE: Research Appointment

Mr. Pickrahn,

My colleague Prasad Gullapalli (copied on this email) is available to go out there for an appointment next Monday, April 22, at 3:00PM.
Please let me know if your availability changes.

Thank you.
Ashley

From: MSHDA-SHPOresearch <MSHDA-SHPOresearch@michigan.gov>
Sent: Tuesday, April 16, 2019 9:43 AM
To: Allen, Ashley <AAllen@hrcengr.com>
Subject: RE: Research Appointment

Ms. Allen,

Research appointments are typically made a week in advance, and are on Mondays, Tuesdays, and Fridays, from 9-4:30PM. As of now, Monday and Friday of next week are open; however, this Friday, we do have an opening at 11AM if that suits you. Let me know which day/time would work best for you.

Respectfully,

Luke Pickrahn
Sec. 106 Student Assistant
Michigan State Historic Preservation Office
735 East Michigan Ave, Lansing, MI 48909
Phone: 517-241-6607

From: Allen, Ashley <AAllen@hrcengr.com>
Sent: Friday, April 12, 2019 2:20 PM
To: MSHDA-SHPOresearch <MSHDA-SHPOresearch@michigan.gov>
Cc: Gullapalli, Prasad <PGullapalli@hrcengr.com>
Subject: Research Appointment

Good afternoon,

Hubbell, Roth & Clark Inc. (HRC) is presently working with the Washtenaw County Water Resource Commissioner to amend the 2017 SRF Project Plan for improvements in mitigating non-point source pollution. The original 2017 plan included 21 total projects. However, the 2019 amendment will include a total of 14 projects. This will include several projects at various locations throughout the City of Ann Arbor, Ypsilanti and Pittsfield Twp.

The eleven projects being re-inserted/added from the 2017, 2010 and 2011 plans were already researched and reviewed by scheduled meeting with SHPO last time and do not need to be reviewed again. However, the two new projects added on and the amended Churchill Park project do need to be researched and reviewed by a scheduled meeting with SHPO.

HRC is interested in scheduling a research archaeological appointment for:

- 2017 Amended Project – Churchill Park, Ann Arbor, Washtenaw County (T3S, R5E, SEC 1)
- New project – Carpenter Road Drain Pond Retrofit, Pittsfield Twp, Washtenaw County (T3S, R6E, SEC 12)
- New project – Miller Drain/Upper Paint Creek, Ypsilanti, Washtenaw County (T3S, R7E, SEC 7)

I've also attached the quadrangle maps. Please let me know if you need anything else.

Thanks,

Ashley Allen
Staff Analyst – Environmental Engineering Department
Phone: (248) 454-6300
Direct: (248) 454-6832
Cell Phone: (248) 464-7834
Email: aallen@hrcengr.com
Hubbell, Roth & Clark, Inc.
555 Hulet Dr.
Bloomfield Hills, MI 48303
www.hrcengr.com

HUBBELL, ROTH & CLARK, INC
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MAILING: PO Box 824
Bloomfield Hills, MI 48303-0824
SHIPPING: 555 Hulet Drive
Bloomfield Hills, MI 48302-0360
PHONE: 248-454-6300
WEBSITE: hrcengr.com

April 12, 2019

U.S Fish and Wildlife Service
East Lansing Field Office
2651 Coolidge Road
Lansing, MI 48823-6360

Re: Protected Plants and Animals Review — HRC Job No. 20190134
Washtenaw County 2019 SRF Project Plan Amendment
Washtenaw County Water Resource Commissioner

Dear Ms. Tameka Dandridge:

The Washtenaw County Water Resource Commissioner (WRC) is submitting a Project Plan Amendment from the 2017 SRF Plan to the Michigan Department of Environmental Quality (MDEQ) for acceptance into the Clean Water State Revolving Fund (SRF) Loan Program. The Project Plan requires a review to determine any potential impacts on protected plants and animals in the vicinity of the project. The original 2017 plan included 21 total projects. However, the 2019 amendment will include a total of 14 projects:

Ten projects from the previous 2017 SRF plan re-inserted:

- Briarwood Mall Pond
- Churchill Park/Eisenhower ROW Basin (amended slightly)
- Detroit Street Brick Rd Stormwater Management
- Huron Hills Golf Course Stormwater Improvements
- Lawton Park Stormwater Basin
- Mallets Streambank Stabilization Phase II
- Millers Creek Channel Modification - Reach 5
- Seventh (Scio Church to Greenview) Stormwater Improvement
- Street Tree Planting (FY2016-FY2020)
- Traver Creek Tributary Streambank Stabilization

An addition of one project from the 2010 plan:

- Swift Run MDOT

An addition of one project from the 2011 plan:

- Springwater Phase IV Stormwater Improvements

Two new additional projects:

- **Carpenter Road Drain Pond Retrofit (Cole Blvd and Hillside Drive)**
- **Miller Drain/Upper Paint Creek (Glory Lane)**

The twelve projects being re-inserted/added from the 2017, 2010 and 2011 plans were already reviewed by you and do not need to be reviewed again. However, the two new projects added on do need to be reviewed.

On behalf of the WRC, we are requesting information regarding the impacts of the above referenced new projects upon protected plants and animals. The proposed work intends to present improvements for mitigating non-point source pollution. This will include several projects at various locations throughout the City of Ann Arbor, Ypsilanti and Pittsfield Twp. These projects may include road reconstruction, stream bank stabilization along various creeks, regional water detention, construction of rain gardens and/or planting trees or other vegetation. These projects are being undertaken as part of the County's ongoing mission to improve surface water quality in the Huron River. Appropriate permitting measures will be taken for all work included in this project. The locations of the water system improvements and the areas of the City of Ann Arbor that will be impacted are provided in attached Figure 1: Overall Project Locations.

On behalf of the WRC, we have completed the U.S. Fish and Wildlife Service Section 7 streamlined review process; see Attachment A. Native vegetation removal will occur during several projects which "may affect" the listed species. Since the specific project scopes have yet to be determined, the projects which may affect the listed species are still unknown. Therefore, thorough consultations and further analysis of the possible impacts of the proposed projects categorized as "may affect the listed species" will be completed during the design phase for each. Necessary mitigation measures will be taken during design and construction to reduce the impacts to the listed species and biological surveys will be performed as needed. Per your email request from June 28, 2017, should tree removal need to occur at a particular site and if the trees appear to be potentially suitable for roosting/breeding bats, they will be removed outside of the roosting/breeding season. Note that the roosting/breeding bat season is typically April 1 through September 30 and will be addressed during the permitting process.

Therefore, on behalf of the WRC, we are requesting concurrence with this determination. We appreciate your review and would be grateful for a response as soon as possible so that we may meet program deadlines.

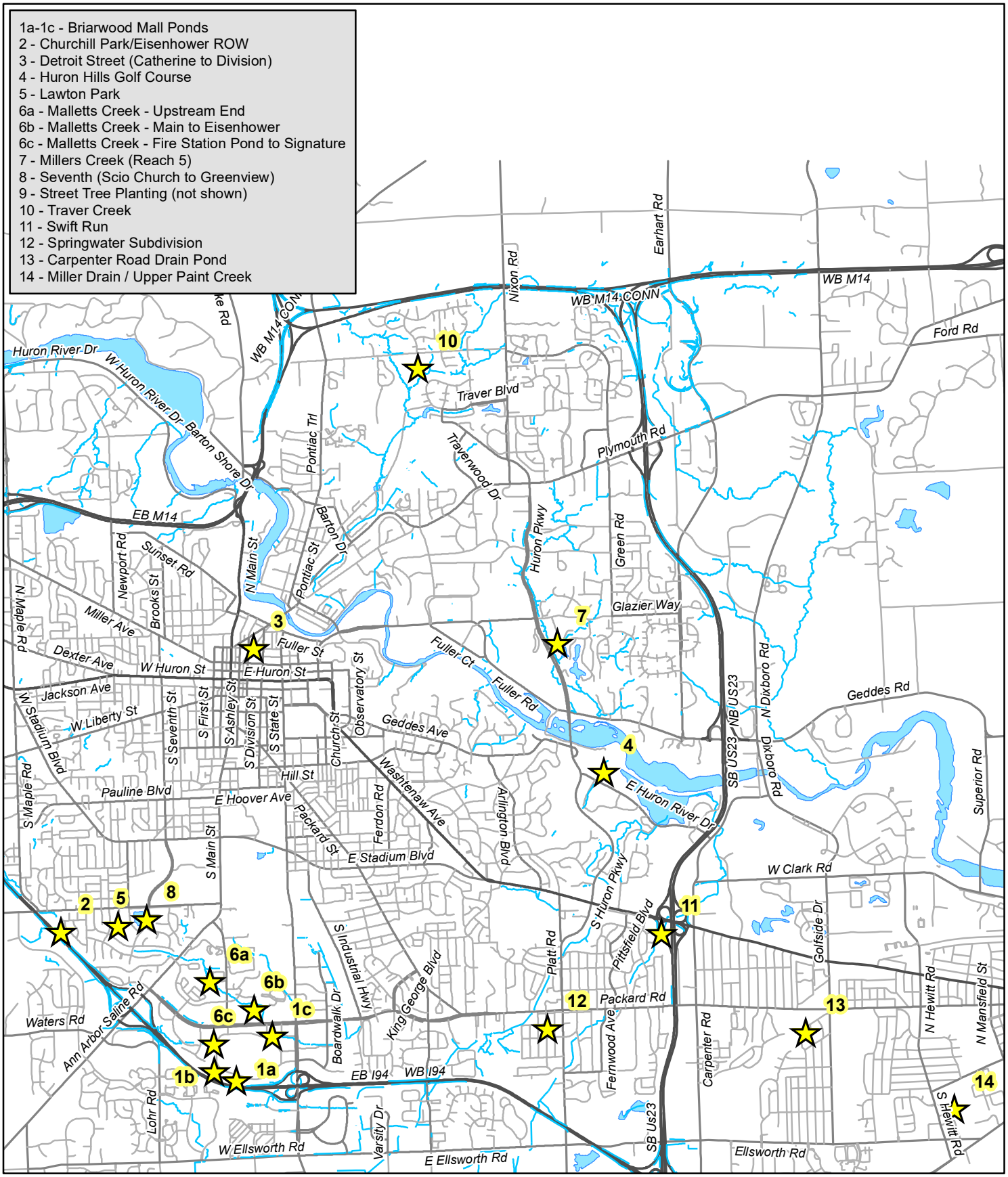
If you have any questions or require any additional information, please contact the undersigned.

Very truly yours,
HUBBELL, ROTH & CLARK, INC.

Prasad Gullapalli, P.E.
Staff Engineer

Attachment

pc: WCWRC; Harry Sheehan
HRC; J. Burton, A. Allen



Overall Project Locations
Project Plan Amendment 2019

Figure 1

N
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0 0.7 1.4 Miles

HRC
HUBBELL, ROTH & CLARK, INC
CONSULTING ENGINEERS SINCE 1915

Document Path: Y:\2019\01\2019\0134\03_Studies\Working\GIS\OverallProjectLocations.mxd

Attachment A
May Affect Determination

U.S. Fish & Wildlife Service

Endangered Species

Midwest Region

Search

Midwest Endangered Species Home
Section 7 Home
Section 7: A Brief Explanation
Section 7: Technical Assistance
Biological Assessment Guidance
Section 7 Consultation Handbook
Contact Us

The Midwest Region includes Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio and Wisconsin. Find a location near you

Endangered Species Program

Conserving and restoring threatened and endangered species and their ecosystems

Great Lakes RESTORATION

Section 7 Consultation Technical Assistance

Step-by-Step Instructions - Step 1

Step 1. Based on your project type (listed below), either contact the appropriate Ecological Services Field Office or proceed to Step 2:

- For **wind energy projects**, contact the Ecological Services Field Office located in the state where the project would occur for assistance.
- For **projects installing towers that use guy wires or are over 200 feet in height**, contact the Ecological Services Field Office located in the state where the project would occur for assistance.
- For **all other projects**, continue with Step 2.

Previous - Next (Step 2)

Section 7 Technical Assistance Home

Last updated: February 6, 2019

Michigan

County Distribution of Federally-Listed Endangered and Threatened Species

Updated October 2018

County	Species	Status	Habitat
Alcona	Northern long-eared bat *Myotis septentrionalis*	Threatened	Hibernates in caves and mines - swarming in surrounding wooded areas in autumn. Roosts and forages in upland forests during spring and summer.
	Kirtland's warbler (*Setophaga kirtlandii*)	Endangered	Nests in young jack pine
	Rufa Red knot *(Calidris canutus rufa)*	Threatened	Only actions that occur along coastal areas during the Red Knot migratory window of MAY 1 - SEPTEMBER 30
	Eastern massasauga (*Sistrurus catenatus*)	Threatened	
	Hine's emerald dragonfly *(Somatochlora hineana)*	Endangered	Spring fed wetlands, wet meadows and marshes; calcareous streams & associated wetlands overlying dolomite bedrock
	Pitcher's thistle (*Cirsium pitcheri*)	Threatened	Stabilized dunes and blowout areas
Alger	Canada lynx (*Lynx canadensis*)	Threatened	A Canada lynx was recently documented in the Upper Peninsula. The counties listed here have the highest potential for Lynx presence. Alger, Baraga, Chippewa, Delta, Dickinson, Gogebic, Houghton, Iron, Keweenaw, Luce, Mackinac, Marquette, Menominee, Ontonagon, Schoolcraft.
	Gray wolf *Canis lupus*	Endangered	Northern forested areas
	Northern long-eared bat *Myotis septentrionalis*	Threatened	Hibernates in caves and mines - swarming in surrounding wooded areas in autumn. Roosts and forages in upland forests during spring and summer.
	Kirtland's warbler (*Setophaga kirtlandii*)	Endangered	Nests in young jack pine
	Piping plover (*Charadrius melodus*)	Endangered	Beaches along shorelines of the Great Lakes
	Piping plover (*Charadrius melodus*)	Critical Habitat	
	Rufa Red knot *(Calidris canutus rufa)*	Threatened	Only actions that occur along coastal areas during the Red Knot migratory window of MAY 1 - SEPTEMBER 30
	Pitcher's thistle (*Cirsium pitcheri*)	Threatened	Stabilized dunes and blowout areas

	Northern long-eared bat *Myotis septentrionalis*	Threatened	Hibernates in caves and mines - swarming in surrounding wooded areas in autumn. Roosts and forages in upland forests during spring and summer.
	Rufa Red knot *(Calidris canutus rufa)*	Threatened	Only actions that occur along coastal areas during the Red Knot migratory window of MAY 1 - SEPTEMBER 30
	Eastern massasauga (*Sistrurus catenatus*)	Threatened	
	Mitchell's satyr butterfly (*Neonympha mitchellii mitchellii*)	Endangered	Fens; wetlands characterized by calcareous soils which are fed by carbonate-rich water from seeps and springs
	Pitcher's thistle (*Cirsium pitcheri*)	Threatened	Stabilized dunes and blowout areas
Washtenaw	Indiana bat (*Myotis sodalis*)	Endangered	Summer habitat includes small to medium river and stream corridors with well developed riparian woods; woodlots within 1 to 3 miles of small to medium rivers and streams; and upland forests. Caves and mines as hibernacula.
	Northern long-eared bat *Myotis septentrionalis*	Threatened	Hibernates in caves and mines - swarming in surrounding wooded areas in autumn. Roosts and forages in upland forests during spring and summer.
	Eastern massasauga *Sistrurus catenatus*	Threatened	
	Snuffbox *Epioblasma triquetra*	Endangered	Small to medium-sized creeks in areas with a swift current and some larger rivers
	Mitchell's satyr butterfly *Neonympha mitchellii mitchellii*	Endangered	Fens; wetlands characterized by calcareous soils which are fed by carbonate-rich water from seeps and springs
	Poweshiek skipperling *(Oarisma poweshiek)*	Endangered Critical Habitat	Wet prairie and fens
	Eastern prairie fringed orchid (*Platanthera leucophaea*)	Threatened	Mesic to wet prairies and meadows
Wayne	Indiana bat (*Myotis sodalis*)	Endangered	Summer habitat includes small to medium river and stream corridors with well developed riparian woods; woodlots within 1 to 3 miles of small to medium rivers and streams; and upland forests. Caves and mines as hibernacula.
	Northern long-eared bat *Myotis septentrionalis*	Threatened	Hibernates in caves and mines - swarming in surrounding wooded areas in autumn. Roosts and forages in upland forests during spring and summer.

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Step-by-Step Instructions - Step 2

Step 2. Determine whether a listed or proposed species or designated or proposed critical habitat may be present within the action area.

A. Check the species list to determine whether any species or critical habitat may be present in the county(ies) of the proposed project.

- If no species or critical habitat is listed, conclude "no species present" and document your finding. No further consultation required.
- If any species or critical habitat is listed, print the species list and continue to B.

B. If a listed/proposed species or critical habitat is in the county where your project is located and your project is any of the following:

- within a developed area,
- a HUD project,
- a pipeline project,
- a buried utilities project,
- a telecommunication project, or
- a request for a Conditional Letter of Map Revision (CLOMR) from FEMA,

then follow this link for instructions specific to those types of projects.

If your project type is not listed above, continue to C.

C. Go to the pertinent species information pages, define your action area, and cross-reference the species information with your knowledge of the project site.

- If suitable habitat is not present in the action area, conclude "species and critical habitat not present" and document your finding. No further consultation is required.
- If suitable habitat is present, but data (e.g., surveys) indicate species and critical habitat are absent from the action area, conclude "species and critical habitat not present" and document your finding. No further consultation required.
- If suitable habitat is present, and no other data indicate species or critical habitat are absent, conclude "species or critical habitat may be present" and proceed to Step 3.
- If suitable habitat is present, and no other data indicate species or critical habitat are absent, you may conduct a survey to determine whether listed species or critical habitat are present. Please contact the Ecological Services Field Office located in the state where the project would occur for more information.

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Decision Process for "No Effect" Determinations

Certain projects nearly always warrant a "No Effect" determination. This website is intended to assist project proponents in determining whether their project qualifies as one of these types of projects, and if so, to provide a streamlined mechanism for documenting their "No Effect" finding. If your project does not meet the criteria below (and associated pages), your action requires further review. To assist with this more detailed review, you will be linked back to Step 2 of our S7 Technical Assistance website.

Step 3*. Click on the type of project to continue with the "no effect" decision process:

- HUD Project
- Pipeline or Buried Utilities Project
- Telecommunication Project
- Conditional Letter of Map Revision (CLOMR) request to FEMA
- Project within a Developed Area (project type is not one of the 4 listed above). A developed area is already paved or supports structures and the only vegetation is limited to frequently mowed grass or conventional landscaping.

* In Step 2 you determined that listed species or critical habitat may be present in the county(ies) of the proposed project.

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Decision Process for "No Effect" Determinations

Projects within a Develped Area[1] - Step 4

Step 4. Is your project located within or adjacent to any unlandscaped areas that support native vegetation (trees, shrubs, or grasses)?

No - Click here to continue.

Yes - Click here to continue.

[1]A Developed Area is an area that is already paved or supports structures and the only vegetation is limited to frequently mowed grass or conventional landscaping.

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Projects within a Develped Area[1] - Step 5

Step 5. Does your project involve removal of native vegetation (i.e., vegetation other than cultivated plants and lawns)?

Yes - Click here to return to Step 2 of the S7 Technical Assistance web pages.

No - Click here to continue with the "No Effect" determination process.

[1]A Developed Area is an area that is already paved or supports structures and the only vegetation is limited to frequently mowed grass or conventional landscaping.

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Decision Process for "No Effect" Determinations

Projects within a Develped Area[1] - Step 5

Step 5. Does your project involve removal of native vegetation (i.e., vegetation other than cultivated plants and lawns)?

Yes - Click here to return to Step 2 of the S7 Technical Assistance web pages.

No - Click here to continue with the "No Effect" determination process.

[1]A Dev tures and the only vegetation is limited

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This site says...

Your project does not meet the "no effect" criteria identified for this process, so you are being redirected to our Technical Assistance website for further review. The project may still warrant a "no effect" determination but requires a more detailed review and additional documentation.

OK

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Step-by-Step Instructions - Step 2

Step 2. Determine whether a listed or proposed species or designated or proposed critical habitat may be present within the action area.

A. Check the species list to determine whether any species or critical habitat may be present in the county(ies) of the proposed project.

- If no species or critical habitat is listed, conclude "no species present" and document your finding. No further consultation required.
- If any species or critical habitat is listed, print the species list and continue to B.

B. If a listed/proposed species or critical habitat is in the county where your project is located and your project is any of the following:

- within a developed area,
- a HUD project,
- a pipeline project,
- a buried utilities project,
- a telecommunication project, or
- a request for a Conditional Letter of Map Revision (CLOMR) from FEMA,

then follow this link for instructions specific to those types of projects.

If your project type is not listed above, continue to C.

C. Go to the pertinent species information pages, define your action area, and cross-reference the species information with your knowledge of the project site.

- If suitable habitat is not present in the action area, conclude "species and critical habitat not present" and document your finding. No further consultation is required.
- If suitable habitat is present, but data (e.g., surveys) indicate species and critical habitat are absent from the action area, conclude "species and critical habitat not present" and document your finding. No further consultation required.
- If suitable habitat is present, and no other data indicate species or critical habitat are absent, conclude "species or critical habitat may be present" and proceed to Step 3.
- If suitable habitat is present, and no other data indicate species or critical habitat are absent, you may conduct a survey to determine whether listed species or critical habitat are present. Please contact the Ecological Services Field Office located in the state where the project would occur for more information.

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Step-by-Step Instructions - Step 3

Step 3. Determine whether the proposed action may affect listed or proposed species or designated or proposed critical habitat.

In step 2, you defined your action area and concluded that a listed resource "may be present." In this step, you will determine whether your project "may affect" species or critical habitat. There are two possible determinations in this step: "no effect" or "may affect."

To assist with making this determination, we suggest the following:

A. Describe the proposed action. In your description, identify the timing, location, and when applicable, the frequency and intensity, of the proposed action.

B. Determine whether listed resources will be exposed to the proposed action or to any of the environmental changes that are likely to occur. You should assess the potential for the action to affect any life stage of the species.

- If species or critical habitat will not be exposed directly or indirectly to the proposed action or any resulting environmental changes, conclude "no effect" and document your finding. No further consultation required. For your convenience, we provide an example of a "no effect" document for your use.
- If species or critical habitat may be exposed, continue.

C. Determine if those species or critical habitat exposed will respond upon exposure. Review the pertinent species information page and review other relevant sources of information (e.g., conduct a literature search for the specific stressor or environmental change to which the species will be exposed).

- If the best available data indicate that the species and critical habitat will not respond in any manner, conclude "no effect" and document your finding. No further consultation required. For your use, an example of a "no effect" document is provided.
- If data indicate the species and habitat may respond upon exposure, or if data are equivocal or lacking to justify a determination of "no effect", conclude "may affect" and proceed to Step 3.
    - If surveys are lacking, it may be appropriate to conduct surveys to determine whether listed species are present. Please contact the Ecological Services Field Office nearest the project for more information.

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Environmental Screening for Eastern Massasauga Rattlesnake in Michigan

March 14, 2017

Background

The Eastern Massasauga Rattlesnake (EMR) is listed as a threatened species under the U.S. Endangered Species Act (Act). The Act protects the EMR and their habitat by prohibiting "take" and may require agencies to coordinate with the U.S. Fish and Wildlife Service (Service) before authorizing or funding an activity affecting the species. To streamline coordination, the Service's Michigan Ecological Services Field Office has developed a set of Best Management Practices (BMPs) for specific activities potentially impacting EMR in Michigan. These BMPs are voluntary and just one of the ways that compliance with the Act may be achieved.

Projects may…

- have no effect to EMR and no need for additional ESA compliance considerations.
- have potential for adverse effects, but use BMPs to avoid adverse effects (i.e., "not likely to adversely affect" EMR) or minimize the adverse effects.
- use surveys to confirm probable absence of EMR (contact the Service for survey guidance).
- use "Informal Consultation" with Service (for actions requiring a Federal permit or funding).
- use "Formal Consultation" with Service (for actions requiring a Federal permit or funding).
- develop a Habitat Conservation Plan and seek an ESA permit, if adverse effects cannot be avoided.

For activities not listed in the BMPs, please contact the Service for project-specific recommendations. In some cases implementation of BMPs may not be sufficient to avoid all adverse impacts to EMR and additional consultation with the Service may be required. The Service can assist planners in determining whether adverse effects are likely as a result of proposed projects, and whether implementation of BMPs is sufficient to remove the risk of adverse effects.

Additional information on compliance with the Act can be found:

For Federal actions/section 7 consultation:
https://www.fws.gov/midwest/Endangered/section7/s7process/index.html

For non-Federal actions:
https://www.fws.gov/midwest/endangered/permits/index.html

For questions or comments you may contact the Service below:
U.S. Fish and Wildlife Service
Michigan Ecological Services Field Office
2651 Coolidge Road, Suite 101
East Lansing, MI 48823
Phone: (517)351-2555
Email: eastlansing@fws.gov

Definitions

Active Season: The active season begins in the spring when snakes emerge from hibernation, generally when maximum air temperatures are above 50°F, and ends in the fall when EMR have returned to their hibernacula and temperatures are consistently below 45°F. In Michigan, the active season is generally April through October. The active season dates will vary by location and weather. **Contact the Service for project-specific dates based on location when work in EMR habitat is planned near the start or end of the active season**.

Affecting hydrology: We consider "affecting hydrology" to include projects that are likely to appreciably change the elevations of surface water upstream or downstream, or in the local ground water (as estimated pre-project vs. post-project). The concern is for changes to local hydrology (e.g., creating new ditches, creating a new impoundment) that might harm EMR hibernating at or near ground water, or actions that significantly alter available suitable habitat either through flooding or drying of EMR wetlands.

Hibernacula: Areas suitable for EMR to overwinter. For most EMR populations, the locations of hibernacula are not known, but these areas are critical to protect. Unfortunately, we lack information on how to reliably identify these areas. EMR usually hibernate below the frost line in crayfish or small mammal burrows, tree root networks or rock cervices in or along the edge of wetlands or in adjacent upland areas with presumably high water tables (areas where the soil is saturated but not inundated). Following egress from hibernacula in the spring, EMR typically remain aboveground in the vicinity for a week or two, and return to these areas in the fall for several weeks prior to entering hibernation. Surveys in the spring (shorting following egress) or fall (prior to ingress) when snakes are congregating in the vicinity may help identify these important areas. Maintaining stable hydrology of these areas is important during the inactive season.

IPaC: "Information for Planning and Conservation" is a project planning tool available on-line to the public that streamlines the Service's environmental review process.

EMR Habitat: "Eastern Massasaugas have been found in a variety of wetland habitats. Populations in southern Michigan are typically associated with open wetlands, particularly prairie fens, while those in northern Michigan are known from open wetlands and lowland coniferous forests, such as cedar swamps. Some populations of Eastern Massasaugas also utilize open uplands and/or forest openings for foraging, basking, gestation and parturition (i.e., giving birth to young). Massasauga habitats generally appear to be characterized by the following: (1) open, sunny areas intermixed with shaded areas, presumably for thermoregulation; (2) presence of the water table near the surface for hibernation; and (3) variable elevations between adjoining lowland and upland habitats." From Michigan Natural Features Inventory (Website: mnfi.anr.msu.edu)

Tier 1 Habitat: Areas known to be occupied by EMR or highly likely to be occupied by EMR.

Tier 2 Habitat: Areas with high potential habitat and may be occupied by EMR.

Within the known range: EMR can occur throughout the Lower Peninsula and on Bois Blanc Island in Mackinac County. Areas within the known range but outside of Tier 1 and Tier 2 are considered less likely to be occupied. EMR is highly secretive and cryptic in nature, and can persist in low densities, which makes them difficult to detect. Further, there are extensive areas of the state that have never been surveyed. It is likely that there are additional and yet-unknown occurrences throughout the Lower Peninsula of Michigan. Mapped habitats are subject to change based on new information identifying current Tier 1 and 2 areas as unsuitable, or based on discovery of new EMR occurrences.

EMR Environmental Screening Step-wise Process

Step 1. Determine if EMR may be present in the action area

- ✓ Determine whether the project is in potential EMR habitat using https://ecos.fws.gov/ipac
  - You can search for your project location and define the action area by drawing a polygon or uploading a shapefile.
  - IPaC will give you a list of species that may be present in the area you identified. If you click on the thumbnail for EMR, it will tell you if your project is within Tier 1 or Tier 2 habitat, or within the known range of EMR. If EMR is not listed, you do not need to consider this species. Effects to other listed species should also be considered; contact the Service if you need assistance.
  - If EMR is listed, it does not necessarily mean that the entire action area is potential habitat, only that some potential habitat is within the action area entered. For large-scale (e.g., county-wide or multi-county projects) consider coordinating the Michigan Ecological Services Field Office for direct assistance.

If your project is within the known range of EMR, including Tier 1 or Tier 2 habitat, continue to step 2:

Step 2. Determine if the project has the potential to affect EMR

Projects have no effect on EMR when…

- ✓ There is no suitable EMR habitat in the project area and no potential impact off-site (e.g., water discharge into adjacent EMR habitat). If project site conditions are determined to be wholly unsuitable for EMR (e.g., project is in regularly mowed turf grass, row crop, graveled lot, existing building, or industrial site), it is not suitable EMR habitat.
- ✓ The project occurs within suitable habitat, but the action will have absolutely no effect on the habitat or EMR.
- ✓ In suitable EMR habitat, but the site is entirely unoccupied by the species. This is typically confirmed through surveys (contact the Service for more information). In some cases it may be easier to assume EMR are present and use BMPs than to conduct surveys for the species.

For projects where there is a potential for effects to EMR, continue to the section of the document as follows:

For Tier 1 Habitat ..... Page 5

For Tier 2 Habitat ..... Page 6

Within the range of EMR ..... Page 7

For projects with a combination of Tier 1 and Tier 2 habitat, follow the instructions for Tier 1.

Tier 1 Habitat

Tier 1: Project will not affect EMR if all of the following apply:

1. Project will not result in any changes to suitable EMR habitat quality, quantity, availability or distribution, including changes to local hydrology
2. If EMR are present in the project area, they are not likely to have any response as a result of exposure to the action or any environmental changes as a result of the action
3. Project includes all General Best Management Practices:
   a. Use wildlife-safe materials for erosion control and site restoration (see Erosion Control Resources side panel). In Tier 1 habitat, immediately eliminate use of erosion control products containing plastic mesh netting or other similar material that could entangle EMR.
   b. To increase human safety and awareness of EMR, those implementing the project should first watch MDNR's "60-Second Snakes: The Eastern Massasauga Rattlesnake" video (available at https://youtu.be/-PFnXe_e02w), or review the EMR factsheet (available at https://www.fws.gov/midwest/endangered/reptiles/eama/pdf/EMRfactsheetSept2016.pdf or by calling 517-351-2555.
   c. Require reporting of any EMR observations, or observation of any other listed threatened or endangered species, during project implementation to the Service within 24 hours.

Tier 1: Project Not Affecting EMR Coordination Recommendation: No pre-project coordination with Service needed. Document the steps above for your records.

Tier 1: All Other Projects: For any other projects in Tier 1 habitat that may affect EMR or its habitat, contact the Service for assistance in evaluating potential impacts. Best Management Practices (starting on page 8) are included for many actions to help with project planning, but may not be sufficient to avoid all adverse impacts. The Service can determine whether additional measures are necessary after a project-specific review.

Erosion Control Resources

There are a variety of products that can be used for soil erosion and control requirements. These products may incorporate plastic mesh netting to help maintain form and function. This plastic netting has been demonstrated to entangle a wide variety of wildlife from birds to small mammals. In Michigan, soil erosion control netting has resulted in the documented mortality of a number of imperiled amphibian and reptile species including the EMR and the Eastern Fox Snake (State Threatened).

Several products for soil erosion and control exist that do not contain plastic netting including net-less erosion control blankets (for example, made of excelsior), loose mulch, hydraulic mulch, soil binders, unreinforced silt fences, and straw bales. Others are made from natural fibers (such as jute) and loosely woven together in a manner that allows wildlife to wiggle free. For more information regarding wildlife-safe erosion control measures contact the USFWS Michigan Ecological Services Field Office.

Tier 2 Habitat

Tier 2: Project is not likely to adversely affect EMR if all of the following apply:

1. Project does not impact more than 1 acre of wetland habitat and includes all applicable activity-specific BMPs (starting on page 8), and
2. Project will not appreciably affect hydrology
3. Project includes all General Best Management Practices:
    a. Use wildlife-safe materials for erosion control and site restoration (See Erosion Control Resources side panel, page 4). In Tier 2 habitat, eliminate the use of erosion control products containing plastic mesh netting or other similar material that could ensnare EMR as soon as is feasible but no later than January 1, 2018.
    b. To increase human safety and awareness of EMR, those implementing the project should first watch MDNR's "60-Second Snakes: The Eastern Massasauga Rattlesnake" video (available at https://youtu.be/-PFnXe_e02w), or review the EMR factsheet (available at https://www.fws.gov/midwest/endangered/reptiles/eama/pdf/EMRfactsheetSept2016.pdf or by calling 517-351-2555.
    c. Require reporting of any EMR observations, or observation of any other listed threatened or endangered species, during project implementation to the Service within 24 hours.

Tier 2: Project Not Likely to Adversely Affect EMR Coordination Recommendation: Informal consultation with Service for actions requiring a Federal permit or funding. For non-Federal projects, document the steps above for your records, but no pre-project coordination with the Service needed.

Tier 2: All Other Projects: Coordinate with the Service for a project-level review to determine potential impacts and whether additional conservation measures are needed to avoid adverse effects.

Within the known range of EMR

For projects within the known range of EMR, but outside of Tier 1 and Tier 2 habitat:

To help ensure your project is unlikely to affect EMR:

1. Project applies the General Best Management Practices:
    a. Use wildlife-safe materials for erosion control and site restoration (See Erosion Control Resources side panel, page 4). By January 1, 2019, eliminate the use of erosion control products containing plastic mesh netting or other similar material that could ensnare EMR (within the known range but outside of Tier1 or Tier 2 habitat).
    b. To increase human safety and awareness of EMR, those implementing the project should first watch MDNR's "60-Second Snakes: The Eastern Massasauga Rattlesnake" video (available at https://youtu.be/-PFnXe_e02w), or review the EMR factsheet (available at https://www.fws.gov/midwest/endangered/reptiles/eama/pdf/EMRfactsheetSept2016.pdf or by calling 517-351-2555.
    c. Require reporting of any EMR observations, or observation of any other listed threatened or endangered species, during project implementation to the Service within 24 hours.
2. Project will not have significant impacts to dispersal, connectivity, or hydrology of existing EMR potential habitat, i.e., filling less than 1 acre of wetland habitat or converting less than 20 acres of uplands of potential EMR habitat (uplands associated with high quality wetland habitat) to other land uses.

Within the Known Range, but Outside Tier 1 or 2 Coordination Recommendation:
Document the steps above for your records and no pre-project coordination with the Service needed. If you cannot implement the General Best Management Practices contact the Service for assistance in evaluating potential impacts.

Activity-Specific Best Management Practices

For Tier 1, BMPs are included; however, even with implementation of the BMPs, project-specific review may be needed to determine whether they are sufficient to avoid all adverse impacts

- In Tier 1 habitat, contact the Service regarding the potential applicability of surveys to determine EMR absence in suitable habitat. In Tier 2, surveys can be conducted to confirm the presence of suitable habitat and/or the presence/probable absence of EMR. If onsite habitat is determined to be wholly unsuitable via desktop analysis (e.g., entirely mowed lawn, row crop, graveled lot, and industrial site), then it can be classified as unoccupied and the BMPs will not be necessary.
- Minimize work in Tier 1 and Tier 2 EMR habitat. When feasible, do not route new construction projects, such as pipelines, facilities, or access roads, through potential EMR habitat. Implement the use of wildlife-friendly corridors (e.g., oversized culverts) into new road design to maintain or enhance habitat connectivity.
- Projects should be designed to minimize the potential for disturbance to EMR during project activities.

Maintenance Activities (includes nominal modifications to existing roads and infrastructure)

1. Ground Disturbing Activities
    a. All
        i. No known EMR hibernacula are destroyed or disturbed at any time of year. Because these areas are often not known:
            1. For Tier 1: contact the Service to determine whether adverse impacts are likely as a result of ground disturbing work in Tier 1 habitat.
            2. For Tier 2: when operating in potential hibernation areas (e.g., EMR wetlands and adjacent areas with crayfish burrows, rodent holes, small mammal burrows, etc.), work is conducted well within the active season (June – August) to avoid when snakes are likely to be present. During this time, they are most likely to be able to move out of the way of disturbance and have greater chances to find alternative hibernation sites. Destroying potential hibernacula may still impact snakes indirectly. Potential hibernation areas should be avoided to the extent possible.
    b. Grading
        i. When working during EMR active season, use exclusionary fencing to separate EMR habitat from the work site to prevent EMR from accessing the disturbance area. For example, in linear projects exclusionary fencing should run parallel to the disturbance, creating a barrier to snake movement. Each end of the exclusionary fencing should be angled away from the area of disturbance to direct snakes traveling along fencing away from the site. The

exclusionary fencing will typically be traditional silt fence that is set up outside of all areas of disturbance and other types of fencing (i.e., snow fence used to delineate the work zone). Do not use fencing materials that can entangle or injure snakes.

ii. Any areas using exclusionary fencing should first be "cleared" by a qualified individual[1] before beginning construction activities. Fencing should be installed a minimum of 1 day before construction activities occur and walked weekly to ensure the integrity of the fence. If snakes are seen within the work zone, activity should stop until the snake can be safely moved, and the fence examined for breeches.

iii. Revegetate all disturbed Tier 1 and Tier 2 habitat with appropriate plant species (i.e., native species or other suitable non-invasive species present on site prior to disturbance). Monitor all restoration plantings for proper establishment and implement supplemental plantings as necessary to ensure restorations are of equal to or better habitat quality than previous conditions.

iv. In Tier 1 and Tier 2, avoid spread of invasive species into EMR habitat by following best practices. This includes inspecting and cleaning equipment and vehicles between work sites as needed to avoid the spread of invasive plant materials.

c. Trenching

i. In Tier 1 and Tier 2, avoid trenching in EMR wetlands when possible. In Tier 1, if open trenching is required install exclusionary fencing (follow measures 1(b)(i)-(iv)) and ensure the area is clear prior to trenching.

d. Fill

i. In Tier 1 and Tier 2, ensure all imported fill material is free from contaminants or invasive species could affect the species or habitat through acquisition of materials at an appropriate quarry or other such measures.

ii. In Tier 1 and Tier 2, use exclusionary fencing around the area to be filled and have the site "cleared" prior to placing fill by a qualified individual (as in 1(b)(i)-(ii).

e. Ditching

i. For Tier 1 and Tier 2, conduct work well within the active season (June-August) when snakes are not likely to be near hibernation sites and can escape disturbance, or contact Service for project specific recommendations.

ii. For Tier 1, use exclusionary fencing around the area to be cleared/graded and have the site cleared by a qualified individual prior to construction activities.

iii. For Tier 1, contact the Service for work greater than 200' for project specific recommendations.

[1] A qualified individual is someone who has received training on the identification and life history of EMR.

2. Site Access with vehicles (both Tiers)
    a. Limit operating vehicles/equipment, clearing trees, etc., in EMR habitat to the inactive season when the ground is frozen. During this time, under these conditions, EMR are most likely underground and will not be impacted by these activities. When possible, use low-impact equipment such as light weight track mounted vehicles with low ground pressure. In Tier 1, if the ground isn't completely frozen (due to weather conditions during the inactive season or if working near seeps and springs that are less likely to freeze), or if working near potential hibernacula, manual access (on foot) may be required.
    b. Strictly control and minimize vehicle activity in known/presumed occupied EMR habitat to the extent possible. During EMR active season, speed limits at facilities and access roads (i.e., 2-track and gravel) in occupied habitat should be <15 MPH.
    c. In Tier 1 and Tier 2 habitat areas, drivers should be aware of the potential danger to the driver of swerving to intentionally drive over snakes as well as legal and conservation implications.

3. Heavy Equipment (both Tiers)
    a. Spill Prevention for oils/fluids
        i. Site staging areas for equipment, fuel, materials, and personnel at least 100 feet from the waterway, if available, to reduce the potential for sediment and hazardous spills entering the waterway. If sufficient space is not available, a shorter distance can be used with additional control measures (e.g., redundant spill containment structures, on-site staging of spill containment/clean-up equipment and materials). If a reportable spill has impacted occupied habitat:
            1. Follow spill response plan;
            2. Call MDEQ and the National Response Center (800-424-8802), and the Service's Michigan Ecological Services Field Office (517-351-2555) to report the release.
    b. Do not use large equipment or perform earth-moving activities, water withdrawal and discharge for hydrostatic testing, or other activities that substantially affect the ground or water levels in potential EMR hibernacula areas. Avoidance measures may include, but are not limited to, re-routing of pipeline and appurtenance facilities, boring or drilling, and timing/weather-related restrictions. Measures will be determined on a site-specific basis, based on local habitat conditions, contact Service for more information.

4. Hydrology impacts (both Tiers)
        i. Water levels in known/presumed occupied habitats should not be artificially manipulated during the inactive season.

ii. Where applicable, water levels should be allowed to flow naturally and not be artificially stabilized. This allows for the restoration of early successional habitats.

Habitat Management and Restoration

5. Vegetation Management
    a. Mowing
        i. In Tier 1, mow during the inactive season.
        ii. For Tier 2, mowing is unrestricted during the inactive season. During the active season, follow daytime mowing restrictions and mow during times of day when snakes are less likely to be active (Figure 1). Increase mower deck height to >8 inches to reduce likelihood of injury to snakes. Higher deck height will reduce the risk of death or injury to snakes in the area.
        iii. In areas with turf grass or areas where trying to discourage EMR (e.g., in areas around buildings), mow regularly and keep grass relatively short (less than 4-6 inches) to reduce its suitability for EMR. If starting with longer grass (greater than 6 inches), mow during the inactive season initially, and then maintenance mowing can occur during the active season (as long as it is regularly maintained and kept shorter than 4-6 inches, so that EMR is unlikely to use those areas). Unmaintained/longer grass may be used by snakes and make them vulnerable to mortality during the next mowing event.

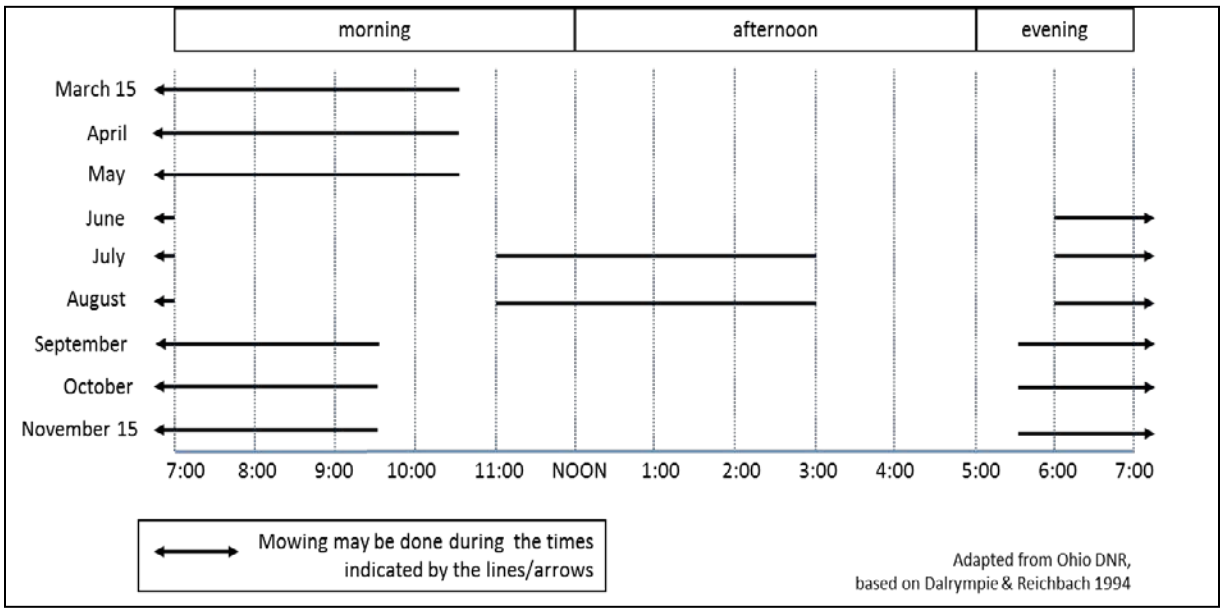

Figure 1. EMR Active season mowing schedule (NiSource Biological Opinion, page 273, USFWS 2015)

b. Cultivation (e.g., disking)
    i. In Tier 1 habitat, disking should be limited to the inactive season, and areas within 50 m of known or potential hibernacula should be avoided. In Tier 2, disking can occur in the active season if area is mowed during the inactive season and maintained shorter than 4-5 inches.
c. Brush/Tree Removal
    i. In Tier 1, conduct brush or tree removal in known/presumed EMR habitat during the inactive season, when the ground is frozen (such that soils can be left undisturbed).
    ii. Use low impact harvest methods in Tier 1 and Tier 2 wetlands to cut and remove individual trees. This includes using low-impact equipment such as light weight track mounted vehicles with low ground pressure. In Tier 1, if the ground isn't completely frozen (due to weather conditions during the inactive season or if working near seeps and springs that are less likely to freeze), or if working near potential hibernacula, use hand tools and access site on foot.
    iii. In Tier 1 and Tier 2, do not burn brush piles during the active season. Dispose of brush offsite or leave in place.
d. Herbicides
    i. Follow all appropriate label instructions regarding which herbicide formulation to use in potential EMR habitat. Avoid spray drift beyond the target species/area (observing label instructions regarding optimal wind speed and direction, boom height, droplet size calibration, precipitation forecast, etc.).
    ii. Avoid broadcast applications of herbicides in Tier 1. Spot spraying or wicking can be used to control invasive plants in occupied habitat. If using broadcast spray in Tier 2, limit the area of exposure to less than half of the available EMR habitat to allow for untreated areas to provide potential areas of refugia from exposure. Contact the Service if you need help in determining this.
e. Prescribed burning (Tier 1 and Tier 2)
    i. Conduct prescribed burns during the inactive season before snakes emerge from hibernation. Walk the burn unit following the burn and report any dead or injured EMR to the Service within 24 hours. Burn only a portion (e.g., one-third) of available EMR habitat in any year to leave suitable cover for EMR and its prey.
    ii. Establish fire breaks using existing fuel breaks (roads, rivers, trails, etc.) to the greatest extent possible. Cultivation (disking or roto-tilling) of burn breaks will be minimized to the extent that human health and safety are not jeopardized. Cultivation and mowing to establish fire breaks will occur during the inactive season.

6. Erosion control
    a. Use wildlife-safe erosion control blankets (without plastic mesh netting in the layers of material) as required in the general BMPs. Remove all silt fence used for erosion control once soils are stable to reduce barriers to EMR movement.
7. Revegetation
    a. Revegetate all disturbed Tier 1 and Tier 2 habitat with appropriate plant species (i.e., native species or other suitable non-invasive species present on site prior to disturbance). Monitor all restoration plantings for proper establishment and implement supplemental plantings as necessary to ensure restorations are of equal to or better habitat quality than previous conditions.
8. Invasive species
    a. In Tier 1 and Tier 2, avoid spread of invasive species into EMR habitat by following best practices. This includes inspecting and cleaning equipment and vehicles between work sites as needed to avoid the spread of invasive plant materials.
9. Wetland restoration
    a. Restoring natural hydrology in areas that have been drained by tiling and ditching may greatly benefit EMR habitat. Conduct tile breaking or excavation well within the active season to avoid potential hibernacula. Have a qualified individual walk in front of the equipment to clear the area. Work with the Service for Tier 1 habitat to ensure no indirect adverse effects are expected as a result of restoration efforts.
10. Water-level manipulation
    a. Water levels should not be artificially manipulated during the inactive season to avoid impacts to hibernating snakes. Contact the Service in Tier 1 habitat when water levels will be manipulated during the inactive season or will result in significant alterations to EMR habitat during the active season.

Allen, Ashley

From: Allen, Ashley
Sent: Monday, May 06, 2019 3:42 PM
To: tameka_dandridge@fws.gov
Cc: Gullapalli, Prasad
Subject: RE: Washtenaw County 2019 SRF Project Plan (HRC Job #20190134)

Ms. Dandridge,

Thank you for your response. Washtenaw County will implement the best management practices you sent over for the massasauga rattlesnake. These BMPs will be added as part of the appendices for the 2019 Amendment.

Please let me know if you have any other comments or concerns.

Thanks,

Ashley Allen
Staff Analyst – Environmental Engineering Department
Phone: (248) 454-6300
Direct: (248) 454-6832
Cell Phone: (248) 464-7834
Email: aallen@hrcengr.com
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From: Dandridge, Tameka <tameka_dandridge@fws.gov>
Sent: Tuesday, April 30, 2019 3:13 PM
To: Gullapalli, Prasad <PGullapalli@hrcengr.com>
Subject: Washtenaw County 2019 SRF Project Plan (HRC Job #20190134)

Dear Mr. Gullapalli:

Based on our records, your project area may provide suitable roosting habitat for Indiana bat and northern long-eared bat, and eastern massasauga rattlesnake.

You indicated the county will adhere to the recommended seasonal tree removal restrictions but did not mention any protective measures for massasauga rattlesnake. In order for us to provide a concurrence response, we recommend you implement the attached best management practices to minimize and avoid impacts to massasauga.

Please advise if your client will include the BMPs into the project plans.

Thank you.

Tameka N. Dandridge
U.S. Fish and Wildlife Service
Michigan Field Office
2651 Coolidge Road
Suite 101
East Lansing, Michigan 48823
517-351-8315
tameka_dandridge@fws.gov
*****My schedule: Mon-Thur: 8am-4:30 and Fri (telework): 7:30-4pm*****

Allen, Ashley

From: Hug, Ed <hug@semcog.org>
Sent: Friday, April 12, 2019 11:20 AM
To: Allen, Ashley
Subject: RE: Washtenaw County 2017 SRF - 2019 Amendment

Follow Up Flag: Follow up
Flag Status: Flagged

Yes, give us 30 days. May 13th would be perfect.

Ed

From: Allen, Ashley <AAllen@hrcengr.com>
Sent: Friday, April 12, 2019 10:50 AM
To: Hug, Ed <hug@semcog.org>
Subject: RE: Washtenaw County 2017 SRF - 2019 Amendment

Thank you Ed for your quick response. Is 30 days prior to the public hearing enough time for your review? So around May 13th?

Thank you.
Ashley

From: Hug, Ed <hug@semcog.org>
Sent: Thursday, April 11, 2019 3:01 PM
To: Allen, Ashley <AAllen@hrcengr.com>
Subject: RE: Washtenaw County 2017 SRF - 2019 Amendment

Hi Ashley,

Yes, we have dropped our automated system for grant reviews. We also no longer review grants if the only nexus is EO 12372.

However, this review is outside of the scope of EO 12372, so you will still need to send a copy of your plan for review. (Certain federal grants that involve water, sewer, and the environment still need to get reviews. The state also requires reviews for the same types of grants.)

I can accept a pdf copy of the plan if it is under ~10 MB. If it is larger than 10 MB, alternative arrangements (Dropbox, etc.) can be made for electronic delivery.

Let me know if you have any questions.

Ed

Edward Hug
Transportation Asset Management, Plan and Policy Development Group
Direct: 313.324-3335 | hug@semcog.org

From: Allen, Ashley <AAllen@hrcengr.com>
Sent: Thursday, April 11, 2019 2:52 PM
To: Hug, Ed <hug@semcog.org>
Subject: Washtenaw County 2017 SRF - 2019 Amendment

Hi Ed,

Hubbell, Roth & Clark, Inc. is assisting Washtenaw County Water Resources Commissioner by providing an amendment to the Washtenaw County 2017 SRF Project Plan previously submitted (Regional Clearinghouse File No. EN 170342). Per the DEQ document requirements, it states that if the applicant municipality is located in Washtenaw County that we must contact SEMCOG and send the entire project plan for approval. However, when visiting the SEMCOG website, it states that you will no longer be participating in the clearinghouse review process for federal grants.

So just to clarify, do you want us to submit a draft copy for your review? If so, is 30 days prior to the public hearing enough time for your review?

Thanks,

Ashley Allen
Staff Analyst – Environmental Engineering Department
Phone: (248) 454-6300
Direct: (248) 454-6832
Cell Phone: (248) 464-7834
Email: aallen@hrcengr.com
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APPENDIX G

SITE PHOTOS

Photo 1 – Briarwood Mall Pond

Photo 2 – Churchill Park/Eisenhower ROW Basin

Photo 3 – Detroit Street Brick Rd Stormwater Management

Photo 4 – Huron Hills Golf Course Stormwater Improvements

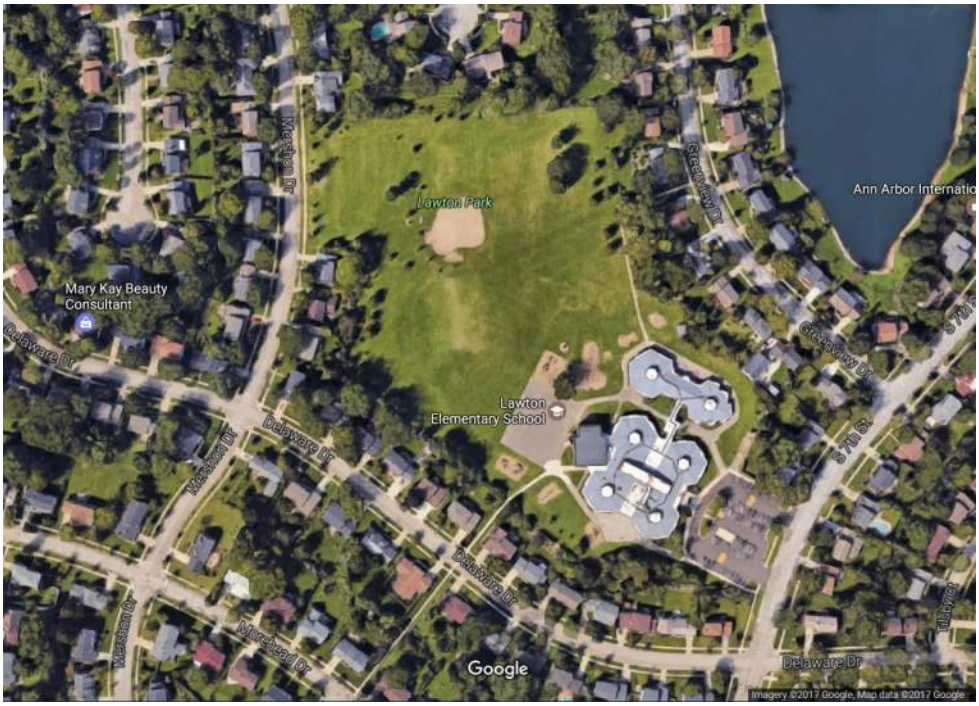


Photo 5 – Lawton Park Stormwater Basin

Photo 6 – Malletts Streambank Stabilization Phase II

Photo 7 – Millers Creek Reach 5

Photo 8 – Seventh Street Stormwater Improvements

Photo 10– Traver Creek Streambank Stabilization

Photo 11 – Swift Run MDOT

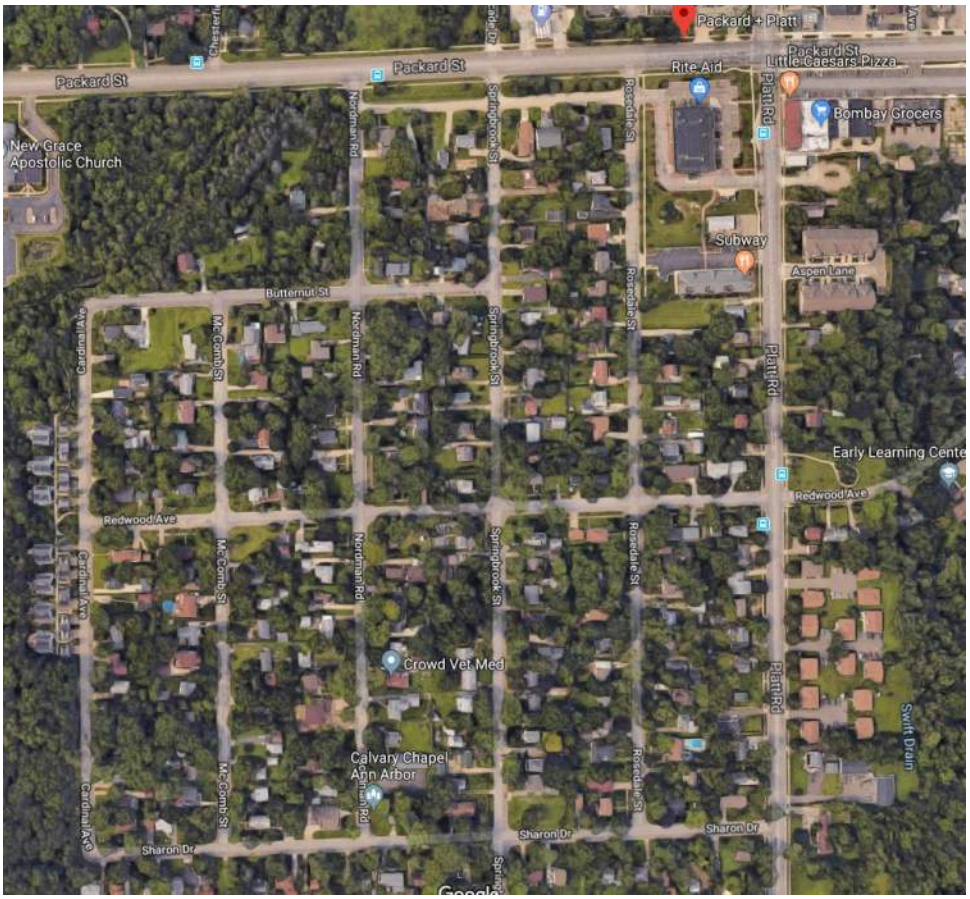


Photo 12 – Springwater Subdivision

Photo 13 – Carpenter Road Drain Pond

Photo 14 – Miller Drain/Upper Paint Creek

APPENDIX H

WATERSHED MANAGEMENT PLANS – EXECUTIVE SUMMARIES

A partnership between The Washtenaw County Drain Commissioner, The City of Ann Arbor, and Pittsfield Township.

EXECUTIVE SUMMARY

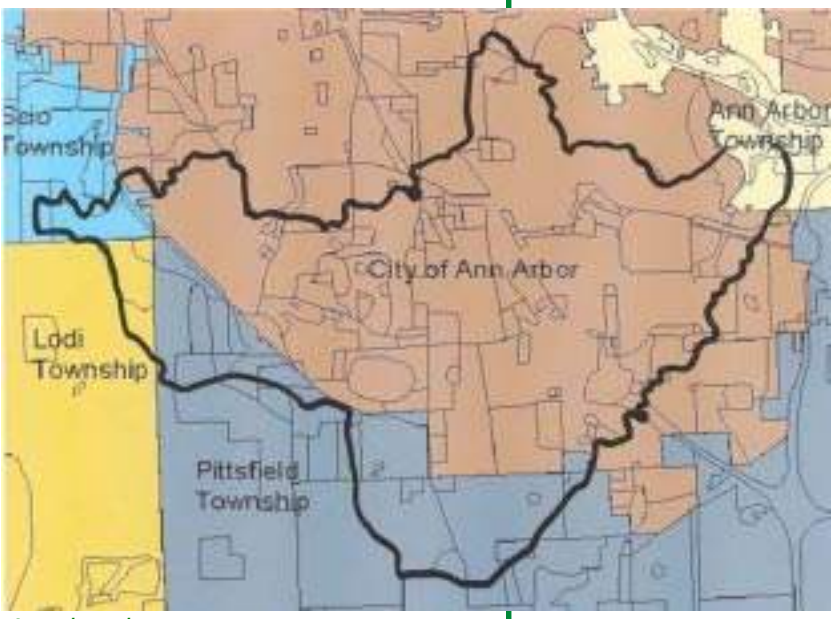
Introduction to Malletts Creek

Malletts Creek is located in eastern Washtenaw County, primarily in the City of Ann Arbor and Pittsfield Township. The Malletts Creek watershed is 11-square miles in area and flows into the Huron River. Most of the creek is a Washtenaw County drain, which means the Drain Commissioner is responsible for maintaining these portions of the drainage course. In the last 40 years, the watershed has seen extensive development, including shopping malls, new subdivisions, apartment complexes, homes, parking lots, businesses, stores, churches, and industrial buildings.

Because much of the land is heavily developed (37% of the land is covered with impervious surfaces), Malletts Creek is considered an urban watershed.

Background of Malletts Creek Restoration Project

Malletts Creek is a Chapter 20 County Drain and natural stream that is in need of maintenance and improvement. The Washtenaw County Drain Commissioner, City of Ann Arbor, and Pittsfield Township, have recognized structural, water quality and flow capacity problems, and wish to restore Malletts Creek. In addition, the Michigan Department of Environmental Quality (MDEQ) has mandated a 50% phosphorus reduction to protect the Huron River and downstream impoundments and has specified the need to improve the creek's habitat (fisheries) value.



Area location

In order to begin the process of restoration and repair of Malletts Creek, the project sponsors contracted with a consultant team to undertake a comprehensive assessment of the Creek and to develop an overall plan to guide the restoration work.

The consultant team worked closely with staff from the office of the Washtenaw County Drain Commissioner, the City of Ann Arbor and Pittsfield Township, to study Malletts Creek, identify the underlying problems and provide an innovative, long-range, staged, practical, cost-effective approach to solving these problems. The final plan was required to reflect community input, have significant public support, and the approval of the City of Ann Arbor and Pittsfield Township.

Restoration Team

In January of 1999, the consultant team of Environmental Consulting & Technology, Inc. (ECT), Applied Science, Inc. (ASI) and Tilton & Associates, Inc. (TAI) was chosen to study the problems in Malletts Creek and prepare a restoration plan.

Research Park

Severe bank erosion at Chalmers Road

Key Problems

Several key problems were identified in previous work performed by the Office of the Drain Commissioner, the City of Ann Arbor, Pittsfield Township, the Michigan Department of Environmental Quality, the Huron River Watershed Council and the Malletts Creek Association. These included:

Water quantity problems:

- Increased peak quantity and peak velocity in the creek
- Channel and bank erosion resulting from high velocities
- Isolated flooding associated with increased flow and culvert restrictions

Major water quality problems:

- High phosphorus
- Erosion and sedimentation
- Increased water temperature

Structural Problems

- Repairs to headwalls/endwalls
- Repairs to bridge abutments

Diminished habitat:

- Lack of bank vegetation
- Degraded stream beds
- Frequent and severe peak flows

Consequences of the Problems

As a consequence of the urbanization and the resulting flashy flow characteristic of the creek, the view of the creek as a community amenity was diminished. The resulting sediment and associated phosphorus loads from Malletts Creek degrading the downstream impoundments, leading the Michigan Department of Environmental Quality (MDEQ) to require a 50% reduction in the phosphorus loading. In addition, the MDEQ recognized that the Malletts Creek fish and wildlife habitat had been severely impacted. This, coupled with isolated flooding issues, caused the local units of government to initiate this comprehensive restoration project.

Goals of the Restoration Project

The project team analyzed the creek and its watershed, with the goal of developing plans and implementation activities to achieve the following:

- Address structural repairs as needed
- Reduce phosphorus pollution by 50%
- Increase habitat for fish and wildlife
- Control stream velocities and flow rates
- Establish an educated and involved public

Throughout the project, the team aggressively sought and obtained input, advice and preferences of the public, to learn about its perception of problems and acceptable strategies for restoration.

Use a safe lawn fertilizer

Detention Pond by I-94

Data Collection Activities

The team began to study the watershed by collecting existing data on water quality, quantity, and benthic populations. To supplement the existing data, new water quality testing, and a benthic study were conducted. The team performed a limited detention pond inventory, surveyed cross sections, and performed a physical survey by walking the stream and reporting on the vegetation and habitat as well as needed structural repairs.

Best Management Practices (BMPs)

Previous studies of the watershed indicated that sources of its problems are largely "non-point" sources of pollution. Best Management Practices (BMPs) are methods to prevent or mitigate such pollution. Categories of BMPs that were reviewed included management methods, treatment methods, and source controls. BMPs were evaluated by the project team and at public meetings.

Three categories of BMP's were identified and evaluated:

Source controls, such as changing lawn fertilization and landscape practices, are proactive, keeping water runoff clean and using it as a resource. These measures can save money and are particularly useful in residential areas but they need to happen throughout the watershed and require public education and buy-in by the public.

Treatment methods, such as detention ponds, are reactive, cleaning up and slowing down polluted storm water runoff from developed lands. Since they require initial capital investment and long term maintenance, treatment methods can be implemented by government alone, or in partnership with private land owners. Existing ponds can be retrofitted to improve quantity and quality performance

Management methods include revising local ordinances to reduce runoff and improve storm water management and protecting key flood-prone land.

Modeling Study

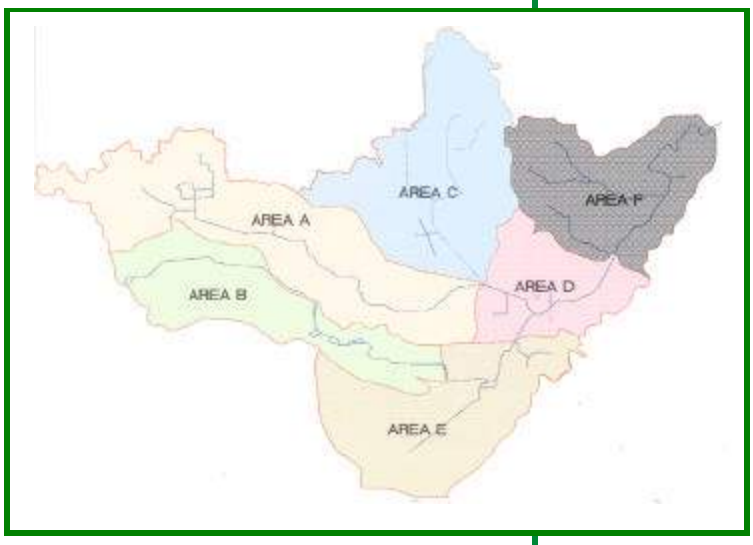
A detailed computer modeling study was performed. This study enabled the team to predict flow rates and flood elevations as well as phosphorus levels in the creek. Simulation of future land use assumed full development of the watershed. Because future development projects will be required to adhere to modern ordinances, the differences are minimal between the existing conditions and the model predictions for future land use. The modeling study components are described below:

Hydraulic Study

- Installed and collected data from a USGS flow gage at Chalmers Road and a rain gage at the U.S. Army Reserve Base on Industrial Highway
- Input data into the EPA Storm Water Management (SWMM) model
- Identified areas of potential flooding and suggested solutions

Phosphorus Study

- Reviewed existing water quality data
- Collected water samples at six locations across the watershed during the year
    - Input this data into a phosphorus loading model
    - Predicted likely sources of high phosphorus loading by subwatershed, and identified anomalies suggesting unknown sources of phosphorus, such as illicit discharges



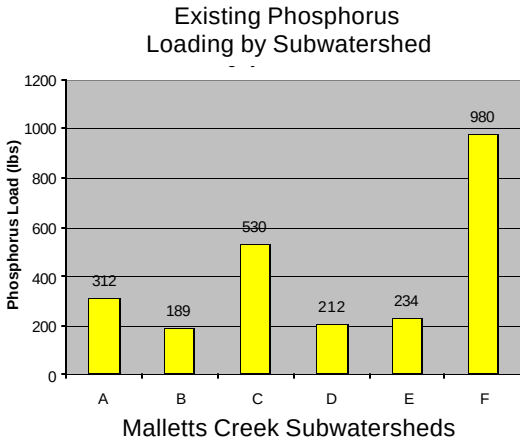
Malletts Creek Subwatersheds

Hydraulic and Hydrologic Analysis Results

This portion of the modeling study showed that Malletts Creek is experiencing extreme peak flows, most likely attributable to the fact that 22% of the land area in the watershed is impervious surface directly connected to the storm water system and creek. Half of the flow of Malletts Creek is from the Burns Park residential neighborhood (shown as area "C" on the map displayed to the left), which represents 20% of the watershed.

Analysis of the 10-year storm and the 100-year storm showed 5 specific points of concern along Malletts Creek resulting from changes in hydrology, or improperly sited, designed or constructed buildings or private storm water management facilities:

- Eisenhower Office Park (100-year storm)
- Eisenhower Parkway west of State St. (100-year storm)
- Oakbrook Drive east of Main St. (10-year storm)
- Lansdowne residential area (10-year storm)
- Cranbrook Tower area upstream of Briarwood ponds (100-year storm)



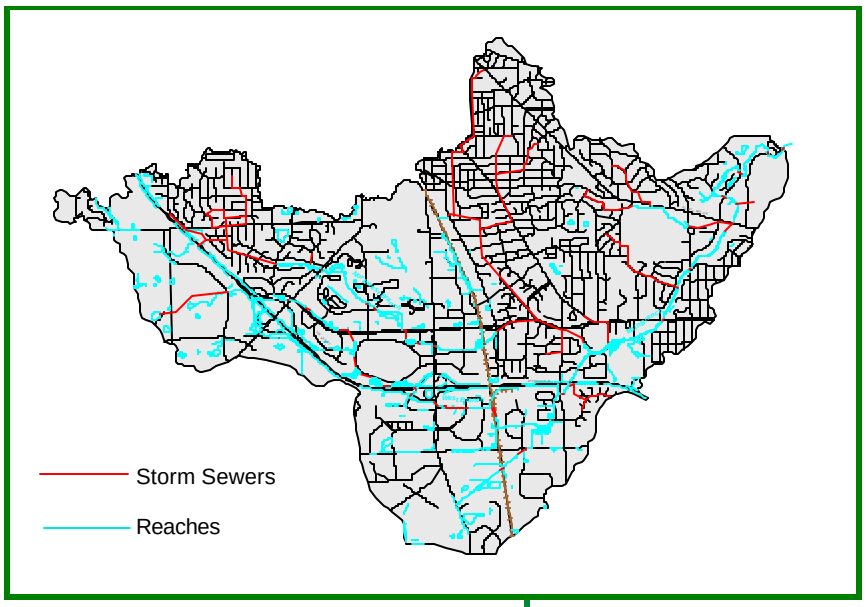
Phosphorus Analysis Results

From the water quality data, it was determined that the majority of the phosphorus pollution washes off of the land, entering the Creek in rainstorms.

The team divided the watershed into 6 subwatersheds for a detailed analysis, and the phosphorus model enabled the team to distribute the contribution of phosphorus among the 6 different subwatersheds.

The phosphorus contribution varied between the subwatersheds which is a significant finding and means that different management activities are appropriate in the subwatersheds. Creative source controls need to be implemented, and treatment methods or detention areas need to be constructed where possible.

To reduce the total phosphorus in the creek by 50% the following activities are recommended:



Malletts Creek hydrology

- Modify existing detention basins to detain and treat smaller storms
- Add 5 in-system storage structures to 3 storm drains (County Farm, Lansdowne and Burns Park areas)
- Promote landowner participation in creek-safe lawn maintenance (target 25% participation)
- Increase street sweeping in residential and commercial areas
- Renovate Brown Park pond, which is owned by the Malletts Creek Drainage District
- Create a new wetland pond at County Farm Park

If these recommendations are implemented, the MDEQ requirements will be fulfilled for the Malletts Creek Watershed.

Habitat Analysis Results

Malletts Creek is under an MDEQ mandate to improve habitat quality. Excessive water velocities are undermining fisheries and species habitat. The following are recommendations from the habitat analysis.

- Increase detention in the watershed to reduce peak velocities
- Remove logjams and sediment islands
- Create meandering low flow channels between pools
- Stabilize stream bank with plantings to provide food and cover for wildlife
- Protect and create riparian wetland areas

The team completed a thorough reconnaissance of Malletts Creek and identified locations where structures and streambanks were in need of repair. Structures such as culverts and headwalls were in some cases found to be deteriorated and will need to be repaired or replaced. Structural streambank stabilization approaches such as rip rap may be needed where vegetative methods are not feasible.

Malletts Creek at Highland Drive

Public Involvement

To be effective, the restoration planning and implementation process must continue to include all the groups that live and work in the watershed. One of the project goals was to establish an educated and involved public. To accomplish this, the team identified a list of stakeholder groups, including elected and appointed officials, environmental groups, public and private schools, business associations, homeowners associations, commercial, residential and riparian landowners and lawn care companies.

Several mechanisms were used to reach and involve these stakeholders. These included a web page, four community-wide meetings, interacting with the Malletts Creek Association (a citizen based creek protection group), conducting focus groups and telephone surveys.

The restoration activities included in this report come from the community as well as the staff of the Washtenaw County Drain Commissioner's Office, City

of Ann Arbor, Pittsfield Township, and the consultant team. The full range of problems in Malletts Creek can only be addressed by including actions that involve the people who live, work and visit the watershed; government alone cannot achieve full success.

Key Findings that Direct Restoration Activities

The study's findings, consisting of direct observation, sampling and analysis, modeling and community involvement, have directed the team to recommend a restoration strategy. The key findings are as follows:

- Peak discharge and velocity exceed acceptable levels
- 97% of the phosphorus pollution occurs from storm water runoff, not dry weather flow
- The urbanized areas, such as most of subwatersheds C and F that are built without detention ponds, contribute more to the Creek's high peak flows velocity and phosphorus problems than others
- With control of discharge and velocity, habitat can be improved

Recommended Restoration Activities

Based on the key findings, the team and stakeholders formulated activities and strategies to accomplish the reduction in peak flows and velocities, reduction in phosphorus concentration and improvement in fish and wildlife habitat.

Treatment Controls

- Institute both public and private solutions for flood concerns
- Retrofit detention basins
- Add in-system storage structures on large storm drains
- Renovate Brown Park pond
- Create wetland pond at County Farm Park
- Create new wetland ponds and extended detention basins
- Install catch basin restrictors

Structural Repairs

- Repair failed endwalls and outlet structures
- Repair broken culverts
- Repair cracked headwalls
- Remove large sediment islands
- Stabilize sections of the streambank

Source Control Activities

- Reduce lawn fertilizer use, increase native landscaping
- Implement related public education and technical assistance program
- Conduct illicit discharge elimination program
- Provide extra resources to strengthen soil erosion and sedimentation control enforcement
- Increase street sweeping
- Revise local government ordinances to reduce runoff and improve storm water management
- Modify residents yard waste and leaf handling practices

Habitat Restoration

- Remove logjams
- Remove sediment islands
- Restore streambank corridor and stabilize erosion
- Make in-stream improvements, the addition of low flow channels, ponds and riffle pools.

The Malletts Creek Restoration Plan also recommends ongoing periodic monitoring to measure program success.

Restoration Plan Activities and Costs

The recommended restoration activities are presented on Table 1. The activities are described and have been given project numbers for tracking of costs and scheduling during a restoration plan period of 6 years. It is further recommended that some activities continue to occur after the 6 year restoration period. These activities are given on Table 2 as on-going activities. The estimated cost of the on-going activities also is given on Table 2.

On Table 3, the costs of the restoration are summarized by year, for the 6 year restoration plan is about $19 million, with about $11.5 million in capital costs for: the construction of a new wetland pond in County Farm Park; improvements of the wetland in Brown Park; streambank stabilization; structural repairs to headwalls, endwalls, bridge abutments, detention pond modifications and construction of in-system storage structures in large storm drains. The remainder of the costs are for finance costs, operation and maintenance (O&M) costs, and public involvement programs.

The current apportionment for drain improvement projects requested by petition to the Drain Commissioner is given on Table 4.

Beneficial Impacts of Restoration Activities

The recommendations of this restoration plan will:

- Reduce peak discharge
- Reduce flow velocity
- Reduce total phosphorus to the Huron River by 50%
- Provide habitat improvement along 7 miles of the Creek
- Increase aesthetic enjoyment of the Creek
- Control flooding for the ten-year storm along the main channel.

Table 1: Restoration Activity Schedule and Estimated Costs

Project #	Restoration Activities	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Total Estimated Costs
		SCHEDULE						
1	Illicit Discharge Elimination Program							$212,700
2	Sampling for Bacteria & Phosphorus							$27,720
2a	Sampling for Benthics							$9,900
3	USGS Stream Gage - Continue Operation							$54,000
4	Enforce Existing Ordinances							$450,000
5	Ordinance & Code Revisions for Stormwater Quality & Management							$360,000
6	Stream Maintenance (routine)							$195,000
7	Public Education Program							$720,000
8	Design In-System Storage Structures for Large Storm Drain Outlets							$75,000
9	Remedy 10-yr. Storm Flooding Problem - Design Solution for Oakbrook Drive Crossing							$10,000
10	Investigate 100-yr. Storm Flooding Problems - Determine Responsibilities							$20,000
8a	Construction of In-System Storage Structures							$1,198,214
9a	Remedy 10-yr. Storm Flooding Problems - Start Construction							$42,600
11	Start Detention Pond Study Throughout The Watershed (Survey & Design 40 ponds/year)							$696,360
12	Design Structural Repairs to Stream -To be done by petition.							$150,000
11a	Start Detention Ponds Retrofit - Outlet Structures, Wetlands and Sediment Forebay							$2,218,250
12a	Structural Repairs to Stream -Start Construction							$4,837,815
13	Residential Street Sweeping - Phase 1 - Area F							$10,100
14	Brown Park Pond Improvements - Design							$250,000
15	County Farm Park Wetlands - Design							$50,000
13a	Residential Street Sweeping - Phase 2 - Area F & C							$27,000
14a	Brown Park Pond Improvements - Start Construction							$2,244,163
15a	County Farm Park - Start Construction							$263,600
13b	Residential Street Sweeping - Phase 3 - All Areas							$134,800
14b	Brown Park Pond - Monitoring							$35,000
15b	County Farm Park Wetland Pond - Monitoring							$35,000
16	Sweep Commercial Streets on a Monthly Basis							$68,800
17	Stream Bank Stabilization - Design							$208,000
18	Habitat Improvements - Design							$22,000
19	Pilot Project - Catch Basin Restriction							$1,169,329
20	Catch Basin Cleaning - Clean 2x/year							$944,300
17a	Stream Bank Stabilization - Implement							$2,211,311
18a	Habitat Improvements - Implement							$174,000
								$19,124,962

Table 2: On-going Restoration Activities and Estimated Costs

Project #	Restoration Activities	Estimated Costs/Year
2	Sampling for Bacteria & Phosphorus	$9,360
2a	Sampling for Benthics	$3,300
3	USGS Stream Gage - Continue Operation	$9,000
4	Enforce Existing Ordinances	$75,000
5	Ordinance & Code Revisions for Stormwater Quality & Management	$60,000
6	Stream Maintenance (routine)	$32,500
7	Public Education Program	$120,000
13b	Residential Street Sweeping - Phase 3 - All Area	$67,400
14b	Brown Park Pond - Monitoring	$17,500
15b	County Farm Park Wetland Pond - Monitoring	$17,500
16	Sweep Commercial Streets on a Monthly Basis	$34,400
20	Catch Basin Cleaning - Clean 2x/year	$472,150
	TOTAL	$918,110

Table 3: Malletts Creek Restoration Plan Estimated Costs Summary

	Capital Costs	Finance Costs	O&M Costs	Public Involvement Costs	Total Estimated Costs
Year 1	$ 105,000	$0	$ 323,760	$ 53,000	$ 481,760
Year 2	$ 1,117,600	$294,814	$ 324,900	$ 66,000	$ 1,803,314
Year 3	$ 2,206,500	$698,522	$ 337,060	$ 103,000	$ 3,345,082
Year 4	$ 3,597,500	$1,315,285	$ 269,800	$ 178,000	$ 5,360,585
Year 5	$ 2,729,580	$963,651	$ 965,930	$ 181,000	$ 4,840,161
Year 6	$ 1,807,160	$613,151	$ 758,750	$ 115,000	$ 3,294,061
Totals	$ 11,563,340	$3,885,422	$ 2,980,200	$ 696,000	**$ 19,124,962**

Note: Finance costs are assumed to be 6.5% over 10 years

Finance costs were calculated on capital projects over $500,000

Table 4: Malletts Creek Drainage District Apportionment %

Ann Arbor City	**74.54**
Pittsfield Twp.	**18.85**
State	**5.62**
Washtenaw County	**0.99**

WATERSHED MANAGEMENT PLAN FOR THE HURON RIVER IN THE ANN ARBOR – YPSILANTI METROPOLITAN AREA

Prepared on behalf of and with funding support from

Janis A. Bobrin
Washtenaw County Drain Commissioner

Technical assistance from
the Huron River Watershed Council

Huron River Watershed Council

Protecting the river since 1965

Revised October 2011

CHAPTER 1: INTRODUCTION

1.1 THE MIDDLE HURON WATERSHED

For the purposes of this plan, the watershed within the Ann Arbor-Ypsilanti Metropolitan Area (see Figure 1.1) will be referred to as the Middle Huron Watershed. The Middle Huron Watershed is part of the Huron River Watershed (see Figure 1.1), one of Michigan's natural treasures. The Huron River supplies drinking water to approximately 150,000 people, supports one of Michigan's finest smallmouth bass fisheries, and is the State's only designated Scenic River in southeast Michigan. The Huron River Watershed is a unique and valuable resource in southeast Michigan that contains ten Metroparks, two-thirds of all southeast Michigan's public recreational lands, and abundant county and city parks. In recognition of its value, the State Department of Natural Resources has officially designated 27 miles of the Huron River and three of its tributaries as "Country-Scenic" River under the State's Natural Rivers Act (Act 231, PA 1970). The Huron is home to one-half million people, numerous threatened and endangered species and habitats, abundant bogs, wet meadows, and remnant prairies of statewide significance.

The Huron River basin encompasses approximately 900 square miles (576,000 acres) of Ingham, Jackson, Livingston, Monroe, Oakland, Washtenaw, and Wayne counties (Figure 1.1). The main stem of the Huron River is approximately 136 miles long, originating at Big Lake and the Huron Swamp in Springfield Township, Oakland County. The main stem of the river meanders from the headwaters through a complex series of wetlands and lakes in a southwesterly direction to the area of Portage Lake. Here, the river begins to flow south until reaching the Village of Dexter in Washtenaw County, where it turns southeasterly and flows to its final destination of Lake Erie. The Huron is not a free-flowing river. At least 98 dams segment the river system, of which 17 are located on the main stem.

The immediate drainage area to the Middle Huron Watershed is 217 square miles (138,593 acres), representing approximately 24% of the Huron River Watershed. The Middle Huron Watershed is defined as the land area that drains to the Huron River downstream of the confluence with Mill Creek and through Ford and Belleville Lakes. All or portions of 13 local communities are situated in the Middle Huron Watershed, of which the largest portions are within the Cities of Ann Arbor and Ypsilanti, and the townships of Scio, Ann Arbor, Superior, Pittsfield, Ypsilanti and Van Buren. Other communities with smaller areas in the watershed include the townships of Webster, Northfield, Salem, Lodi, as well as the Village of Dexter and the City of Belleville. The entire watershed lies in Washtenaw County, with the exception of the majority of the drainage to Belleville Lake, which is in Van Buren Township and the City of Belleville in Wayne County.

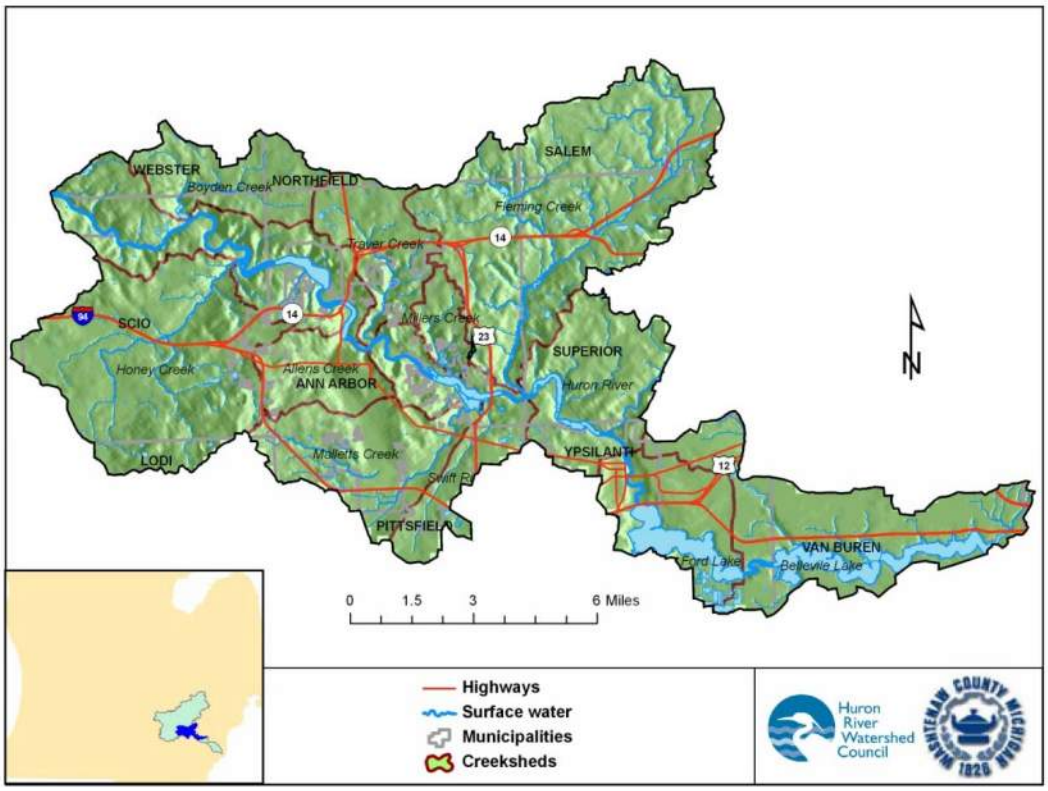


Figure 1.1 The Middle Huron Watershed boundary within the Ann Arbor-Ypsilanti Metropolitan Area, showing municipal and creekshed boundaries.

The segment of the Huron River in the Middle Huron Watershed begins at the outfall of Mill Creek in Dexter and ends at the French Landing Dam, which creates the Belleville Lake impoundment. From the Mill Creek outlet, the river flows unrestricted toward the southeast until it reaches a series of impoundments beginning with Barton Pond and ending in Belleville Lake. Nine major tributaries and the two lake drainages run directly into the Huron River system. These eleven distinct sub-basins are also known as "creeksheds." The mainstem of the Huron River in the Middle Huron Watershed is approximately 40 miles long with additional 593 miles of contributing streams. A relatively significant elevation drop from watershed inlet to outlet coupled with intensive urban development means that fewer lakes and wetlands remain in the Middle Huron than in the Upper Huron watersheds or other watersheds in Michigan. The elevation drops 199.5 feet over 40 river miles for an average gradient of 5.0 ft/mi. This gradient compares to an average of 3.3 ft/mi for the entire Huron River. Approximately 5,393 acres (8.4 sq. miles) of wetlands remain in the Watershed as of 2000, comprising about 6% of the total watershed area. The Middle Huron area contains 378 lakes and impoundments, of which 43 are greater than 5 acres and 10 of which are greater than 20 acres. All the waters greater than 20 acres in size are impoundments.

The watershed contains a few small protected natural areas including Dexter-Huron Metropark, Delhi Metropark, Barton Park, Bird Hills Park, Nichols Arboretum, Matthaei Botanical Gardens, and Belleville Park, as well as numerous other public and private local parks. The watershed's land cover is dominated by urban and sub-urban residential, commercial and industrial uses, with low-density residential areas,

grasslands/old agricultural fields, forested lands, and wetlands scattered primarily in the northern and western fringes of the watershed.

In recent decades, the Huron River Watershed has experienced amplified development pressures from a growing economy and urban sprawl. According to the U.S. Census data and the Southeast Michigan Council of Governments (SEMCOG)[1], the total population of the seven communities[*] that comprise over 90% of the Middle Huron Watershed's population increased 5.5% from 1990 to 2007. The forecast to 2030 shows a 13.5% increase in population from 2007 levels. This growth rate falls in between that of other subwatersheds of the Huron River: Wayne and Oakland Counties' populations are hovering at a constant rate or declining, while rapid growth is occurring in Livingston County.

Washtenaw County continues to be one of the fastest growing counties in the state, reflecting a trend in growth out from Detroit to the more outlying areas spurred by highway improvements, the establishment of infrastructure, and a desire for open space, among other factors. According to SEMCOG, Washtenaw County's population increased by almost 9% from 2000 to August 2007, compared with 2.2% in Oakland County, -0.9% in Wayne County (excluding Detroit) and 23% in Livingston County. SEMCOG predicts that most of Washtenaw County's growth in the next 23 years will take place in Scio, Superior and Ypsilanti Townships, with projected growth rates all over 30%. The more developed municipalities are projected to experience more modest growth below 10%.

If current development practices are employed to accommodate the projected increase in population and associated infrastructure, then SEMCOG estimates 40% of the remaining open spaces will be developed within the Huron River Watershed by 2020. Much of this projected conversion of undeveloped land will occur in the Middle Huron area where it will hasten degradation of the hydrology and water quality of surface waters. Common practices that impact hydrology and water quality include draining wetlands, straightening and dredging streams ("drains"), removing riparian vegetation, installing impervious surfaces and storm sewers, inadequately controlling soil erosion, and poorly designing stream crossings. Such practices result in altered hydrology ("flashy" flows and flooding), soil erosion and sedimentation, elevated nutrients, nuisance algal blooms, dangerous levels of pathogens, and degraded fisheries.

1.2 Purpose of the Watershed Management Plan

The Watershed Management Plan (WMP) for the Huron River in the Ann Arbor-Ypsilanti Metropolitan Area is part of an effort led by communities in the Middle Huron Watershed seeking to plan activities to address water quality issues highlighted in the State of Michigan's Clean Water Act §303(d) report on impaired waters. The original WMP was completed in 1994 and then updated in 2000. This version is the second update of the WMP, and was carried out as a major redraft. Much data and other information on the Middle Huron has been compiled over this time, and the authors have sought to include as much as possible. This version was also reformatted to be consistent with the structure and content of other WMPs in the Huron River Watershed.

---

[*] Includes Scio Township, City of Ann Arbor, Ann Arbor Township, Superior Township, City of Ypsilanti, Ypsilanti Township, and Van Buren Township.

Portions of the Middle Huron Watershed fail to meet minimum water quality standards or provide designated uses protected under Michigan law. In 1996, based on water quality monitoring studies, the Michigan Department of Environmental Quality (MDEQ) listed the Middle Huron River Watershed as significantly contributing phosphorus to the impaired waterbodies of Ford and Belleville lakes. The MDEQ placed the lakes on the State's 303(d) list of impaired waters, which means that their quality is poor enough to require the establishment of a Total Maximum Daily Load (TMDL). A TMDL is the maximum amount of a particular pollutant a waterbody can assimilate without violating numerical and/or narrative water quality standards. The reason for the impaired status was cited as excess phosphorus loading from point and nonpoint sources in the Middle Huron River Watershed.

Both point and nonpoint source contributions need to be reduced if the goal is to be met. The communities of the Middle Huron are under mandate from the State of Michigan to reduce phosphorus loading to the river by 50% in order to meet the TMDL. As a result of field studies, MDEQ established a TMDL target concentration of 50 micrograms per liter (µg/L) of phosphorus for Ford Lake, and 30 micrograms per liter (µg/L) of phosphorus for Belleville Lake to significantly reduce or eliminate the presence of nuisance algal blooms (Kosek, 1996). Scientists estimate that the areas covered under this WMP contribute about 75% of total phosphorus to the Middle Huron, with Mill Creek contributing the remainder.

The primary purpose of this plan is to address this impairment as well as others listed for the Middle Huron Watershed (see section 1.2.1). The Ann Arbor-Ypsilanti Watershed Management Plan represents a broad effort to restore and protect the integrity of water quality and quantity of the Middle Huron system. This plan presents a state-approved methodology to diminish the adverse effects of nonpoint source pollution to meet the established TMDLs and proactively address others that will be developed within the watershed. This plan outlines both quantitative and qualitative steps considered necessary to meet water quality goals for the Middle Huron River and its Watershed.

In order for the State of Michigan to approve a watershed plan, the plan must meet the following criteria as established in State Rule 324.8810:

> *A watershed management plan submitted to the MDEQ for approval under this section shall contain current information, be detailed, and identify all of the following:*
>
> > *(a) The geographic scope of the watershed.*
> > *(b) The designated uses and desired uses of the watershed.*
> > *(c) The water quality threats or impairments in the watershed.*
> > *(d) The causes of the impairments or threats, including pollutants.*
> > *(e) A clear statement of the water quality improvement or protection goals of the watershed management plan.*
> > *(f) The sources of the pollutants causing the impairments or threats and the sources that are critical to control in order to meet water quality standards or other water quality goals.*
> > *(g) The tasks that need to be completed to prevent or control the critical sources of pollution or address causes of impairment, including, as appropriate, all of the following:*
> >
> > > *(i) The best management practices needed.*

(ii) Revisions needed or proposed to local zoning ordinances and other land use management tools.
(iii) Informational and educational activities.
(iv) Activities needed to institutionalize watershed protection.

(h) The estimated cost of implementing the best management practices needed.
(i) A summary of the public participation process, including the opportunity for public comment, during watershed management plan development and the partners that were involved in the development of the watershed management plan.
(j) The estimated periods of time needed to complete each task and the proposed sequence of task completion.

The above criteria are necessary for approval under the Clean Michigan Initiative guidelines. To be approved for funding under federal Clean Water Act section 319, a plan must meet the "9 Minimum Elements:"

a. *An identification of the causes and sources or groups of similar sources that will need to be controlled to achieve the load reductions estimated in this watershed-based plan (and to achieve any other watershed goals identified in the watershed-based plan). Sources that need to be controlled should be identified at the significant subcategory level with estimates of the extent to which they are present in the watershed.*
b. *An estimate of the load reductions expected for the management measures described under paragraph (c) below. Estimates should be provided at the same level as in item (a) above.*
c. *A description of the NPS management measures that will need to be implemented to achieve the load reductions estimated under paragraph (b) above (as well as to achieve other watershed goals identified in this watershed-based plan), and an identification (using a map or a description) of the critical areas in which those measures will be needed to implement this plan.*
d. *An estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon, to implement this plan.*
e. *An information/education component that will be used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the NPS management measures that will be implemented.*
f. *A schedule for implementing the NPS management measures identified in this plan that is reasonably expeditious.*
g. *A description of interim, measurable milestones for determining whether NPS management measures or other control actions are being implemented.*
h. *A set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made towards attaining water quality standards and, if not, the criteria for determining whether this watershed-based plan needs to be revised or, if a NPS TMDL has been established, whether the NPS TMDL needs to be revised.*
i. *A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established under item (h) immediately above.*

The communities involved in the development of this plan are committed to protecting the sensitive natural areas of the Middle Huron Watershed, mitigating impacts of existing point and nonpoint source pollution, and restoring degraded areas.

1.2.1 Total Maximum Daily Load Program

A Total Maximum Daily Load (TMDL) is the maximum amount of a particular pollutant a waterbody can assimilate without violating state water quality standards. Water quality standards identify the applicable "designated uses" for each waterbody, such as swimming, agricultural or industrial use, public drinking water, fishing, and aquatic life. MDEQ establishes scientific criteria for protecting these uses in the form of a number or a description of conditions necessary to ensure that a waterbody is safe for all of its applicable designated uses.

The state also monitors water quality to determine the adequacy of pollution controls from point source discharges. If a waterbody cannot meet the state's water quality criteria with point-source controls alone, the Clean Water Act requires that a TMDL must be established. TMDLs provide a basis for determining the pollutant reductions necessary from both point *and nonpoint* sources to restore and maintain the water quality standards. Point sources is the term used to describe direct discharges to a waterway, such as industrial facilities or waste water treatment plants. Nonpoint sources are those that enter the waterways in a variety of semi- or non-traceable ways such as stormwater runoff.

In Michigan, the responsibility to establish TMDLs rests with the MDEQ. Once a TMDL has been established by the MDEQ, affected stakeholders must develop and implement a plan to meet the TMDL, which will bring the waterbody into compliance with state water quality standards

As of the 2006 303(d) List of Nonattaining Waterbodies from the DEQ, ten waterbodies in the Middle Huron are listed for water quality problems. To date, four TMDLs have been established for Ford and Belleville Lakes (phosphorus), Geddes Pond (pathogens), Malletts Creek (poor fish and macroinvertebrates), and Swift Run (poor macroinvertebrates). Six TMDLs for other pollutants are scheduled for future establishment in the watershed, as described in Table 1.1.

Table 1.1: Waterbodies requiring TMDLs in the Middle Huron Watershed
(Source: MDEQ 2006 303(d) list of nonattaining waterbodies)

Waterbody	Pollutant or Problem	TMDL Status	Location/Area
Ford Lake/ Belleville Lake	Nutrient enrichment (phosphorus)	Approved in 2000	Impoundments of the Huron River located between the cities of Ypsilanti and Romulus.
Huron River (Geddes Pond and Allen Creek)	Pathogens (rule 100)	Approved in 2001	Geddes Pond Dam upstream to Argo Dam, Ann Arbor

Waterbody	Pollutant or Problem	TMDL Status	Location/Area
Malletts Creek	Poor fish and macroinvertebrate communities	Approved in 2004	Huron River confluence u/s to Packard Rd.
Swift Run	Poor macroinvertebrate community	Approved in 2004	SE Ann Arbor: Huron River confluence upstream to Ellsworth Rd
Honey Creek	Pathogens (rule 100)	Approved in 2009	Confluence of Huron River upstream to Wagner Rd..
Barton Pond	Fish Consumption Advisory for Polychlorinated Biphenyls (PCBs)	Scheduled for 2010	Impoundment of Huron River in vicinity of Barton Hills (suburb of Ann Arbor). From dam u/s to Conrail RR bridge crossing.
Ford Lake/ Belleville Lake	Fish Consumption Advisory for Polychlorinated Biphenyls (PCBs)	Scheduled for 2010	Impoundments of the Huron River located between the cities of Ypsilanti and Romulus.
Huron River	Water Quality Standard Exceedance for Polychlorinated Biphenyls (PCBs)	Scheduled for 2010	Lake Erie confluence upstream to include all tributaries.
Second Sister Lake	Fish Tissue-Mercury	Scheduled for 2011	W of Ann Arbor.
Unnamed Lake	Fish Consumption Advisory for PCBs, and Fish Tissue-Mercury	Scheduled for 2010 (PCBs) and 2011 (Mercury)	S. of Ford Lake in the NE corner of Sec. 26, T3S, R7E (Textile Road and Burton Road).

These individual TMDLs are discussed in greater detail in Chapter 2. Concerns related to established TMDLs in the watershed, and primarily nonpoint source-related actions to address those TMDLs, are included in this plan. However, because the problems associated with Mercury and PCB TMDLs are likely to be linked to broadly diffuse air-deposition or specific point sources yet to be defined, actions designed to address such TMDLs are not emphasized in this plan. The TMDLs to be developed for those waterbodies will identify source reductions to be implemented. This plan should be updated following development of those TMDLs, if necessary, to incorporate implementation activities.

1.2.2 Other Subwatershed Management Plans

This Plan was developed with the intention of fulfilling the watershed management planning criteria for the U.S. EPA's Clean Water Act §319 Program and MDEQ's Clean Michigan Initiative Program. In addition, many of the communities have developed plans to comply with the NPDES Phase II Stormwater Program, and these plans are referenced within. It should also be noted that several other "subwatershed" plans have been developed previously through a combination of community, public and private collaborative efforts. These include the Millers Creek Plan (see Appendix E), the

Malletts Creek Plans (Appendices F and X), the Fleming Creek Plan (Appendix G), the Ford Lake Plan (Appendix H), Allens Creek Plan (Appendix I), and the Swift Run Plan (Appendix Y). These plans and efforts are described in further detail in other chapters of the plan.

It is intended that this WMP will serve as an "umbrella" plan to incorporate and reference those other plans and consolidate their recommendations. Due to the broader scope of this plan, the evaluation, analysis and recommended actions will also be broader and less specific than those in subwatershed plans. For example, this plan recommends implementation of a number of individual best management practices (BMPs) in targeted areas. The subwatershed plans will often recommend specific locations for implementation of these BMPs. In many sections of this plan, references are made to elements within subwatershed plans. Users are encouraged to refer to those plans for more specific analysis and recommendations.

1.3 The Watershed Management Plan Community Input

The first task involved in developing the original 1994 Watershed Management Plan was the formation of a Policy Advisory Committee, with members representing each of the communities in the project area. In January 1993, an initial meeting of this group was convened to discuss issues related to nonpoint source pollution in the planning area and individual community concerns. Following this introductory meeting, goals and objectives for controlling water quality were developed and submitted to committee members for review and approval. Since that time the Committee has continued to meet on a regular basis to assist in watershed planning activities throughout the Middle Huron basin. Currently, the Middle Huron Partnership Initiative coordinates the meeting of these communities with the expressed intent to plan and implement activities to address the Ford and Belleville Lakes TMDL for phosphorus.

Efforts to update the Ann Arbor-Ypsilanti WMP are being coordinated under the leadership of the Washtenaw County Drain Commissioner (WCDC) in conjunction with the Huron River Watershed Council. For this 2007 update, an Advisory Committee was established, with representation from each of the communities in the Middle Huron Watershed, with the exception of Van Buren Township and the City of Belleville, as Belleville Lake was added to the geographic scope late in the update process. Project staff held bi-monthly meetings with the Advisory Committee to get feedback on different sections of the WMP. Materials were also distributed to Committee members and other interested parties for review, comment and input. All communities were given draft copies of the WMP for review prior to finalizing. The recommendations contained in this Watershed Plan update were the result of formal and informal meetings with community officials and staff since adoption of the initial plan in 1994 and its 2000 update. This update will again be presented to these communities to integrate with their commitments under other plans.

1.3.1. Technical Advisory Committees

Several Technical Advisory Committees were established to provide input to individual components of this plan. A Committee was established to assist in revising the Drain Commissioner's standards governing the design of stormwater management systems in new developments. Members included staff from local planning, engineering, building

inspection and utilities departments. Private engineering and planning consultants were also represented, as well as the Huron River Watershed Council, the County Soil Conservation District and the MDNR. Committee members were provided with working drafts of the Drain Commissioner's standards (including explanations about how revisions work to improve water quality and quantity control) and asked to provide feedback on their practicality for implementation within Washtenaw County. Revised standards were adopted in 1994. Public involvement and review also guided the 2000 update and this 2007 update. That group was developed specifically to recommend stormwater permit standards. Those standards are not scheduled for revision prior to adoption of the WMP.

Additionally, the Middle Huron Partnership Initiative was formed to address the Ford and Belleville Lakes TMDL. The Partnership originally formed in 1999 following development of the TMDL, and an updated Cooperative Agreement was signed in 2005 (see Appendix B). This voluntary agreement commits the DEQ and community partners to specific steps to address the phosphorus reduction targets described in the TMDL. The Partnership meets twice a year to report on progress and also serves as a de facto advisory body for this WMP.

1.3.2 Input from Local Subwatershed and Creek Groups

Creek groups have contributed a unique community involvement component to the development of the original WMP and updates. Several creek groups have formed since the development of the original WMP, and several of these have developed subwatershed plans or other sets of recommendations. These include plans for Allens, Millers, Malletts, and Fleming Creeks, and Ford Lake. This plan incorporates these components not simply as feedback for the update, but as a basic framework for updating the plan. Recommendations made in this document represent a collaborative effort between the Huron River Watershed Council, the Office of the Washtenaw County Drain Commissioner, the individual creek groups and the greater creekshed communities.

Staff from the Huron River Watershed Council and the Washtenaw County Drain Office have met, and will continue to meet with creek groups, throughout the process of developing and implementing watershed plans. Involving these groups will continue to foster community support for WMP implementation and creek restoration activities. Representatives of the Huron River Watershed Council and the Drain Office will remain involved in these groups to assist in their development, management planning, grant proposals, policy and technical assistance, and special event coordination. In addition, creek group representatives will continue to advise the Drain Office and the Huron River Watershed Council in program development as they have for current and past restoration projects, the Huron River Watershed Council's Adopt-A-Stream program and others.

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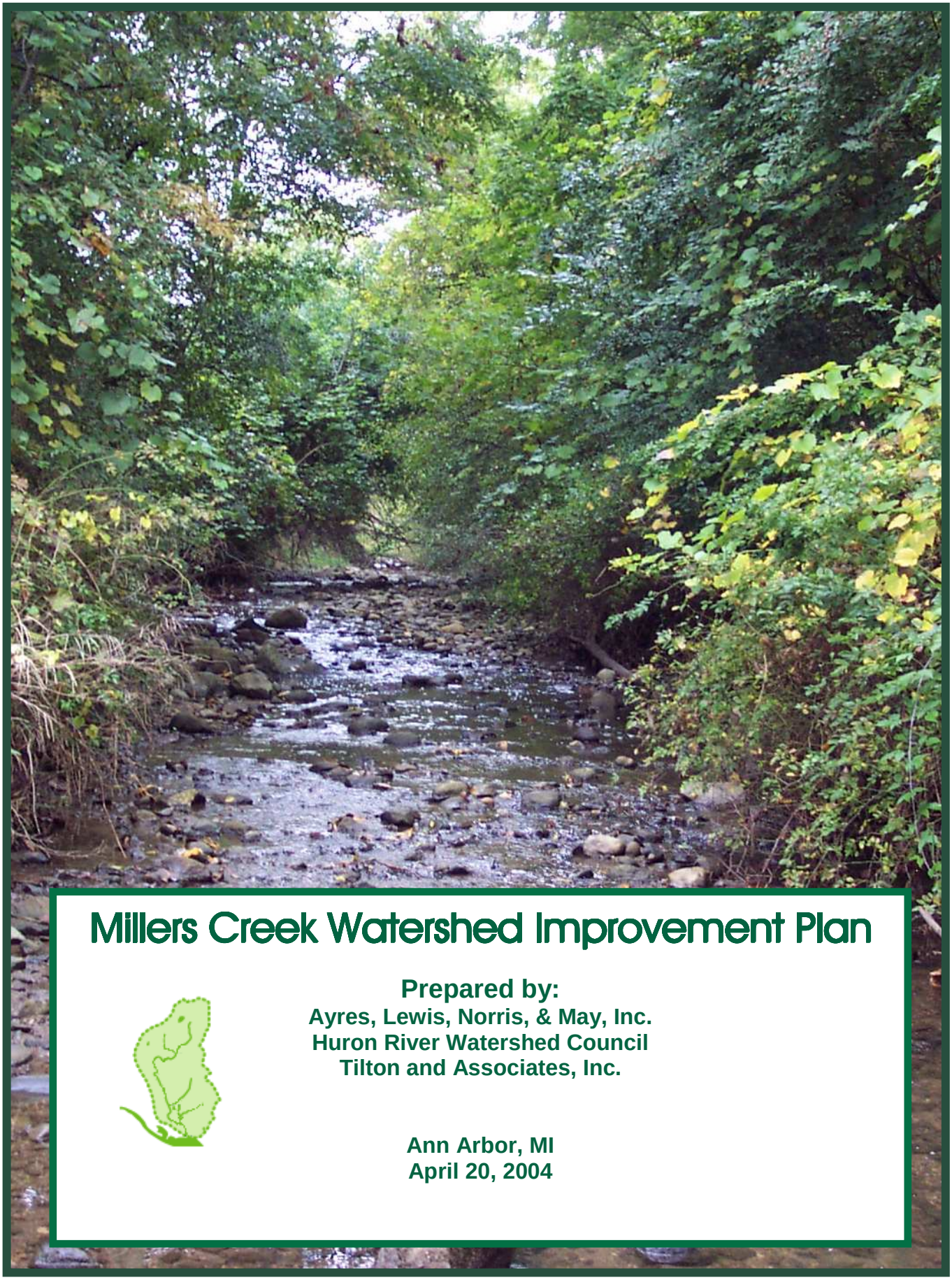
[1] Southeaset Michigan Council of Governments. Community Profiles. http://www.semcog.org/data/communityprofiles. Accessed August 2007.



Millers Creek Watershed Improvement Plan

Prepared by:
Ayres, Lewis, Norris, & May, Inc.
Huron River Watershed Council
Tilton and Associates, Inc.

Ann Arbor, MI
April 20, 2004

ACKNOWLEDGEMENTS

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Tilton and Associates, Inc. (TAI)

The Millers Creek Action Team (MCAT)
MCAT served as the oversight committee during plan development and starting in February 2004 will lead plan implementation. Organizations represented on MCAT include:

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City of Ann Arbor (AAP) Planning Commission
City of Ann Arbor (AAB) Building Department
City of Ann Arbor (AAU) Utilities Department (now Systems Planning, Public Services)
Huron River Watershed Council (HRWC)
Pfizer Global Research and Development, Inc. (PGRD)
Pollack Design Associates (PDA)
State of Michigan Department of Environmental Quality (MDEQ) – Surface Water Division
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[2]All scenarios includes Alternatives 2, 3 & 4, Calibrations 1, 2, & 3, Buildout & Existing Conditions

1. EXECUTIVE SUMMARY

1.1 Project Background

This document is a comprehensive watershed improvement plan for Millers Creek, an urban tributary of the Huron River located on the northeast side of the City of Ann Arbor in Washtenaw County, Michigan. This project originated as a unique public and private sector partnership funded by Pfizer Global Research and Development, Inc. (Pfizer), the second largest landowner in the watershed. Plan development oversight was provided by the Millers Creek Action Team (MCAT), a voluntary group of watershed stakeholders including businesses, community representatives, and local and state entities.

This project was prompted by flooding and bank erosion on Pfizer's Ann Arbor campus (See **Figure 1.1**). Pfizer decided to investigate the problems and develop a solution by looking at their campus in the context of the entire Miller Creek watershed. With assistance from the Washtenaw County Drain Commissioner (WCDC) and the Huron River Watershed Council (HRWC), Pfizer initiated MCAT and this project. Concern for the creek coalesced in the middle to early 1990s when an earlier version of MCAT, led by the Environmental Research Institute of Michigan (ERIM), the HRWC and the WCDC began investigating possible watershed-wide improvements.

Figure 1.1 Damage on Pfizer Campus Along Millers Creek

The creek has little to no existing institutional support. It is not a county drain and is considered a receiving water for the City of Ann Arbor and the University of Michigan North Campus storm water drainage. The creek is also identified as a contributing source in the Ford and Belleville Lakes Total Maximum Daily Load (TMDL) for phosphorus and the Geddes Pond TMDL for *E. coli*.

On-going planning efforts consulted for this project include the Northeast Area Plan (NAP), the Ann Arbor Parks and Recreation Department Open Space Plan 2000-2005 (PROS Plan), and the *E. coli* implementation plan (2003). The NAP and PROS plans provided recommendations of forecasted land use for a fully built-out Millers Creek watershed.

1.2 MCAT Mission and Project Goals

The mission of MCAT is to establish and implement socially, environmentally, and economically sustainable watershed management standards and practices that will improve the quality of the Millers Creek watershed. The goals of this plan are to develop a set of recommendations that will improve stream habitat and watershed hydrology, improve recreational opportunities in and around the creek and help local stakeholders achieve the objectives of the Ford and Belleville Lakes total phosphorus TMDL and the Gallup (Geddes) Pond *E. coli* TMDL. Implementation of these recommendations will also help foster activities that perpetuate urban watershed and stream stewardship, and create a healthier balance between the local community and its ecosystems.

1.3 Project Overview

This project began in the spring of 2002. MCAT developed a work scope, selected a consultant team to prepare the Watershed Improvement Plan, and regularly advised and collaborated with the consultant team to create the plan. The consultant team compiled existing source data and undertook a detailed investigation of field conditions including watershed and subwatershed delineations, flow, velocity and, water quality measurements, in-stream and corridor habitat, macroinvertebrate diversity, stream bed and bank stability, and infrastructure conditions. Runoff, flow, velocity, and water quality models were developed and calibrated to field-collected data sets.

MCAT developed a vision statement for the watershed, including goals and objectives to measure progress. Watershed residents and other volunteers helped with stream monitoring and developing management recommendations. Feasibility and performance of each recommended improvement were assessed using qualitative and quantitative measures. This report was compiled to summarize and communicate project results. It includes a prioritized implementation plan, estimated costs and a monitoring plan.

1.4 Existing Conditions

Millers Creek is the steepest tributary to the Huron River. Over the mainstem of the creek, the average gradient (change in elevation over creek length) is 52 ft/mi. By comparison, the average gradient of the Huron River is 2.95 ft/mi. Approximately 36% of the 2.4 square mile (1,531 acres) Millers Creek watershed is covered in impervious surfaces – roads, roofs, driveways, and parking lots. Most of the storm sewer was designed to be self-cleaning and does not have catch basin sumps. Many built-out areas in the watershed have little or inadequate storm water detention storage, and watershed soils are predominantly poorly draining clay loams. This combination results in high peak flows arriving at the stream minutes after the onset of rainfall. The steepness and flashiness of the stream wreak havoc on the aquatic community by periodically wiping away the streambed and severely eroding the stream banks. In some locations near Huron Parkway, creek incision and meandering are threatening the bike path. All macroinvertebrate sampling, with the exception of the site near Narrow Gauge Way, has found an impoverished benthic community. This is probably due to frequent episodes of mobilized streambed. High concentrations of *E. coli* (up to 18,000 counts/100 ml), indicative of water contaminated with warm-blooded animal waste, have been found in several locations along the creek. High total suspended solids and high total phosphorus loads are most likely a result of runoff loads and stream bank and bed erosion. Flow and geomorphology data suggest the erosion loads are primarily originating in the middle reaches of the creek. These loads are then deposited in the creek delta that extends from Huron High School to the Huron River or are carried into the Huron River.

1.5 Improvement Plan and Analysis

An extensive list of possible improvements was compiled based on field and Geographical Information Systems (GIS) analyses. Improvement feasibility was ranked qualitatively based on technological challenges, engineering design requirements (e.g., level of complexity), property ownership, public acceptance, and potential site constraints. A total of 112 separate improvements were considered. Five alternative scenarios were created to capture key improvement recommendations and to quantify the degree of hydrologic and water quality goal attainment. The alternatives analysis was structured as a series of incremental improvements: from the least costly and most highly feasible projects to the most costly and least feasible. It was assumed that there was no practical limit on the number of improvements that could be implemented to try and reach some predevelopment standard. Research has shown that

streams with a high percentage of impervious surface area (>15%) are not likely to ever be completely restored to predevelopment condition (Booth, et al. 2002). This does not invalidate the need to conserve and enhance the resource, but rather imposes realistic limits for restoration success.

1.6 Quantitative Assessment and Results

Recommended improvement performance was tested using the calibrated suite of models and literature estimates of source control effectiveness. The calibrated models were adjusted to assumed build–out conditions based on the NAP and PROS plans. The build-out scenario included 30.5 acres of new residential development, 18 acres of new commercial land with an additional 80.5 acres set aside for floodplain, recreational area or conservation easements. Since the watershed is almost completely built out, and most soils are poorly drained, hydrologic control relies almost entirely on new and retrofitted best management practices (BMPs). Results also demonstrate that even with a built-out watershed, source control is still more efficient and cost-effective for protecting water quality than end of the pipe BMPs.

1.7 Implementation, Projected Costs and Funding

Implementing the Millers Watershed Improvement Plan will require the concerted efforts of the City of Ann Arbor, Washtenaw County, Ann Arbor Township, and the University of Michigan, all of which are regulated storm water communities under Phase I and II National Pollutant Discharge Elimination System (NPDES) storm water permits. These communities are responsible for ensuring water quality and addressing water use impairments. However, a committed public-private partnership, much like the one that initiated this project, will ultimately be the key to success. All individual landowners, institutions, industries, business owners, and local units of governments have a stake in the Millers Creek improvement process and can contribute to the successful implementation of the plan.

The recommended improvements include structural and non-structural BMPs. The structural BMPs include proprietary BMPs (underground storage/treatment units), detention pond retrofits, roof drain disconnects, sediment traps, detention ponds and regional off-line peak flow reduction facilities. Some of the recommended non-structural BMPs include a phosphorus-free fertilizer ordinance, street sweeping, conservation easements, public education plans and long-term performance monitoring. Except for the purchase of (some) conservation easements, these non-structural BMPs are the most cost-effective solutions for hydrologic and water quality control. Structural BMP priorities include detention pond retrofits, roof drain disconnects, sediment traps, detention facilities and two priority streambank stabilization sites. The next priority is for regional off-line peak flow reduction facilities. Recommended streambed stabilization, daylighting and some bank stabilization measures are assigned the lowest priority.

The next major step for this plan is to obtain City of Ann Arbor, the University of Michigan and the Michigan Department of Environmental Quality (MDEQ) acceptance and endorsement. MDEQ acceptance will make the watershed eligible for Clean Michigan Initiative (CMI) and Clean Water Act-Section 319 funding, two of the most significant sources of outside support. This plan also recommends that watershed stakeholders petition for creation of a Millers Creek Drainage District to provide a long-term framework for financing improvements and maintenance activities. MCAT intends to lead implementation of this plan and offer technical and administrative assistance to watershed stakeholders.

Millers Creek Sediment Study

Public Meeting

September 10, 2012

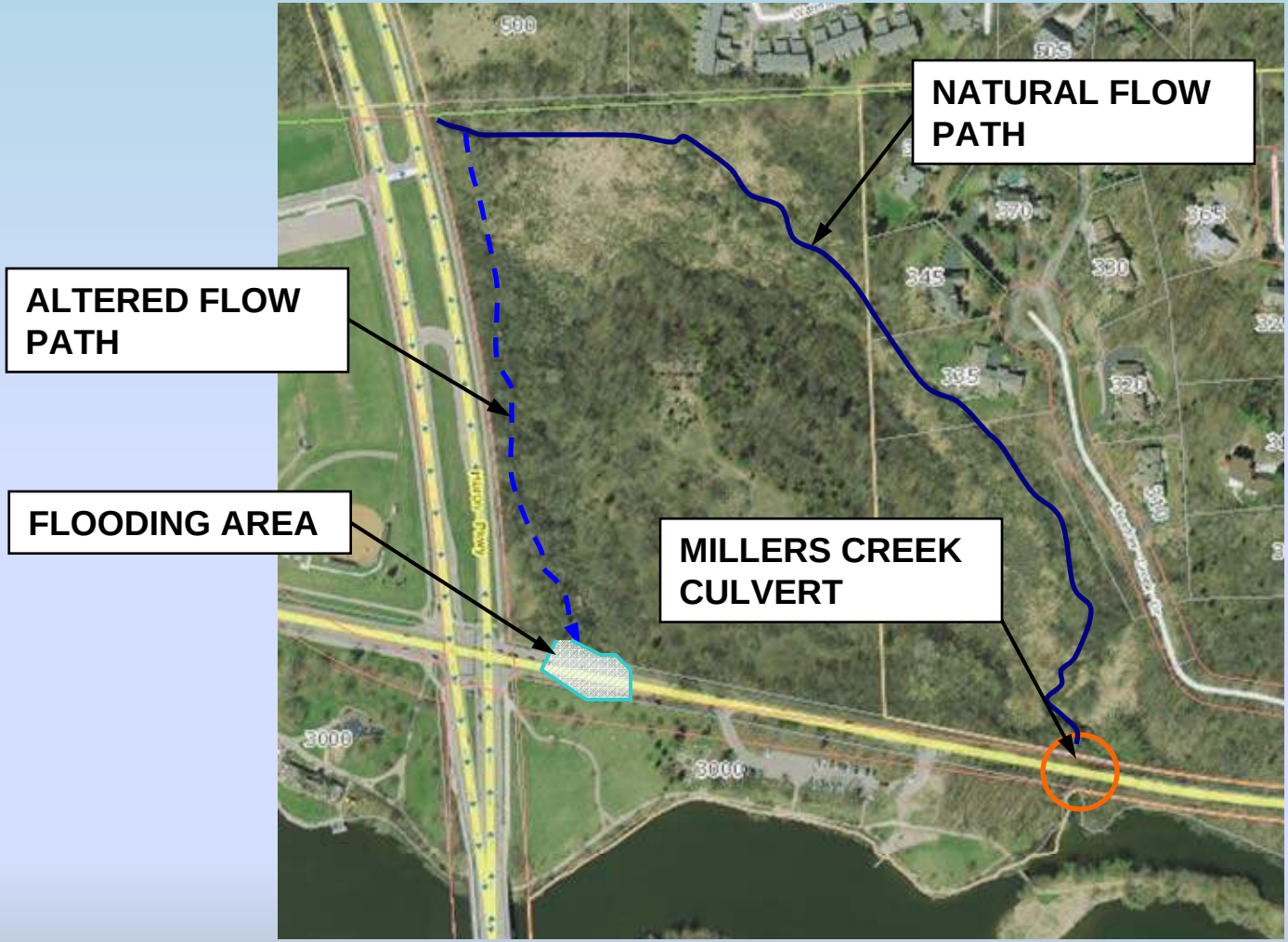
Introduction

- Study Purpose
- Schedule
- Meeting Purpose and Agenda
- Introductions

Problem Statement

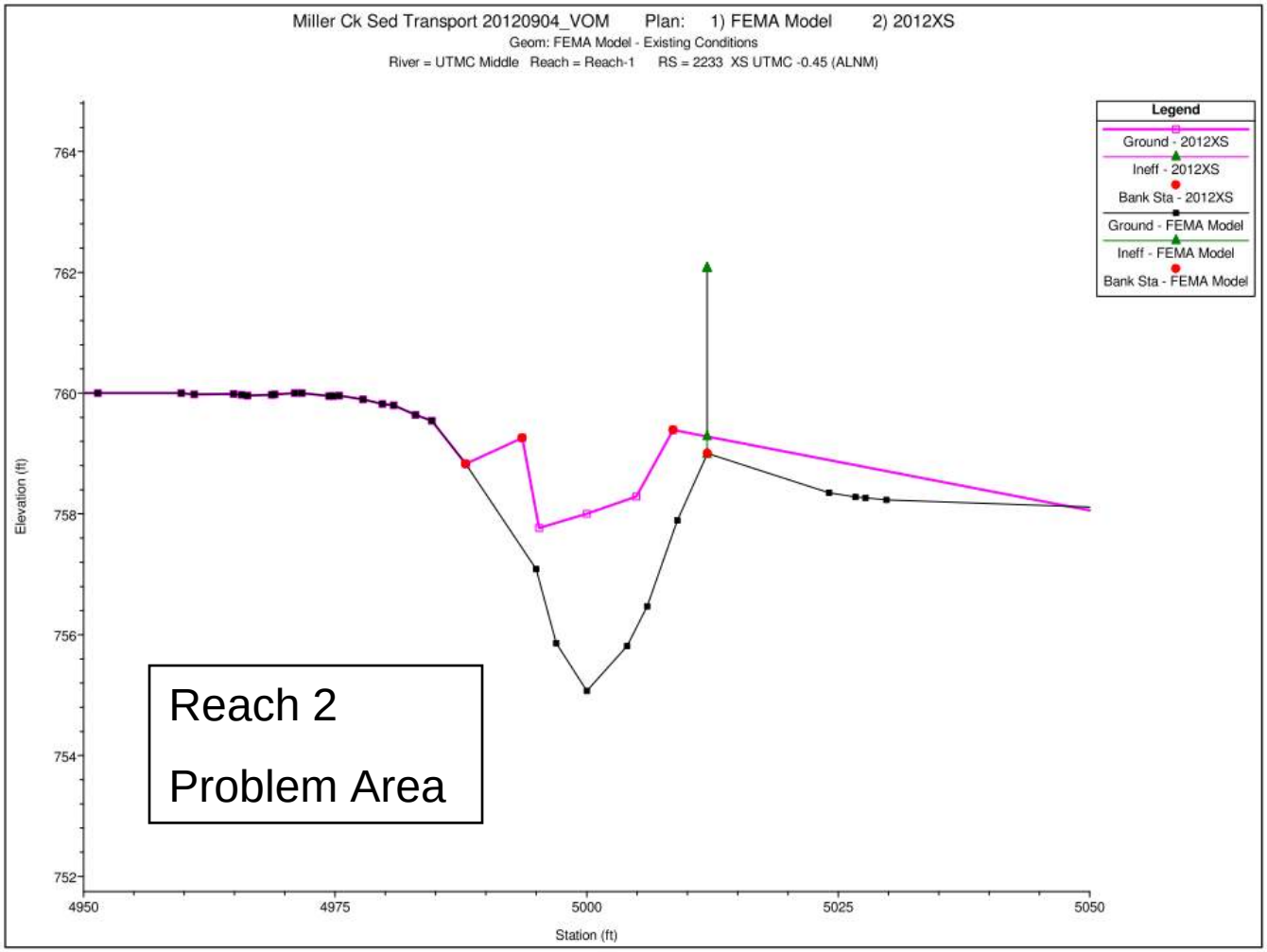
- **Sediment accumulation – Ruthven Nature Area**
  - Sediment accrues on bed of channel faster than it is transported
  - Decreased channel conveyance capacity
- **Altered flow path & Geddes Road flooding**
  - Flow bypassing Millers Creek culvert under Geddes Road
  - Secondary culvert is too small

Problem Area



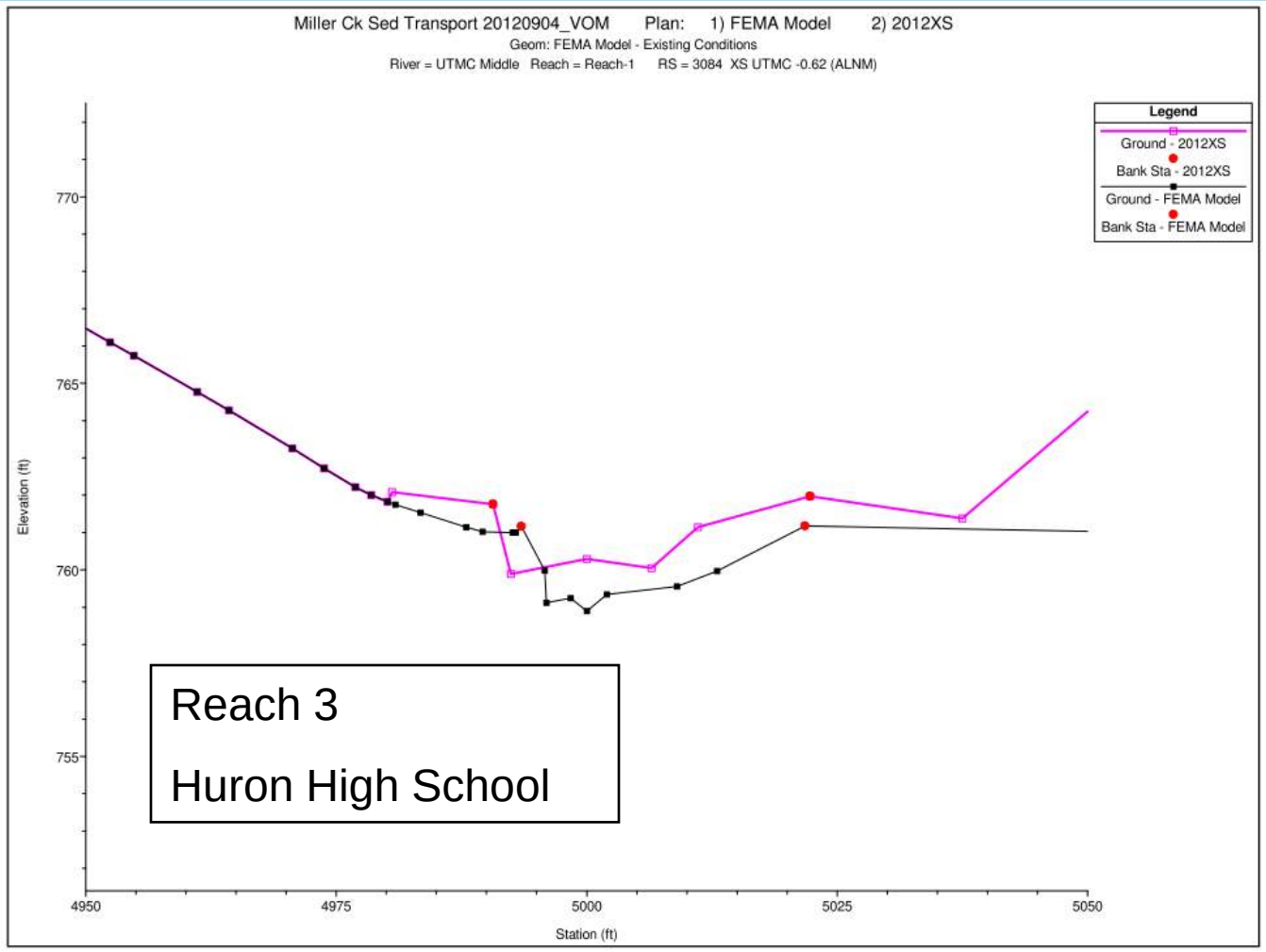
Geddes Road Flooding

Sediment Aggradation



Sediment Aggradation

Sediment Aggradation



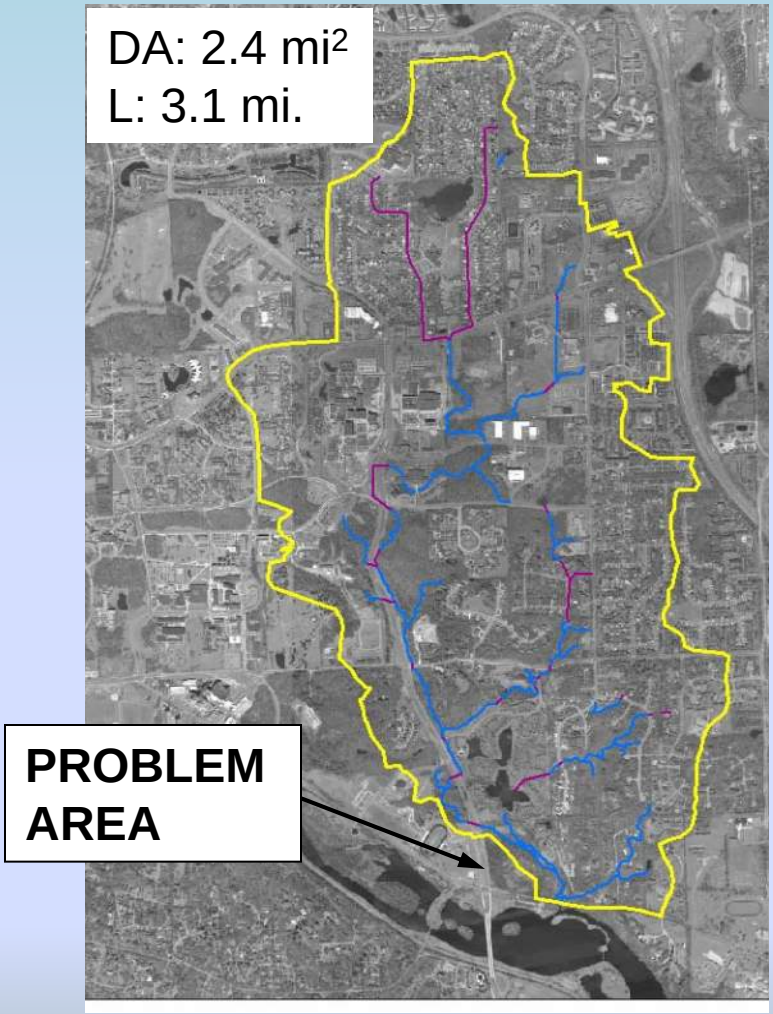
Watershed Background

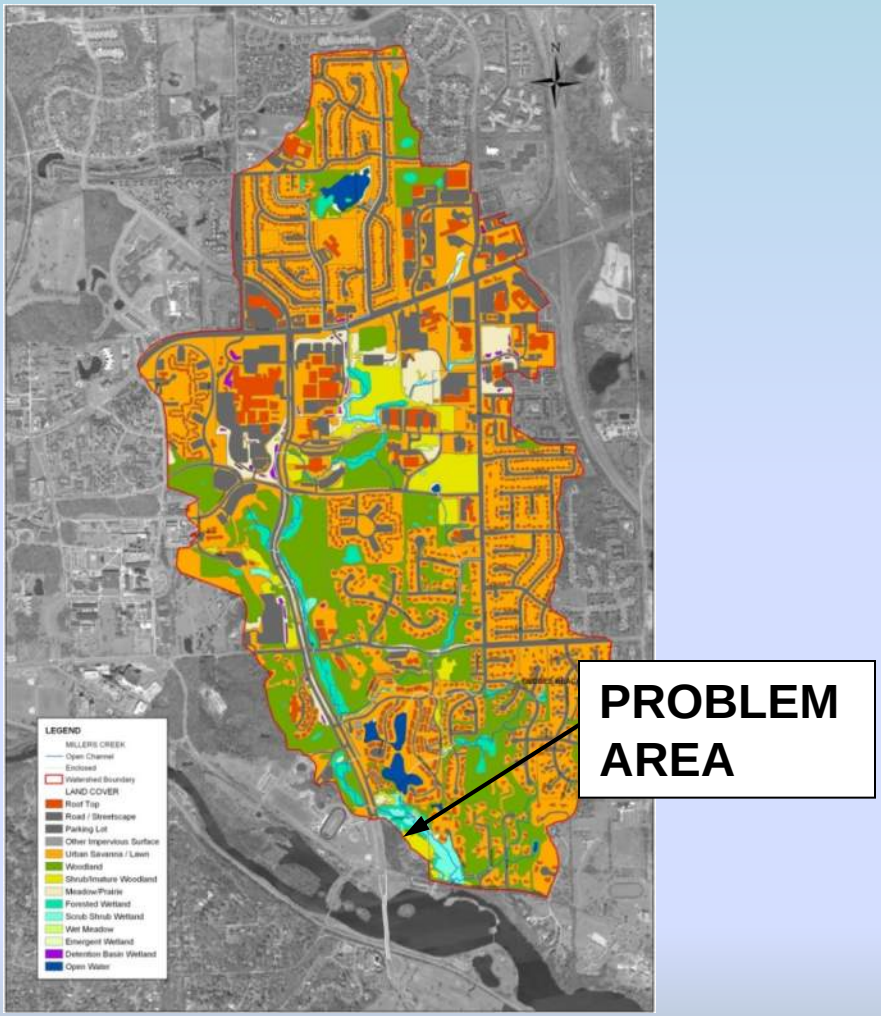
- **Historical context**
  - Widespread channel alterations
  - Widespread development
- **Geography**
- **Study reaches**

Historical Changes

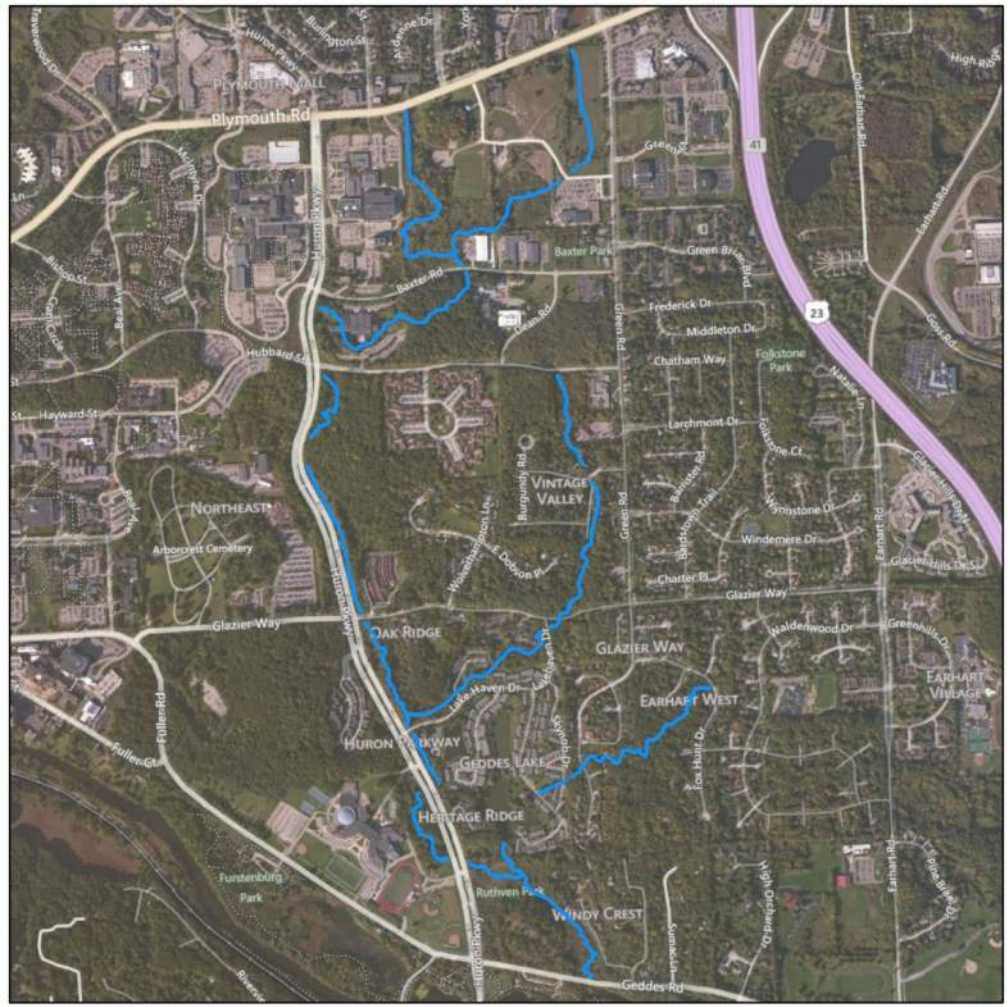
Historical Changes

Watershed Geography

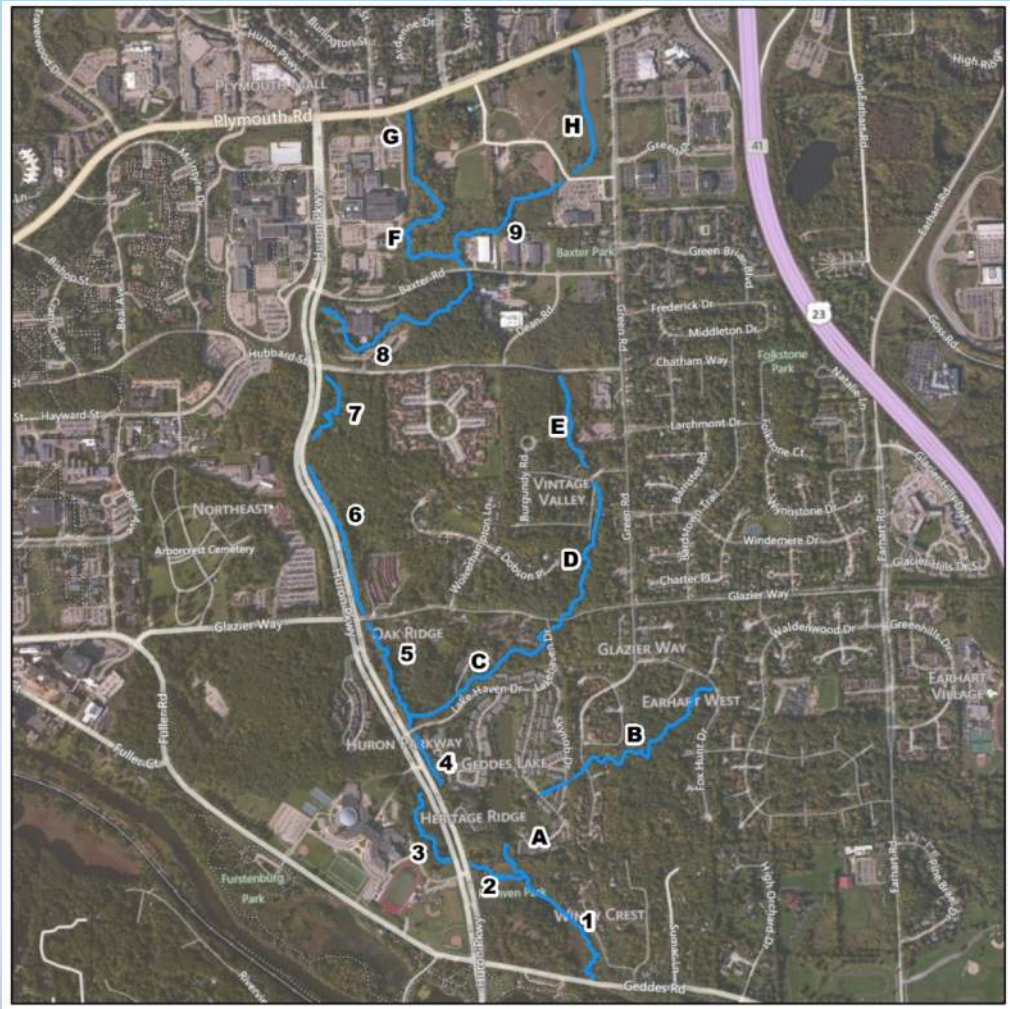




Stream Network



Study Reach Map



Study Objectives

- Identify and assess sediment sources
- Estimate annual sediment load
- Model annual sediment discharge
- Identify cause-effect relationship related to the problem
- Develop management recommendations

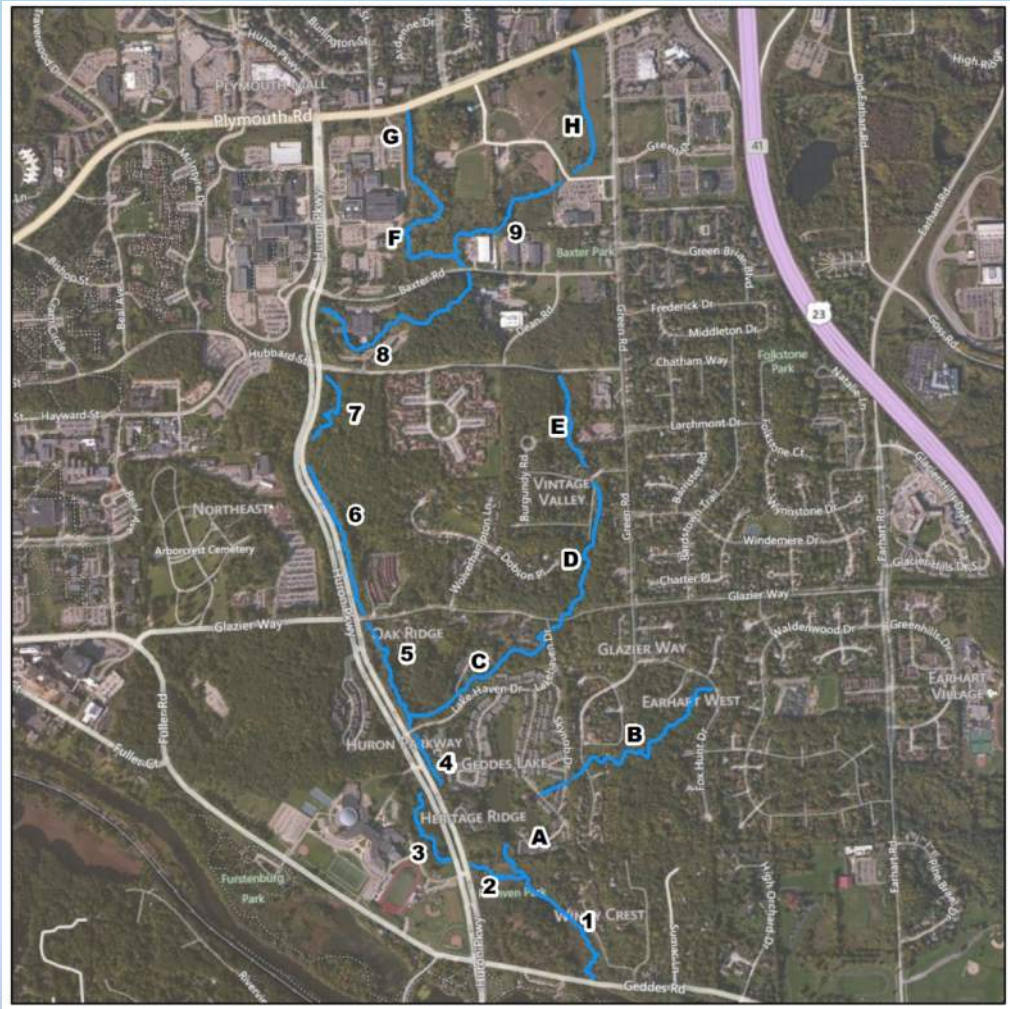
Technical Approach & Status

- **Technical Approach**
  - Hydraulic & sediment transport model
  - Bank erosion assessment
  - Bed material characterization
  - Morphological assessment
- **Status**
  - Field work is complete
  - Data analysis 60% complete
  - Modeling 70% complete

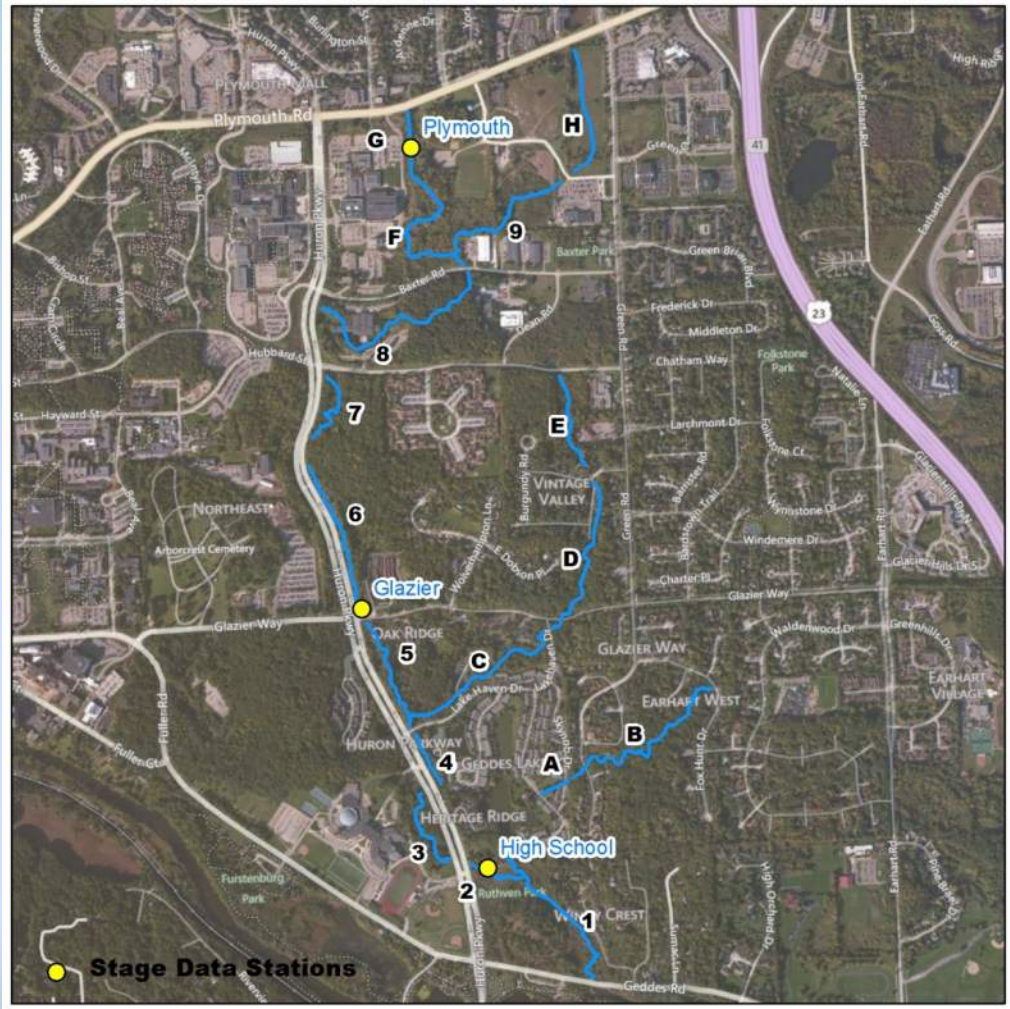
Sediment Transport Modeling

- **Objectives**
  - Simulate transport, erosion, and deposition
  - Estimate sediment loads
  - Evaluate management options
- **Modeling approach**
  - Update FEMA 2004 HEC-RAS model
  - Survey data
  - Bed material gradation data
  - Hydrology
- **Validation**
  - Discharge and sediment transport

Hydraulic Model Network



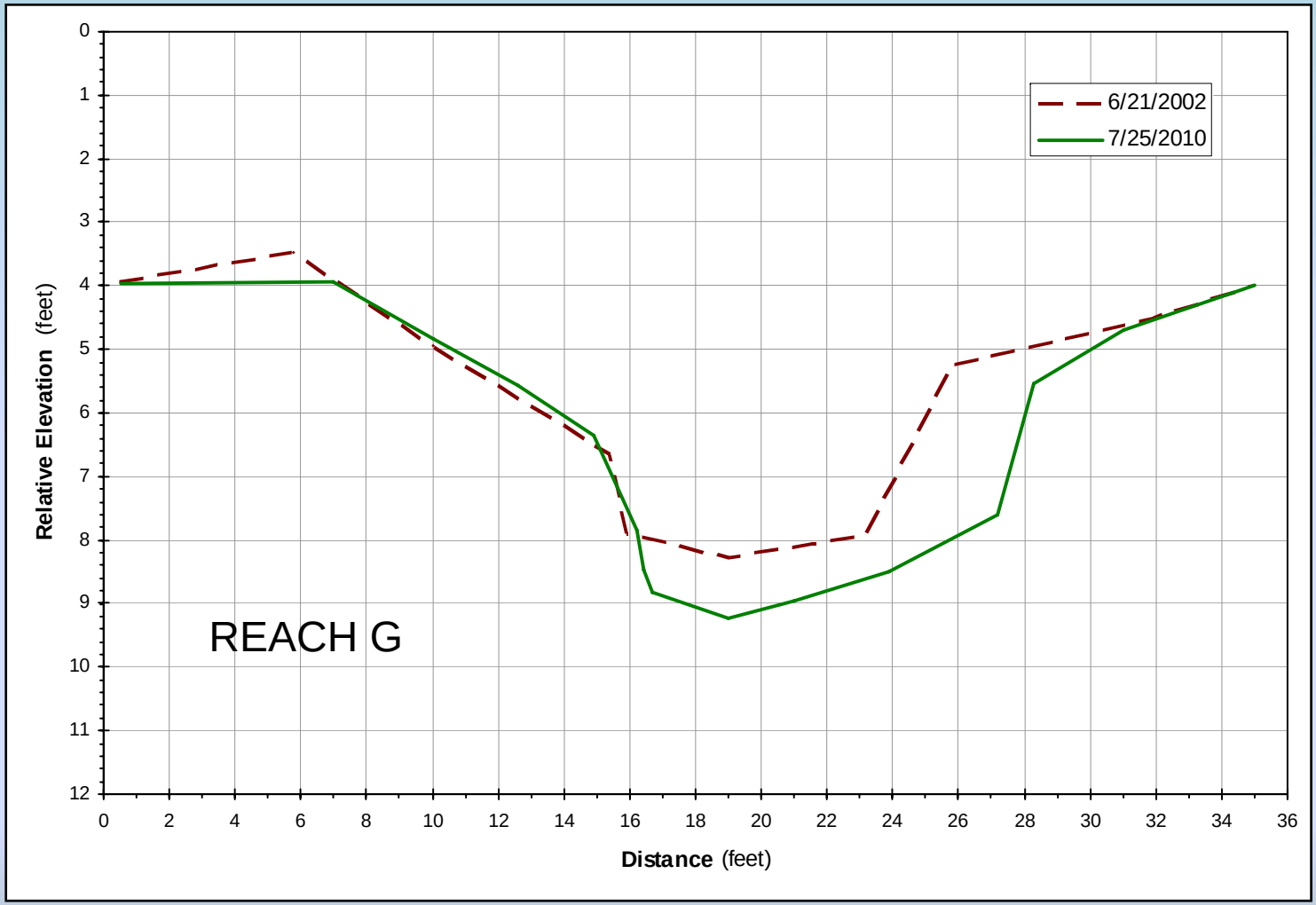
Flow Monitoring Stations



Observed Channel Conditions

- **Unstable channel morphology is common in some study reaches**
  - Excessive channel erosion
  - Exposed clay bed
  - Bed armoring
  - Pronounced and abundant bar formations
- **Eroding bed material sources common in some reaches**

Bed and Bank Erosion



Streambank Erosion

Streambank Erosion

Exposed Clay Bed

Pronounced Bar Formations

Bed Armoring

Bed Material Sources

Bed Material Sources

Closing

- **Questions & Discussion**
- **Next steps**
  - Complete data analysis and modeling
  - Stakeholder meeting and public meeting
  - Develop management recommendations
- **Further information and notices**
  - Jerry Hancock: JHancock@a2gov.org
  - http://www.a2gov.org/storm

Millers Creek Sediment Study
Management Recommendations
(*Preliminary and Advisory*)
March 6, 2013

Option Set I – Maintenance Activities

The sediment loading to Millers Creek from streambank erosion is elevated above natural background levels due to morphological instability throughout the drainage network upstream of Study Reach 3. Sediment transport within all of the Study Reaches upstream of Reach 3 (except Reach C) is efficient, resulting in net export of sediment to the next downstream reach. Only Reach C is storing appreciable quantities of sediment transported from Reach D via accumulation on the streambed and floodplain. Cumulatively, the mass of sediment that is reaching Reach 2 in the Ruthven Nature Area cannot be transported and results in streambed aggradation.

Unless the sediment load from streambank erosion is substantially reduced, aggradation will continue in Reach 2. Option set 2 presents a list of activities that will reduce loading from streambanks. However, implementing some Option Set 2 projects that are designed to reduce bank loading may not be feasible due to funding and property access constraints. At the very least, significant progress on Option Set 2 projects may take five to ten years to achieve. During the interim, shorter-term maintenance activities may be required to prevent Reach 2 aggradation and additional flooding on Geddes Road. As long as the loads remain excessive, the excess load will need to be removed from the system annually or periodically. The following maintenance activities can be used to manage the sediment load if desirable or until substantial bank load reductions can be achieved.

(1) Reach 2 Periodic Sediment Removal

Alternative one involves periodic sediment removal in Reach 2 where sediment was removed in 2012 under a permit. This area could continue to be used as a sediment removal site if desired. The area would require annual inspections to determine when removal is necessary. Removal should be done before sediment accrual results in substantially decreased conveyance capacity and potential side-channel development. Reach 2 is a good sediment removal site because it is owned by the City and has already been excavated under a permit. For various other reasons, Reach 2 may not be a desirable location for annual or periodic sediment removal. Two other alternatives are available.

(2) Multiple Trap-and-Removal Facilities

Alternative two is a diffused sediment removal approach based on establishment of up to four smaller sediment trap-and-removal facilities. The three potential locations include the end of Study Reach 8 at Huron Parkway, the confluence of Study Reaches F and 9, and the confluence of Study Reaches 5 and C. Reach D at Glazier Way is a fourth option that could be evaluated. Each facility would consist of a construction pad; excavated sand trap measuring 100 feet in length, 20 feet wide, and 2 feet deep; and a temporary access and staging area. The City does not own property at any of these locations. Therefore, land purchase or access agreements would be required. The Reach F/9 facility could trap-and-remove 60 tons annually from Reach F, G, and 9 (100% of the bank loads) and would require

maintenance every other year. The Reach 8 facility could trap and remove 33 tons annually from Reach 8 (100% of the bank loads) and would require maintenance every other year. The Reach 5/C facility could trap and remove 115 tons annually from Reaches 5, 6, 7, and D (43% of the bank loads) and would require maintenance annually. Combined the three facilities could trap and remove 208 tons of sediment annually, preventing that load from being transported to Reaches 2 and 3.

(3) Regional Trap-and-Removal Facility

Alternative three is a regional sediment removal approach based on establishment of one trap-and-removal facility. The two potential locations include the confluence of Reaches 5 and C and Reach 3. Using one regional facility may require more frequent maintenance than three facilities, depending on the size of the trap that can be constructed. Reach 3 has the greatest potential in terms of available land area. The Ann Arbor Public Schools may be more willing to work on a land sale or access agreement with the City than the University of Michigan or a private homeowners association. A trap-and-removal facility at Reach 3 could have the potential to trap and remove 230 tons of sediment annually (63% of the upstream bank load) and would require annual maintenance. The remaining 134 tons (37%) of bank load from upstream reaches would be transported into Reach 2 annually (a 63% reduction in Reach 2 sediment loading).

(4) Huron Parkway Culvert Clean-out

The sediment transport model showed an improvement in sediment transport efficiency in Reach 2 with simulated removal of the Huron Parkway culvert between reaches 3 and 2. Therefore, there is some benefit that can be gained from maintaining the full culvert capacity by removing accumulated sediment from the culvert annual or as needed. Annual maintenance inspections should be conducted to determine the need for sediment removal.

<u>Option Set II – Sediment Load Reduction Activities</u>

The sediment load coming from streambank erosion is excessive compared to expected natural background conditions due to morphological instability throughout the Millers Creek channel network. Due to site specific conditions and erosion rates in each reach, some reaches are generating higher loads than others. It is possible to eliminate or significantly reduce sediment accumulation in Ruthven by reducing the annual bank erosion load within certain reaches and without having to address bank erosion in every reach. In other words, it is most cost-effective to target sediment load reduction activities.

Using information obtained during the field assessment and sediment modeling results, a set of projects has been identified for all reaches with a moderate or higher (> 10 tons per year) sediment loading rate that once implemented would eliminate problematic sediment accumulation in Reach 2. This includes load reduction projects in Reaches 5, 6, 7, 8, D, and F. Reach G is included with Reach F despite having a loading rate lower than 10 tons/year because a previously designed restoration project included reaches F and G together as discussed below.

(1) Reach F & G Restoration
This project was previously funded by a Michigan 319/CMI grant with cost share by Pfizer. Design was 85% complete and ready for engineering review by the Department of Environmental Quality. After Pfizer moved its operations from the facility at Huron Parkway and Plymouth Road, the project was abandoned. Given the level of design work that has already gone into this project, it is a good candidate for reducing the annual streambank erosion sediment loads by 45 tons per year. The property is now owned by the University of Michigan.

(2) Reach 5 Restoration
Most of Reach 5 is also owned by the City (Oakridge Park). The very southern end of Reach 5 is privately owned. Reach 5 is very similar to Reach 8, although erosion severity is lower. Bank erosion and instability in Reach 5 is nearly continuous although the erosion rates vary considerably. Bank heights are typically low and some floodplain connectivity still exists for flood dissipation. The restoration potential for Reach 5 is high. Restoration of Reach 5 would reduce the sediment load by 13 tons.

(3) Reach 6 and 7 Streambank Stabilization
Between 2007 and 2009 the City stabilized eight streambank erosion sites totaling 1,400 feet in Reach 6 along the west side of Millers Creek at an approximate cost of $1.1 million. The primary purpose of the stabilization project was to protect infrastructure being threatened by rapid lateral migration caused by accelerated erosion and improve public safety (the high banks in vicinity of the pedestrian path presented a fall hazard). However, the project also substantially reduced sediment loading to Millers Creek within Reach 6. Still, there is an estimated 1,200 feet of severely eroding streambanks in Reach 6 contributing an estimated 50 tons per year of sediment. The most severe eroding streambanks in Reach 6 are located on the east side of Millers Creek on property owned by the University of Michigan. Some of the eroding banks located in Reach are located on the west side of Millers Creek, but they are also located on property owned by the University of Michigan. Stabilizing these streambanks could reduce the sediment load to Millers Creek within Reach 6 by 21 tons. Streambank stabilization in Reach 7 would reduce the sediment load by another 19 tons. Proven techniques used in Reach 6 between 2007 and 2009 are recommended for both reaches.

(4) Reach 6 and 7 Restoration
The former option addresses the most severe eroding streambanks within Reaches 6 and 7. Additional streambank erosion is likely to occur along streambanks not treated and bed erosion continues to be a problem in Reaches 6 and 7. Although a more expensive option, holistic restoration of reaches 6 and 7 will more effectively address long-term channel instability and sediment loading. Restoration of reaches 6 and 7 would require extensive grading along the east side of reaches 6 and 7 located on property owned by the University of Michigan. The least costly approach to channel restoration in reaches 6 and 7 is the Priority-II or Priority-III approach which involves creation of a bankfull bench and bankfull channel within the existing. The two approaches differ in the degree of channel modification and size of the created floodplain. Priority-III is a lower cost approach due to lower excavation quantities and requires less land space. However, the Priority-III approach is usually more

dependent upon in-stream structures and bank armoring to achieve stability. Restoration of reaches 6 and 7 would reduce the sediment load from bank erosion by 82 tons combined (39 and 43 respectively).

(5) Reach D

Reach D is located on property owned by two different residential housing associations north and south of Glazier Way. Reach D starts at the end of a large storm sewer that drains most if not all of the northern residential neighborhood. The energy and volume of flow from the storm sewer has caused extensive bed and bank erosion in Reach D leading to channel enlargement and loss of floodplain connectivity; the worst erosion is located upstream of Glazier Way. However, a road culvert located in the Geddes Lake community is perched six feet above the bed, indicating extensive bed erosion in that area as well. Sediment load from Reach D is accumulating in sections of Reach C, but is also being transported into Millers Creek where it is eventually transported into Reaches 2 and 3. Erosion in Reach D is so extensive that streambank stabilization alone is not a practical approach to reducing the sediment loading. Channel restoration is the only option that would effectively reduce the sediment load. Channel restoration will necessarily be heavily dependent on structural solutions due to limited access, limited space, sanitary sewer, steep valley slope, and high energy flow. Restoration of Reach D would reduce the sediment load from bank erosion by 149 tons.

(6) Reach 8 Restoration

Reach 8 is entirely located on property owned by the University of Michigan. Part of Reach 8 flows near, and even under a wing of, the North Campus Administrative Complex building. Bank erosion and instability in Reach 8 is nearly continuous although the erosion rates vary considerably. Bank heights are typically low and some floodplain connectivity still exists for flood dissipation. The restoration potential for Reach 8 is high. Restoration of Reach 8 would reduce the sediment load by 26 tons.

<u>Option Set III – Combination of Maintenance and Load Reduction Activities</u>

Option Set 3 presented in Table 1 has been developed to minimize the amount of load reduction work by focusing on the most cost-effective projects combined with maintenance activities that can manage the existing sediment loads until the load reduction projects can be funded and implemented. As such, Option Set 3 is a combination of activities under Option Sets 1 and 2. Option Set 3 is presented below as a schedule of maintenance activities and projects. The maintenance activities are based on activities 3 and 4 presented above (regional trap-and-removal and culvert clean-out). The load reduction projects focus on the four reaches with the largest loads: 6 and 7 restoration (#4), D (#5), and F (#1, including G as discussed above). Refer to detailed descriptions of the maintenance activities and load reduction projects above. Preliminary estimates indicate the regional trap-and-remove facility could have the capacity to remove 230 tons (63% of upstream bank loads) of sediment annually from the system before it reaches Reach 2 providing the City has sufficient funding to maintain the facility annually (the facility capacity will be reached every year). Sediment transport model results indicate that the four load reduction projects combined could reduce sediment loading to Reach 2 by 276 tons per year.

Table 1. Option Set III recommended sediment load reduction projects.

Load Reduction Project	Load Reduction	Cumulative Load Reduction
#1 (Reach F and G)	45	45
#5 (Reach D, Design/Permit)	0	45
#5 (Reach D, Construction)	110	155
#5 (Reach D, Construction)	39	194
#4 (Reach 7, Design/Permit)	0	194
#4 (Reach 7, Construction)	39	233
#4 (Reach 6, Ups 1/2, Design/Permit)	0	233
#4 (Reach 6, Ups 1/2, Construction)	21	254
#4 (Reach 6, Dns 1/2, Design/Permit)	0	254
#4 (Reach 6, Dns 1/2, Construction)	22	276

Upper Malletts Stormwater Conveyance Study

Washtenaw County Water Resources Commissioner
Washtenaw County, Michigan

Prepared for:

Evan N. Pratt, P.E.
Washtenaw County Water Resources Commissioner
705 N. Zeeb Road
PO Box 8645
Ann Arbor, MI 48107-8645

March 21, 2014

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

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 uses box culverts connected to create a storage capacity of 6.4 acre-ft. (Figure I-4). The basin encompasses an area of 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.

Figure I-4: Project C – Lawton Park Underground Storage and Sewer Improvements

Cost estimates were prepared for the recommended alternatives. The costs were based on conceptual designs and the best available information. A contingency factor, costs for professional services, and permitting are included in the cost estimates to give a true picture of the total investment necessary. The costs were developed using 2013 dollars and an appropriate inflation factor must be used for future budgeting.

Table I-1: 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**	

Green infrastructure solutions and street stormwater storage were also considered as part of the study. 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. The analysis included LID methods and the utilization of oversize storm sewers for detention within the street right-of-way (ROW). 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 and has proven very effective when combined with LID methods. The types of ROW treatment solutions considered included:

- Porous pavement and stone reservoirs for runoff storage under the pavement
- Road diets (reducing the road cross section width) to reduce impervious area
- Rain gardens
- Oversize pipe storage

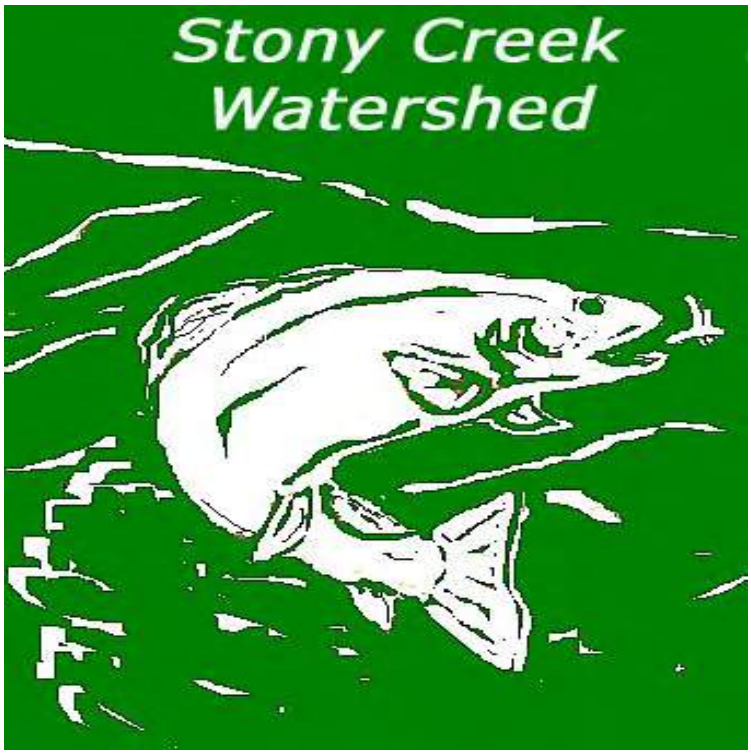
Utilizing information from previously completed projects, a cost benefit analysis for the ROW treatment improvements was completed. The sample projects were averaged for the volume provided per foot of street reconstruction and the cost per cubic foot of storage achieved. The ROW solutions cost per cubic feet of storage ranges from $43 to $353 with an average of $119.08. Comparatively, 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. 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. However, where opportunities exist, ROW treatment and private rain gardens should be combined with other improvements.

A critical component of the Upper Malletts Stormwater Conveyance Study was public engagement. Gathering input first on the problems and issues, then on the stormwater management alternatives was essential to accurately model the hydrologic response to rain and to select functional, acceptable alternatives. Public meetings, websites, social media, and personal contacts were all utilized to gather and distribute information appropriately. In addition, a Citizens Advisory Group made up of 12 residents was established to help guide the project.

Strong and consistent messaging was an essential part of the project. Key messages were developed and communicated to stakeholders throughout the study to ensure continuity and help maximize understanding and engagement.

During the study, the WCWRC and the City completed cleaning and storm sewer inspection within the watershed. This included more than 65,000 feet of storm sewer ranging in size from 12" to 72". The inspection found the sewer system to be in good condition and functioning properly. Deterioration, sediment and debris deposits were found, but these were very minor compared with expectations for a system of this size and age. Corrective measures were completed or are being planned for minor defects found. The findings of the inspections were that pipe deterioration or obstructions in the main lines of the storm sewer system were not a significant factor in the March 15, 2012 flooding event. However, inlet blockages caused by debris were an issue in many areas. These are being proactively managed by the WRC and City to reduce the occurrences of blockage.

The probability of future flooding will be reduced as the recommendations of the Upper Malletts Stormwater Conveyance Study are implemented. Each project manages stormwater for a portion of the watershed and reduces a percentage of the overall flooding previously experienced. 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.



STONY CREEK WATERSHED MANAGEMENT PLAN

DEQ
Michigan's
Nonpoint Source
Program

June 2005

STONY CREEK
WATERSHED
MANAGEMENT PLAN

Prepared by

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June 2005

ACKOWLEDGEMENTS

This project could not have been completed without the support, encouragement and assistance of many people. We have identified the members of the two critical committees that guided and supported the planning process over the past two years in the Appendix. But several people made contributions above and beyond what was expected. They are acknowledged here.

Three members of the Steering Committee demonstrated tireless enthusiasm and unflagging support throughout the planning process:

> ***Kathy Giszczak, now Clerk of Augusta Township***—Kathy attended almost every meeting and event sponsored by or convened during the planning process, including tours, Public Forums, the Macroinvertebrate Study and Steering Committee meetings. She pushed all of us to ask more questions, find more data, present information in a more user-friendly fashion, and bring more people into the circle of stakeholders.
>
> ***Cheryl Baltrip, Supervisor of Exeter Township***—Cheryl and her staff graciously agreed to host Steering Committee meetings to minimize travel times for attending participants. This meant juggling other meetings in Township Hall and moving tables and chairs on a regular basis. But, most important, it meant providing coffee and soft drinks, cookies, chips, pretzels and other assorted goodies, necessary to improve the mood of meeting participants.
>
> ***Roger Bezek, watershed property-owner and farmer***—Roger also was an active participant in planning activities as an alternative representative from Exeter Township, and he provided the group with an important perspective on the impact of agricultural uses on the watershed and of the potential impact of recommended strategies for mitigating watershed problems on those same agricultural uses. His was an important voice at the table.

Another person who contributed much time, energy and baked goods to the planning discussions is not named on either of the two committees mentioned above. ***Aretta Schils***, a resident living in the watershed in London Township, attended most of the Steering Committee meetings over the first twenty months of the project until health problems required her attention.

Many different professionals provided technical assistance and advice during the planning process, especially as the Steering Committee began to focus on recommendations for action. But, the work of ***Harry Sheehan*** from the Office of the Drain Commissioner, Washtenaw County, and ***Dennis Rice*** from the Washtenaw County Conservation District, warrant special mention. Harry participated in a number of Steering Committee meetings and shared his expertise from working with the Huron River Watershed Council. Both Harry and Dennis thoroughly examined and carefully commented on the draft table of action strategies over a three month period as final decisions were reached by the Steering Committee.

While the role of the two project staff from Eastern Michigan University is noted on the title page and in the list of Steering Committee members, two other groups of people need to be recognized, along with the contributions of a former EMU staff member.

Over the past two and half years, three different EMU students have supported the planning process, providing logistical support, attending meetings and taking minutes, and serving as the connecting link between ICARD and various project participants; they include ***Laura Shue (now Larson), Megan Lindsey and Jennifer Hartlep.*** We hope they learned as much as we did about watersheds, collaboration and grant relationships in the process.

In addition, Charles Monsma, Director of the Institute for Community and Regional Development, Jane Wright, Grant and Contract Administrator, and the rest of the ICARD staff took care of the mundane but nonetheless important financial and administrative details involved in implementing the 319 planning grant. This relieved the project directors of those duties and allowed more time to devote to the scientific/technical and political issues to be addressed in a watershed encompassing two counties and portions of three cities, a village and eight townships.

While she left the University before the project began, ***Dr. Anita Zot***, the Director of the Water Resources Consortium at EMU, was the instigator behind the project, assembled the initial working group of township and county officials and other stakeholders, and drafted the original 319 proposal. She left the area before seeing the fruits of her efforts, but her contributions should not go unnoticed.

Finally, several different staff from DEQ assisted project implementation over the past thirty months; they are listed among the members of the Technical Committee. But ***Janna Sebald***, the Stony Creek liaison from the Jackson Office, proved demanding yet patient and supportive. When she didn't have the answers to questions we asked because of her newness to the 319 task, she did not hesitate to identify other DEQ staff who could help. Her turnaround time in providing feedback on draft materials was always surprising, and she like several of the other committee members, had more than one run-in with bad weather during the winter months.

We appreciate the help of these and all the other people who were instrumental in creating the Stony Creek Watershed Management Plan.

Dr. Joe Ohren and Dr. Kevin Gustavson, June 2005

Stony Creek
Watershed Management Plan

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Volume II Appendices

STONY CREEK WATERSHED MANAGEMENT PLAN

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June 2005

Chapter 1: Introduction and Public Participation

1.1 Introduction

The Stony Creek Watershed lies within Washtenaw and Monroe Counties in Southeastern Michigan (Figure 2.1) and contains portions of Pittsfield, Ypsilanti, York, Augusta, Milan, London, Exeter, Ash, and Frenchtown Townships, and very small parts of the cities of Ann Arbor, Ypsilanti, Milan, and the Village of Maybee. Sandwiched between the larger Huron River Watershed and the River Raisin Watershed, the Stony Creek Watershed is a long, narrow watershed (about 32 miles long and 8 miles at its widest) that is oriented northwest-southeast and tapers as it drains toward Lake Erie in Frenchtown Township just north of Monroe, MI.

The upper portion of the watershed, in Washtenaw County, is developed, with significant residential, commercial and industrial land uses, and developing. More importantly, evidence suggests that the pace of development has quickened, especially in Augusta and Ypsilanti Townships, contributing to the pressures on and problems in the watershed. Land uses in the Monroe County portion of the watershed are largely agricultural, with pockets of residential development in the northern townships and more dense residential development in Frenchtown Townships, at the lower end of the watershed.

Several studies of water quality were conducted in the 1990s in various parts of the Stony Creek basin. A 1995 study by the Michigan Department of Environmental Quality concluded that the water quality and macroinvertebrate community in Amos Palmer Drain, one of the tributaries of the Stony Creek, were extremely impaired. A similar assessment two years later by the MDEQ concluded that water quality and the macroinvertebrate community in Amos Palmer Drain were extremely impaired.

Given development patterns in the watershed, particularly in the headwaters of Paint Creek and Stony Creek, which suggested continued threats to the quality of water in the several creeks and drains which make up the watershed, a group of local citizens came together in late 2001 to discuss the feasibility of preparing and submitting an application to MDEQ for funding to support preparation of a watershed management plan. Such a plan would provide a comprehensive and long-term effort to engage citizens and communities in a systematic effort to improve and protect water quality in the watershed.

With support from a number of local government officials in the watershed, a team of Eastern Michigan University (EMU) faculty was assembled, drawing on the resources of the Institute for Community and Regional Development (ICARD) and the Water Resources Consortium (WRC). In collaborative fashion the group met over several months and drafted a proposal for a 319 planning grant to support development of a watershed management plan for the Stony Creek watershed. The proposal was endorsed by nearly every local government unit with significant land area in the watershed, and an award was made to EMU as fiduciary agent for the planning process. Initial efforts to implement the proposed planning process began in early 2003.

1.2 Early Steps

Early project efforts were devoted to establishing a Steering Committee and creating other mechanisms for engaging and informing the public about the unfolding 319 planning process.

1.2.1 Establishing the Steering Committee

Initial efforts were devoted to selecting a representative body to guide the decision-making process. Given the fact that the watershed encompassed a number of local government jurisdictions in two counties, the decision was made to secure representation from as many of those local government jurisdictions as possible. These were viewed as the key implementation bodies and were viewed as critical to the success of the planning effort. Letters were sent out to each of the eight townships in the watershed as well as the village of Maybee, describing the process of assembling the 319 planning grant proposal and the tasks ahead in the watershed management planning process. An opportunity to present a brief discussion of the project at a regular board meeting was sought and each Board was invited to identify a representative to serve on a newly created Stony Creek Steering Committee.

Professor Ohren attended each meeting, outlined the process, answered questions and again reiterated the invitation to participate. Of the eight townships and one village, seven townships appointed a representative to the Steering Committee. Ash Township, with little land area in the watershed, was not responsive to the request; the village of Maybee assigned its engineer to keep abreast of progress of the watershed plan. In addition to the township representatives, each of the two Drain Commissioners was asked to appoint a representative to the Steering Committee. The membership of the Stony Creek Steering Committee is noted in the Appendix.

1.2.2 Role of the Steering Committee

The Stony Creek Steering Committee served as the key decision-making body throughout the planning process. Staff worked closely with the Committee, preparing supporting materials for monthly meetings and engaging the group in the critical decisions throughout the process. After the first one or two monthly meetings, held on the campus of EMU for convenience of staff, the remaining meetings were held in the Exeter Township Hall, located in the middle of the watershed. This minimized travel times for members, and generally five or six of the eight townships were represented at monthly meetings. Minutes were kept of all Steering Committee meetings and formed a record for purposes of preparing quarterly reports; they were also posted on a newly created website to insure wider dissemination. While there was some turnover among Steering Committee members over the course of the two-year planning process, the Committee provided leadership and continuity in decisions. Ultimately, as will be noted later, the draft watershed management plan was also presented to each of the Boards by EMU staff with an invitation to support the plan through a Resolution.

1.2.3 Stony Creek Stakeholders

In order to broaden participation in the planning process and to keep a wide array of community members informed about the unfolding watershed plan, a second group of individuals and organizational representatives were solicited to make up what came to be called the Stakeholders List. Included on the List was an assortment of other governmental agencies as well as representatives of groups with specific interest in the watershed.

In addition, any individual who expressed interest in the work of the Steering Committee or who participated in any of the Committee's meetings, volunteer activities or public events were added to the Stakeholder List. This insured that a wider group of interested residents and stakeholders would be kept apprised of the unfolding planning process.

Members on the list received email updates of the activities of the Steering Committee, were invited to attend all Committee functions, were sent minutes of Steering Committee meetings and copies of all supporting material, and specifically were invited to participate in several public participation efforts, described more specifically below. While the Stony Creek Stakeholders never formally convened as a group—hence the name Stakeholders List—the group served an important information-sharing role as the planning process progressed over two years.

1.2.4 Stony Creek Technical Committee

Still a third vehicle for sharing information and providing insight into the Stony Creek planning process is reflected in the creation of the Stony Creek Technical Committee.

Several of the municipal jurisdictions forwarded the names of individuals and groups that would be interested in providing professional or technical advice for the Steering Committee. In addition, staff sought out representatives of key watershed related agencies and organizations to secure nominations for an advisory group. These included individual citizens, community groups and national organizations such as the Sierra Club, as well as a variety of local, state and national agencies with relevant administrative responsibilities, such as the Soil Conservation Service. A contact list of such individuals and groups was maintained and they too were notified of committee meeting dates, agendas and meeting minutes. Ultimately, from among this smaller group of experts, a Technical Advisory Group was formally convened to provide continuing guidance to the Steering Committee (a list of Technical Committee members is included in the Appendix).

On several occasions over the past two years the Technical Advisory Committee convened to address specific issues and questions and provide advice and recommendations to the Steering Committee. Members were asked for feedback on the desired uses of the watershed, as defined by the Steering Committee, the pollutants and impairments identified, the most effective means for engaging the public in the discussion of these issues, and ultimately reaction to the list of best management practices that emerged to address the challenges facing the watershed. Feedback from the Technical Committee was provided to Steering Committee members at their regular meetings, often in the form of supporting material.

In addition to periodic meetings, and because of the busy schedules of members of the Technical Committee, regular interactive communication occurred between EMU staff and Committee members. This proved to be an effective and efficient means for securing insights and feedback on decisions of the Steering Committee in developing the watershed management plan.

1.3. Opportunities for Information-Sharing and Public Participation

1.3.1 Stony Creek Community Forums

After several months of working together on early watershed planning tasks, the Steering Committee directed staff to prepare for and implement two community forums to inform the public about the unfolding planning process and to solicit public input on goals for the watershed as well as perceived water quality problems. Assistance was sought from the Huron River Watershed Council in developing plans for the forums, with HRWC staff attending several monthly meetings of the Steering Committee to describe options and opportunities for public participation. To publicize the events information was disseminated through the Steering Committee, to the Stakeholder List and the Technical Committee, announcements were sent to each of the Township Clerks for posting on local websites and distribution at regular Board meetings, and the local media were contacted to share the meeting dates and times.

Forums were conducted in each of the two counties to maximize public participation, and a brief presentation of the 319 planning process and a summary of water quality testing data to date were shared. Both programs, conducted in early 2004, followed a similar format reflected in the agenda below. The Monroe County presentation at Frenchtown Township Hall was not well attended, while the Washtenaw County presentation, held at the Ypsilanti District Library, drew nearly fifty residents from across the upper portion of the watershed. In both instances, Steering Committee members were present to answer questions, hear the comments and concerns presented by residents, and to be recognized.

- The Stony Creek Watershed
  - What is a watershed?
  - What and where is the Stony Creek Watershed?
- The Watershed Management Planning Process
  - Past Activity in the Stony Creek Watershed
  - The 319 Planning Grant
  - The Stony Creek Steering Committee
  - The Watershed Management Planning Process
- Tell Us What You Think About the Stony Creek Watershed
  1. How has the Stony Creek watershed changed in the past two decades?
  2. What are your concerns about the watershed today?
  3. The Steering Committee has identified four uses as most important for the Stony Creek watershed—do you agree? Would you add others?
  4. In thinking about impairments and challenges to the watershed, the Steering Committee has begun to discuss the most critical pollutants and impairments. Which impairments do you consider the most important, given the desired uses?
  5. What do you perceive as the causes of these impairments?
- Next Steps

As suggested by the agenda, the opening segments of the forum were primarily descriptive, letting participants know about the unfolding process and decisions to date. The latter part of the agenda involved an interactive exercise; participants were asked first to identify what they

perceived as the most critical impairments in the watershed, and then asked to rank order those impairments. The exercise was designed to help the Steering Committee complete a similar task as part of the planning process, and the results of the public priority-setting process are included in the Appendix.

1.3.2 Volunteer Activities

Several additional opportunities for information sharing and participation were pursued over the past two years, as described below.

1.3.3 Website Outreach

One of the first steps taken at the start of the planning process was to create a Stony Creek Website on the EMU computer system; http://www.emich.edu/wrc/stonycreek/. Dr. Gustavson created and maintained the site throughout the two year planning process and on a regular basis uploaded all Steering Committee materials as well as the results of the water quality testing conducted on a regular basis. As the draft watershed management plan began to take shape, earlier versions of the text were also uploaded to provide an opportunity for those on the Stakeholder List, the Technical Committee as well as other interested residents to review the progress of the planning process.

Individuals were encouraged through the site to send email about their watershed concerns. In addition, sections were created on the webpage to provide links to related sites, to encourage further reading and to promote personal decisions that could improve water quality in the watershed. Given the size and land area in the watershed, use of the website was seen as one of the critical means of continually communicating with and updating residents and interested parties about the progress of the Steering Committee.

1.3.4 Watershed Tours

At several times throughout the planning process, small groups of individuals from the Steering Committee, the Technical Committee, and other interested individuals completed tours of the watershed to identify sensitive areas, discuss impairments and consider action strategies for remediation. Initial tours were intended to familiarize participants with the entire watershed, since those that lived in the headwaters were not necessarily familiar with the lower end of the water shed, and vice versa. The tours also were publicized as a means for drawing attention to the planning process and enlisting additional interested participants. Names of participants were routinely added to the Stakeholder List, and feedback through these outreach efforts were incorporated into the findings of the Steering Committee.

In the summer of 2004, an additional tour was scheduled to accommodate the interests of Congressman John Dingell, who expressed an interest in seeing first hand the problems faced in the watershed, particularly related to farming interests. Dr. Gustavson organized the Stony Creek portion of the larger tour arranged by the Congressman's staff and shared on behalf of the Steering Committee the ongoing planning process. The Congressman appeared to be very concerned about under-funding of soil conservation projects and the apparent link between urbanization and flooding in the watershed, concerns already incorporated by the steering Committee into the priority impairments.

Related to the tours and insuring coordination of activities in the watershed, Steering Committee members were also kept apprised of work being undertaken in the Stony Creek under the auspices of the Monroe Soil Conservation District, pursuant to a Consent Agreement in a case involving discharges from the London Aggregates facility. The work involved removal of several log jams in a stretch of creek below the aggregate site along with stream restoration work, funded by the company. In addition, fish stocking will also occur once testing confirms that the water quality will support fish.

1.3.5 Macroinvertebrate Study

During the spring of 2004 another opportunity for public participation was provided. Nearly two dozen volunteers joined EMU staff and HRWC volunteers for a macroinvertebrate study in the Stony Creek. Several different sites were selected across the watershed. Volunteers met and picked aquatic insects from the creek under the supervision of HRWC volunteer leaders and collectors. The product of that effort, spread over two weeks as a result of high rainfalls, was presented to the Steering Committee as part of its analysis of the conditions in the creek. The event also was used to educate the public about conditions in the watershed (the report of the study is contained in the Appendix and is discussed in more detail in Chapter 3).

1.3.7 Presentations to Township Boards and Residents

As the watershed management planning process came to an end, with the direction of the Steering Committee, EMU staff coordinated and conducted presentations to a number of governmental and community bodies, sharing the results of the water quality assessments and the products of the Steering Committee's deliberations. These included presentations to the Ypsilanti Township Water Resources Commission, the Pittsfield Township Natural Resources Commission, and the Township Boards of each of the eight Townships in the Watershed.

Meetings were scheduled in advance through the office of the Clerk, and a request was made to invite members of the local planning commission to attend the meeting at which the presentation was scheduled. A Resolution for consideration by the Township Board, drafted by EMU staff and approved by the Steering Committee, was presented at each of the Township Board meetings, with the understanding that the Board would take up the Resolution at a subsequent meeting. While not all the information in the plan was presented at such sessions, a summary of water quality findings was provided, the list of priority pollutants and challenges was presented, and the Table of Action Strategies was disseminated and discussed. Those seeking additional information about the plan were directed to the project website. Subsequent to these meetings, copies of several Board Resolutions were received.

1.4 Summary

The success of efforts to address the water quality concerns identified in the Stony Creek Watershed as a product of this planning process does not rest in the hands of township governments alone. As noted later, it will depend upon collaboration among governing bodies of the several units of government that make up the watershed, and the cooperation of a number of community groups and stakeholders with an interest in the environment. More importantly, it will depend upon changing the behavior of citizens and residents who live and work and shop in the watershed. This plan and its recommendations is designed to affect that change, through its findings and recommendations.

This opening chapter of the Stony Creek Watershed Management Plan is intended to identify the key participants in the decision-making process and to describe the outreach efforts undertaken during the two and half year project.

Chapter two describes the watershed in considerable detail, providing information on soil makeup, geography, geology and topography; land uses, development patterns and population density; and hydrology. The information is drawn from a variety of sources, with most recent data utilized wherever possible.

Chapter three summarizes the findings of water quality testing undertaken during the watershed planning process as well as data from other relevant sources. This includes the results of water quality monitoring over a number of months by EMU staff and volunteers as part of the project, a macroinvertebrate study conducted in cooperation with volunteer leaders from the nationally known Huron River Watershed Council, and a detailed road crossings assessment by EMU staff, as well as past studies undertaken by DEQ and others of various aspects of the watershed and creek system. To the extent possible, findings have been digitized and reported in maps and graphs to facilitate dissemination and understanding, and at the point where information was reviewed and endorsed by the Steering Committee, it was posted on the project website.

Chapter four discusses the process used by the Steering Committee to articulate a vision, identify designated uses, designate critical areas, establish priorities for pollutants and challenges, and ultimately identify suspected causes of the pollutants and challenges manifesting themselves in the watershed. Goals for the watershed are noted at the end of chapter four.

Chapter five describes the recommended action strategies designed to address the concerns identified in the prior pages. Those strategies are identified in a lengthy table in the chapter and discussed in detail in the narrative.

Chapter six describes the education and information strategies recommended for implementation of the watershed management plan, with a summary table identifying specific target audiences and estimates of costs. As noted above, the Steering Committee recognized that much of the success of efforts to ameliorate the problems in the Stony Creek Watershed will depend on changing the behavior of individual residents and visitors.

Chapter seven provides an implementation plan, spelling out steps in the coming months to insure that the recommendations contained in the plan will be carried out. The chapter also identifies a set of both qualitative and quantitative evaluation strategies designed to capture the impact of efforts to impact individual behavior, to improve conditions in the Stony Creek and its tributaries, and ultimately impact the quality of life in the watershed.

A set of appendices make up the balance of the plan; in it we identify the names of the key participants in the planning process, describe the findings of the macroinvertebrate study in detail and the prioritizing of pollutants undertaken by the Steering Committee and the public, and offer other relevant information.

Chapter 2: Characteristics of Stony Creek Watershed

2.1 Location and Size

The Stony Creek Watershed lies within Washtenaw and Monroe Counties in Southeastern Michigan (Figure 2.1) and contains portions of Pittsfield, Ypsilanti, York, Augusta, Milan, London, Exeter, Ash, and Frenchtown Townships, and very small parts of the cities of Ann Arbor, Ypsilanti, Milan, and the Village of Maybee (Figure 2.2). Sandwiched between the larger Huron River Watershed and the River Raisin Watershed, the Stony Creek Watershed is a long, narrow watershed (about 32 miles long and 8 miles at its widest) that is oriented northwest-southeast and tapers as it drains toward Lake Erie just north of Monroe, MI.

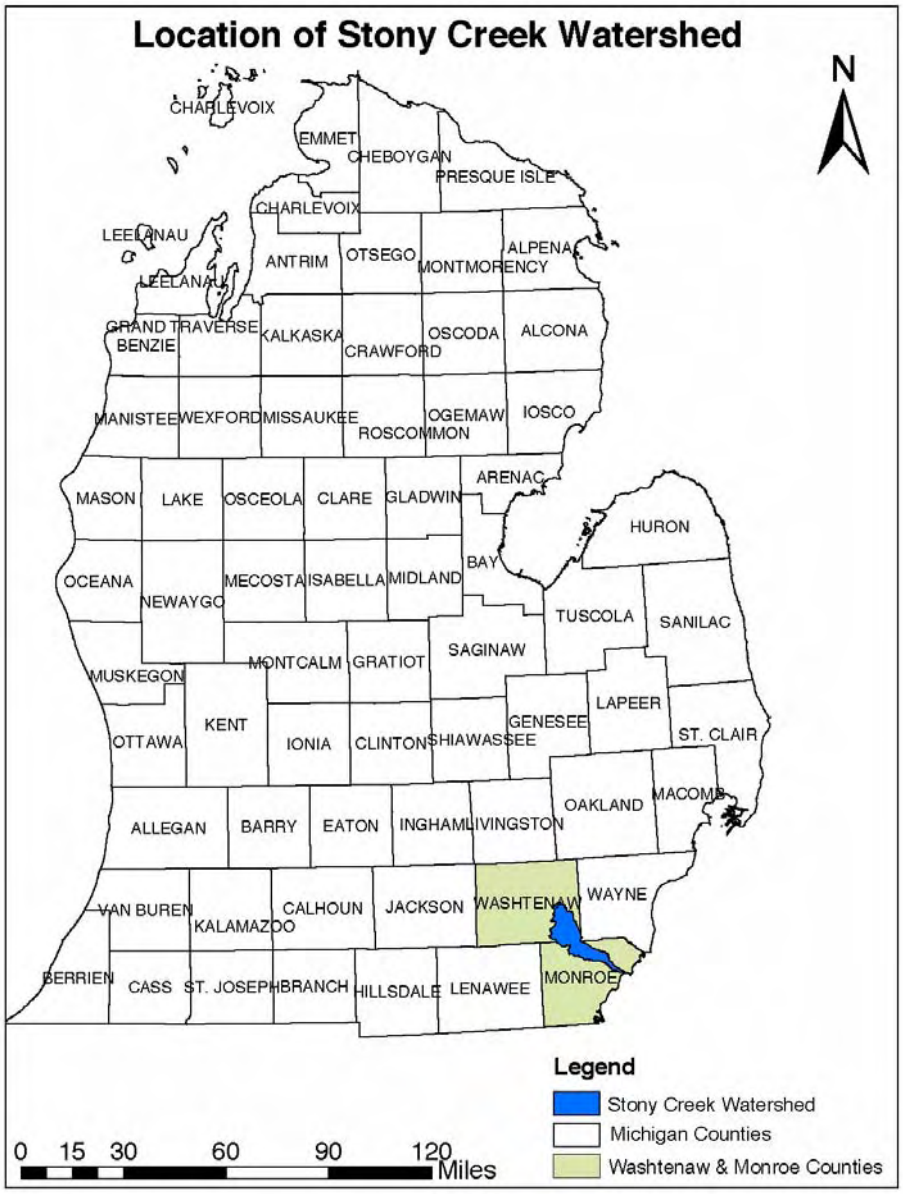

Figure 2.1: Location of Stony Creek Watershed in Washtenaw and Monroe Counties in Southeastern Michigan.

Figure 2.2: Map showing the boundaries of the Stony Creek Watershed, major roads, and the portions of local townships and cities within its borders. The boundary between York/Augusta and Milan/London Townships separates Washtenaw County to the north and Monroe County to the south (see Figure 2.1).

2.2 Geology and Topography

Bedrock Geology
The local bedrock that underlies the Stony Creek Watershed was deposited in a warm, shallow sea between 438 and 360 million years ago when most of North America was covered by oceans and had a tropical climate. The rocks that underlie the Stony Creek headwaters are younger shales and sandstones (rocks made out of clays and/or sand). The lower reaches of the watershed are underlain mostly by older limestone/dolostone (dissolvable) and sandstone (not easily dissolvable). Several quarries operate or have operated in the watershed in order to mine the limestone. The presence of this limestone and its chemical make-up also has an impact on surface and groundwater quality as discussed later in this document (Nicholas, et al., 1996).

Surficial Geology and Topograhy
Over the past million years, multiple glaciers have built up over the area and covered the bedrock with loose sediment as they melted away. The last glacier in the area piled sediment into a ridge along a line trending northeast-southwest passing through what is now Ypsilanti, building a moraine ridge a few miles wide and well over 100 miles long (Figure 2.3). This moraine ridge is made of sediments with a wide range of particle sizes (till), but with large amounts of fine particles (silt and clay) relative to till in many other parts of Michigan. Isolated pockets of sand and gravel deposited by glacial streams can be found associated with the till. This moraine ridge is in the extreme headwaters of the watershed and gives this part of the watershed the steepest slopes, up to 6 degrees (Figure 4). Water draining off the southeastern side of this ridge flows through the Stony Creek Watershed, whereas the northern side of this ridge drains the opposite direction into the larger Huron River and Raisin River Watersheds.

The rest of the watershed is dominated by glacial lake deposits. As the glaciers melted back, they occupied the low areas in Lake Huron and Lake Erie and blocked the current drainage of surface water through Lake Erie toward the Atlantic Ocean. As a result, the glaciers dammed a large lake that flooded the landscape to the edge of the moraine ridge in the upper part of the watershed. Fine clay and silt sized particles were deposited in the lake. Sand was deposited in places along the lake shorelines and in near shore environments as the lakes slowly got smaller toward their current sizes. This lower portion of the watershed tends to be much flatter than the upper watershed with maximum slopes usually no more than about 1 degree (Figure 2.4). Buried moraine ridges may be responsible for the slightly steeper slopes in this part of the watershed.

The surficial deposits are thickest in Washtenaw County and in London Township in Monroe County, where sediment thicknesses can exceed 150 feet. The lake deposits decrease to generally 20 feet or less in Exeter and Frenchtown Townships near the mouth of Stony Creek (Nicholas, et al, 1996). The thinner the surface deposits, the closer bedrock is to the surface. Therefore, quarries tend to be located in the lower half of the watershed. These surface sediments have a profound effect on the watershed hydrology, as discussed later.

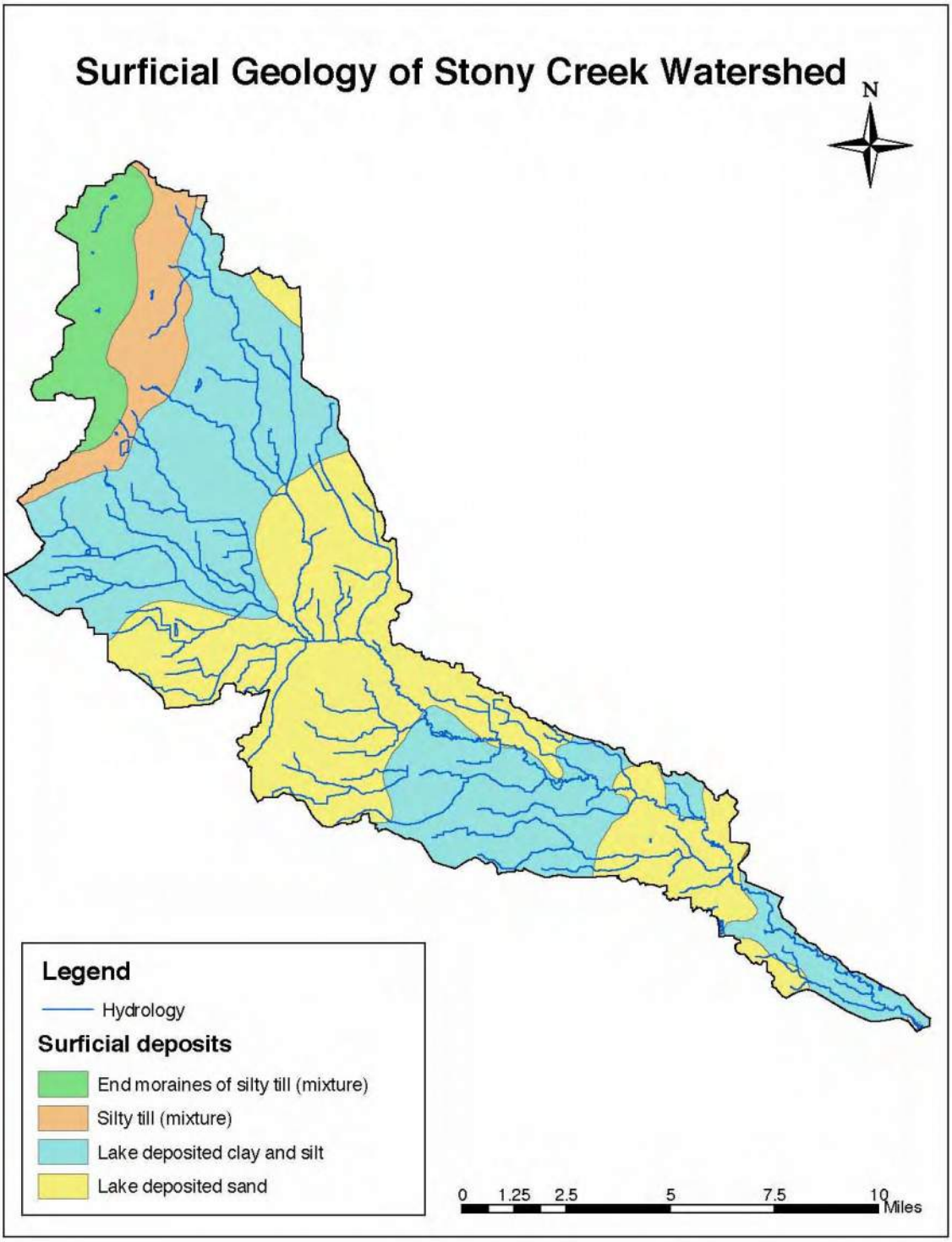

Figure 2.3: Map showing surficial geology (glacial deposits) in the Stony Creek Watershed. A relatively steep end moraine lies in the upper watershed made of a mixture of clay, silt, sand, and larger particles. Flatter sorted (not mixed) lake deposits of sand or silty/clay overlie the majority of the watershed.

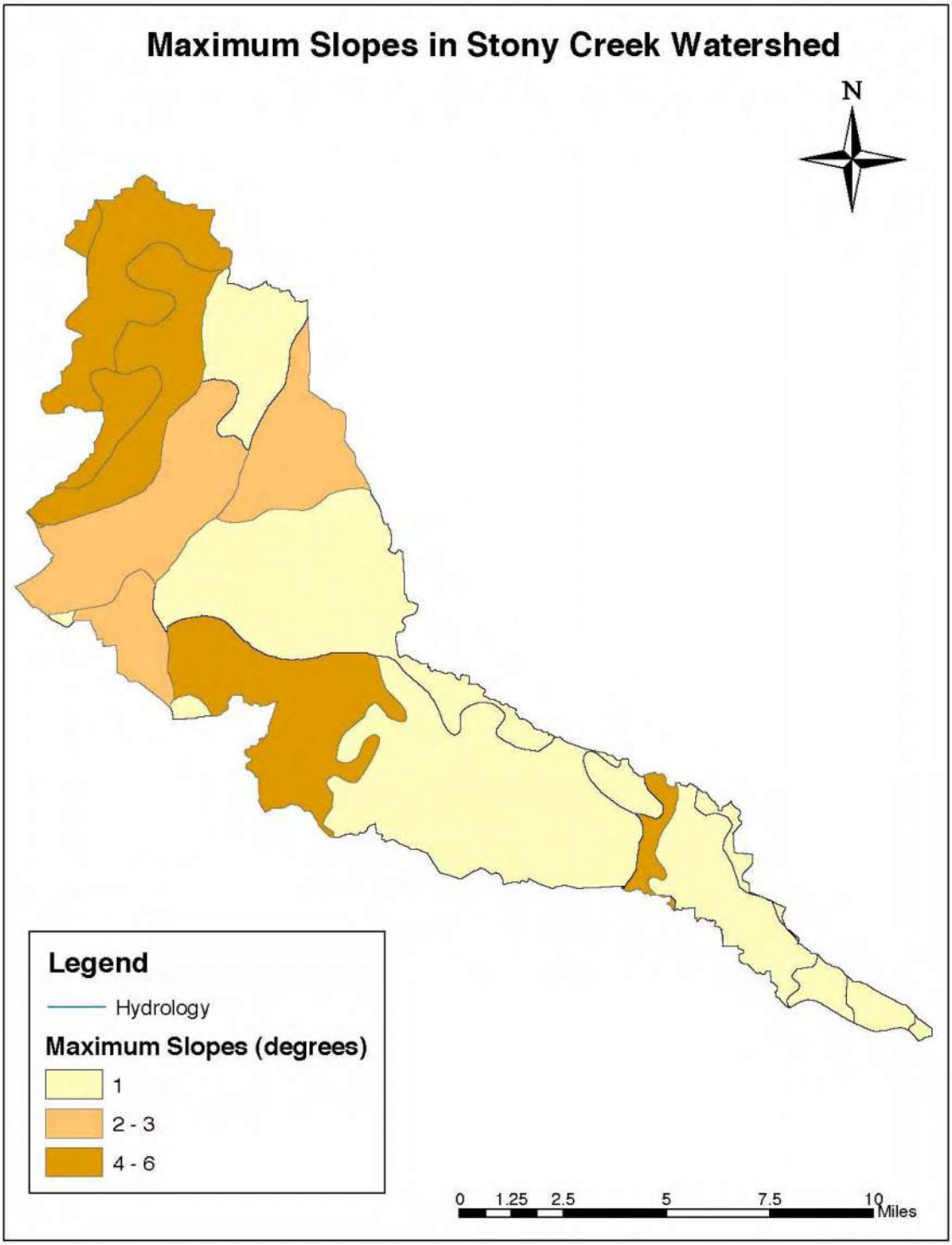

Figure 2.4: Map of the maximum slopes in areas of the Stony Creek Watershed. Notice how the areas with the maximum slopes in the upper watershed correspond to the glacial moraine (Figure 2.3). The other areas of high slope probably correspond to other moraine ridges buried by lake sediments at the surface.

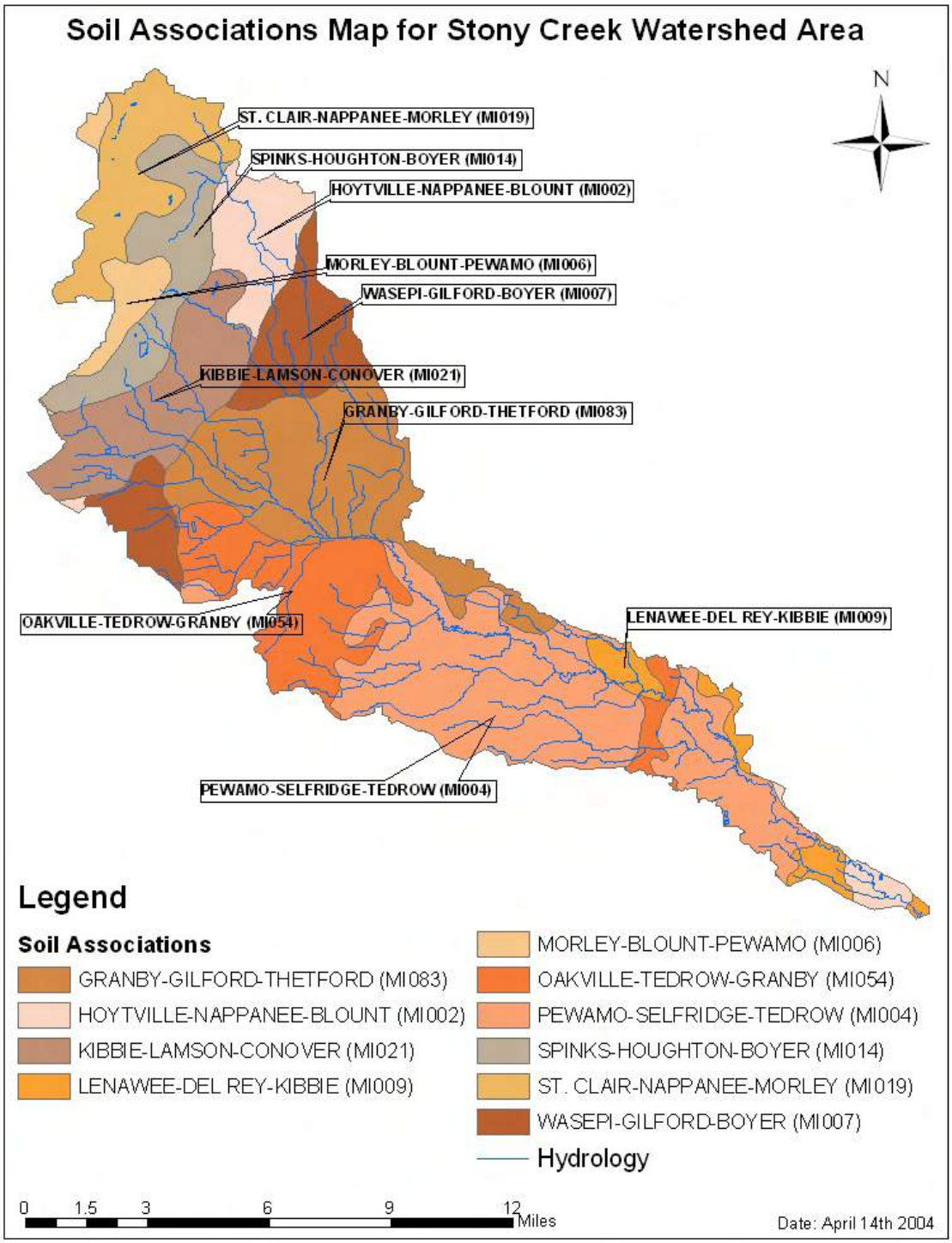

Figure 2.5A: Soil associations in the Stony Creek Watershed with their numeric codes. Descriptions of these soil associations are included in Figure 2.5B.

Soil Association Descriptions

Legend

Soil Associations

- GRANBY-GILFORD-THETFORD (MI083)
- HOYTVILLE-NAPPANEE-BLOUNT (MI002)
- KIBBIE-LAMSON-CONOVER (MI021)
- LENAWEE-DEL REY-KIBBIE (MI009)
- MORLEY-BLOUNT-PEWAMO (MI006)
- OAKVILLE-TEDROW-GRANBY (MI054)
- PEWAMO-SELFRIDGE-TEDROW (MI004)
- SPINKS-HOUGHTON-BOYER (MI014)
- ST. CLAIR-NAPPANEE-MORLEY (MI019)
- WASEPI-GILFORD-BOYER (MI007)

GRANBY-GILFORD-THETFORD (MI083)
Consists of poorly drained, rapidly permeable soils on lake plains, outwash plains, and in glacial drainageways. Formed in sandy loam material, slope is 0 to 2 %. Gilford soils have more clay in subsoil. Tedrow soils are somewhat poorly drained.

HOYTVILLE-NAPPANEE-BLOUNT (MI002)
Consists of poorly drained soils on ground moraines & lake plains, formed in fine textured material, with low permeability and slope 0 to 2 %. Nappanee soils are somewhat poorly drained.

KIBBIE-LAMSON-CONOVER (MI021)
Somewhat poorly drained, moderately permeable soils on lake plains and deltas. Formed in loamy & sandy glaciofluvial deposits.

LENAWEE-DEL REY-KIBBIE (MI009)
Consists of poorly or very poorly drained, moderately permeable soil on lake plains, formed in loamy and clayey lacustrine. Del Rey soils are somewhat poorly drained, fine textured subsoil are on slopes similar to Kibbie soils.

MORLEY-BLOUNT-PEWAMO (MI006)
Nearly level to strongly sloping, poorly drained to well drained soils that have a moderately fine textured & fine textured subsoil and underlying material on moraines and till plains. Permeability is moderately slow.

OAKVILLE-TEDROW-GRANBY (MI054)
Consists of well drained, rapidly permeable soils on lake plains & glacial outwash plains, formed in sandy material. Tedrow soils are somewhat poorly drained & are in positions lower than Oakville soils. Grandby are poorly drained & are in low lying depression areas.

PEWAMO-SELFRIDGE-TEDROW (MI004)
Poorly drained, low permeability on ground moraines & lake plains, formed in loamy glacial till. Selridge soils have coarse texture, somewhat poorly drained & are on slight knolls. Tedrow soils are poorly drained.

SPINKS-HOUGHTON-BOYER (MI014)
Consists of very poorly drained, rapidly permeable soils on lake plains & glacial outwash plains, formed in deep sandy material.

ST. CLAIR-NAPPANEE-MORLEY (MI019)
Nearly level to very steep, poorly drained, moderately well drained and well drained soils that have a fine textured subsoil and fine textured underlying material on moraines, till plains and lake plains. Permeability is very slow.

WASEPI-GILFORD-BOYER (MI007)
Somewhat poorly drained soils on till plains, formed in sandy & loamy glacial till, moderately rapid permeability. Gilford are poorly drained soils on outwash plains.

Figure 2.5B: Legend for Soil Associations map (Figure 2.5A) showing descriptions of soil associations in the Stony Creek Watershed.

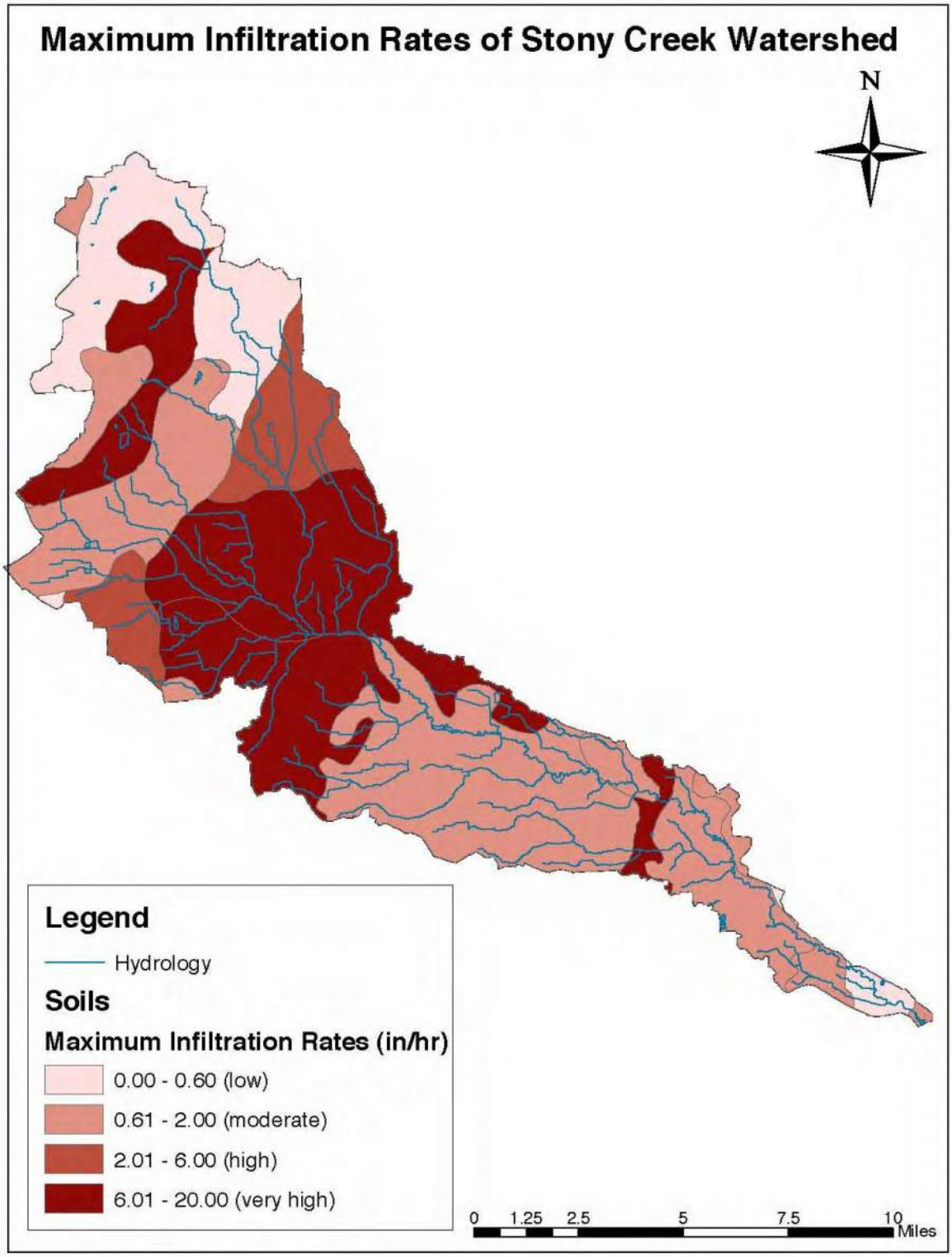

Figure 2.6: Map of the maximum infiltration rates for soil associations in the Stony Creek Watershed. Note that the best drained soils are generally in the central portion of the watershed and roughly coincide with the sandy areas on the surficial geology map (Figure 2.3).

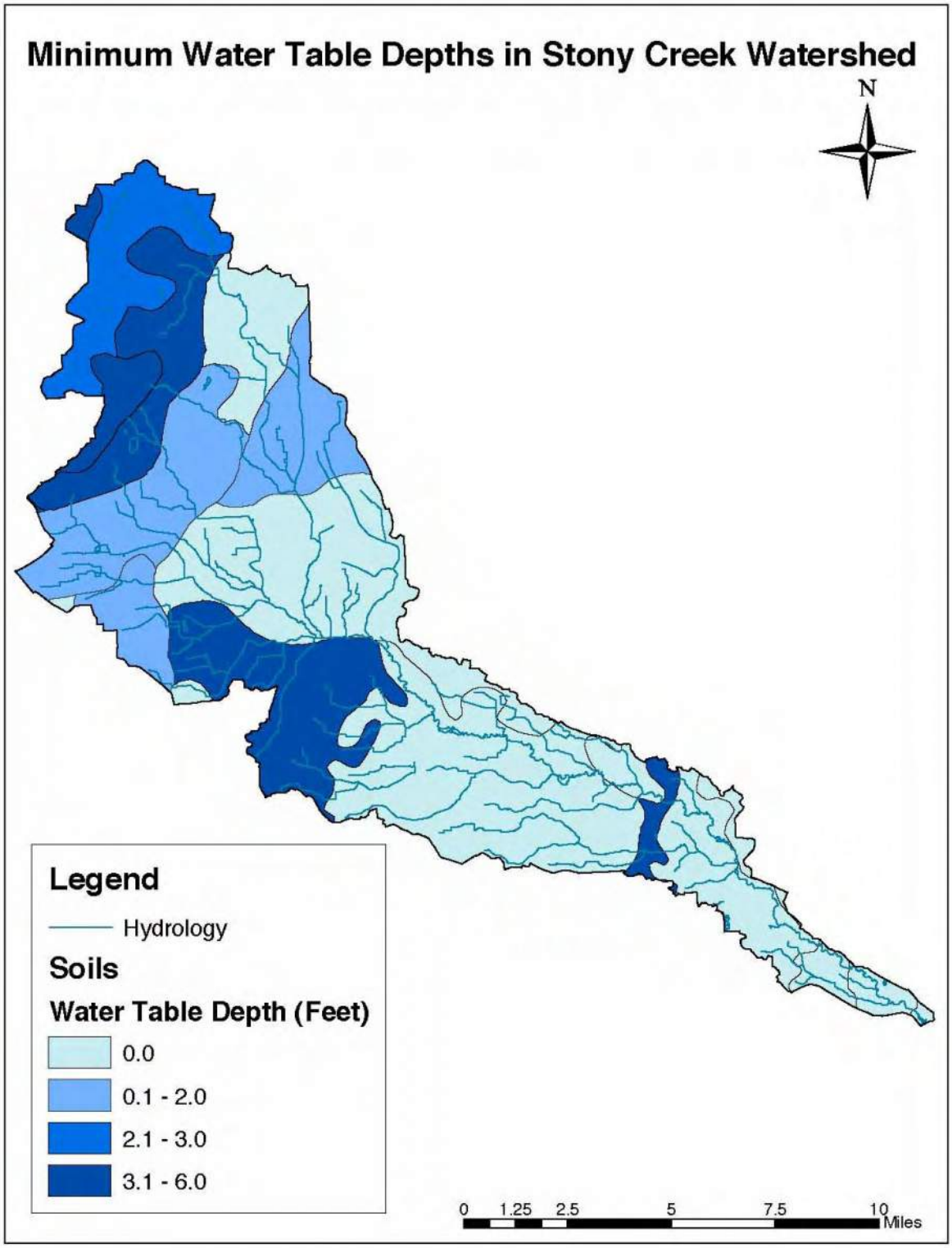

Figure 2.7: Depth to water table (generalized) shows relative drainage of the landscape. A large portion of the watershed has very high water table that indicates poorly drained soils.

2.3 Soils, Infiltration, and Groundwater

Ten soil associations have been mapped in the Stony Creek Watershed (Figure 2.5A) and are described in the detailed legend (Figure 2.5B). Soils are weathering horizons that form in glacial deposits and rocks that are exposed at the earth's surface. In the Stony Creek Watershed, the geologic material (sand, clay, etc) has a profound effect on the soil properties. The glacial tills dominated by fine particles in the upper watershed and the lake deposits that were dominated by fine particles in other parts of the watershed have developed into soils rich in fine particles. These soils generally have low to moderate maximum infiltrations rates below 2 inches per hour (Figure 2.6). The areas in the central watershed are rich in sand deposited in a lakeshore environment (Figure 2.3) and drain more readily with maximum infiltration rates 2 to 20 inches per hour (Figure 2.6). The infiltration rate of soils has a profound effect on the hydrology, as discussed later.

There are two main aquifers under the Stony Creek Watershed: the upper aquifer in the surficial deposits and a lower aquifer in the bedrock. The bedrock aquifer is closer to the surface in the area closest to Lake Erie, and is deeper in the upper watershed where there are thicker sequences of surficial sediments. Figure 2.7 shows a generalized depth to the water table map that is based solely on minimum expected depths based on soil association type. This map should not be used for specific projects where a more detailed distribution of groundwater should be determined. In general, over a large part of the watershed, the water table is essentially at the ground surface. However, the water table may be 6 feet or lower in other areas.

2.4 Land Use

Pre-settlement vegetation in the Stony Creek Watershed was dominated by wetland vegetation on the flat, poorly drained former lake plains (Figure 2.8) and generally forest in other areas. Conversion of the land to agriculture and development of the land for suburban and urban residential and shopping areas has drastically changed the vegetation in the watershed.

The most recent land use data for the Stony Creek Watershed is from 2001 and is based on the types of vegetation covering the landscape (Figure 2.9). As a result, the data actually represents earth cover rather than land use specifically. The major weakness of this system for determining land use is that trees that provide 25% canopy are considered forest, even if within a residential area. Therefore, the land use map actually visually minimizes the true scope of urbanization and suburbanization within the watershed. On the other hand, the satellite imagery used to generate these data can be used to identify types of trees present (including agricultural groves) and specific types of crops. So, the imagery is excellent at delineating land uses when the vegetation present is a clear indication of land use.

Agriculture

The land use map from 2001 (Figure 9) shows that the watershed is still dominated by agricultural uses (over 36%, excluding livestock). In addition, a substantial portion of the "Rangeland" category may be agricultural fields in fallow in 2001. The dominant crops in the watershed are corn and soybeans, in rotation. A third crop of significance, but much less common, is wheat. Agricultural areas tend to be on soils in flatter areas with high silt and clay

content (former wetlands in Figure 2.8). In addition, there are a few orchards in the upper half of the watershed. The main ways that agriculture affects surface water quality is through soil erosion and transport of fertilizers and pesticides with surface runoff. Many of the fields are tiled to increase drainage of the land and reduce surface runoff.

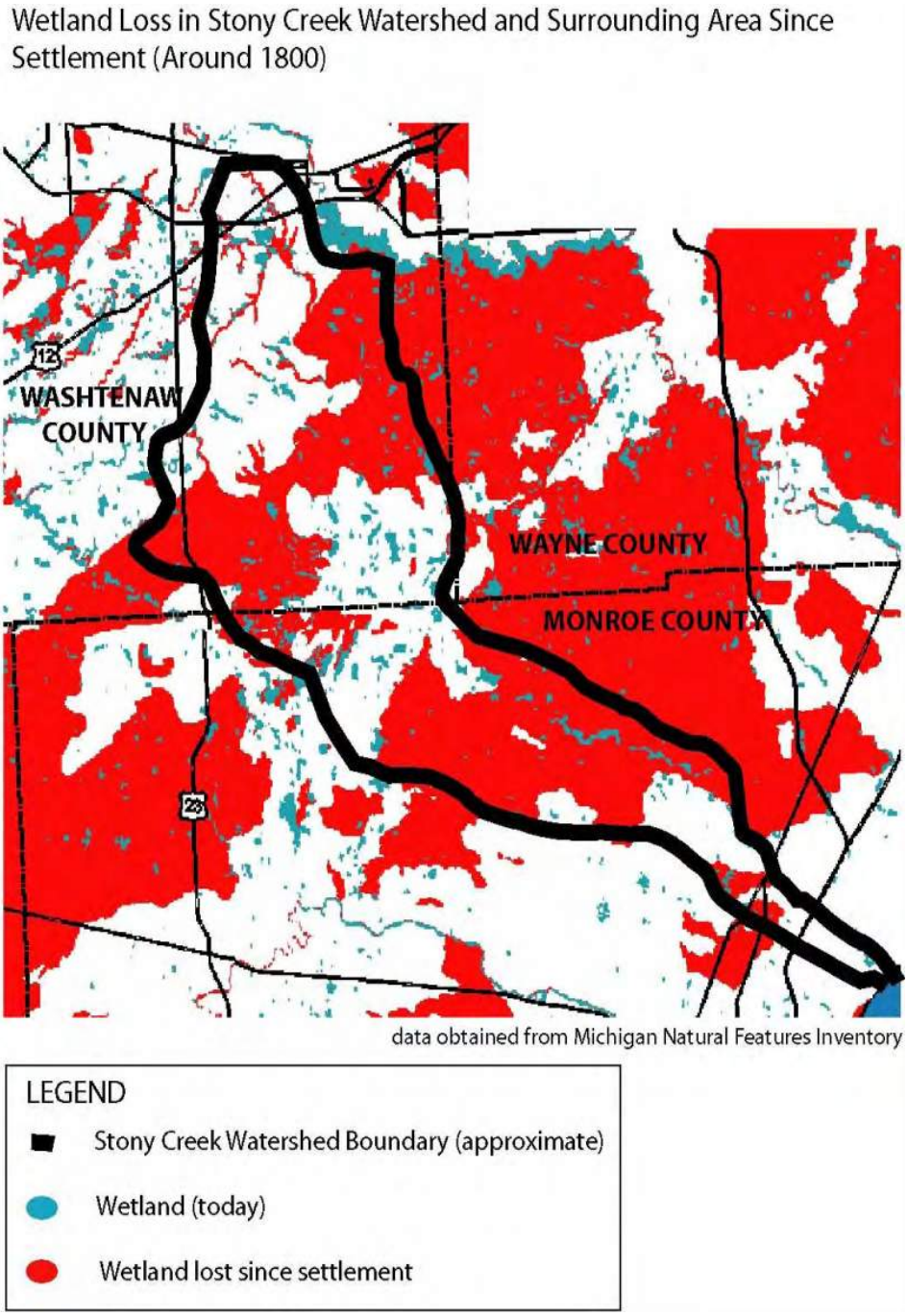

Figure 2.8: Map showing that about half of the Stony Creek Watershed was wetland before settlement. The remaining wetlands are only a tiny fraction of the original, natural condition of the watershed.

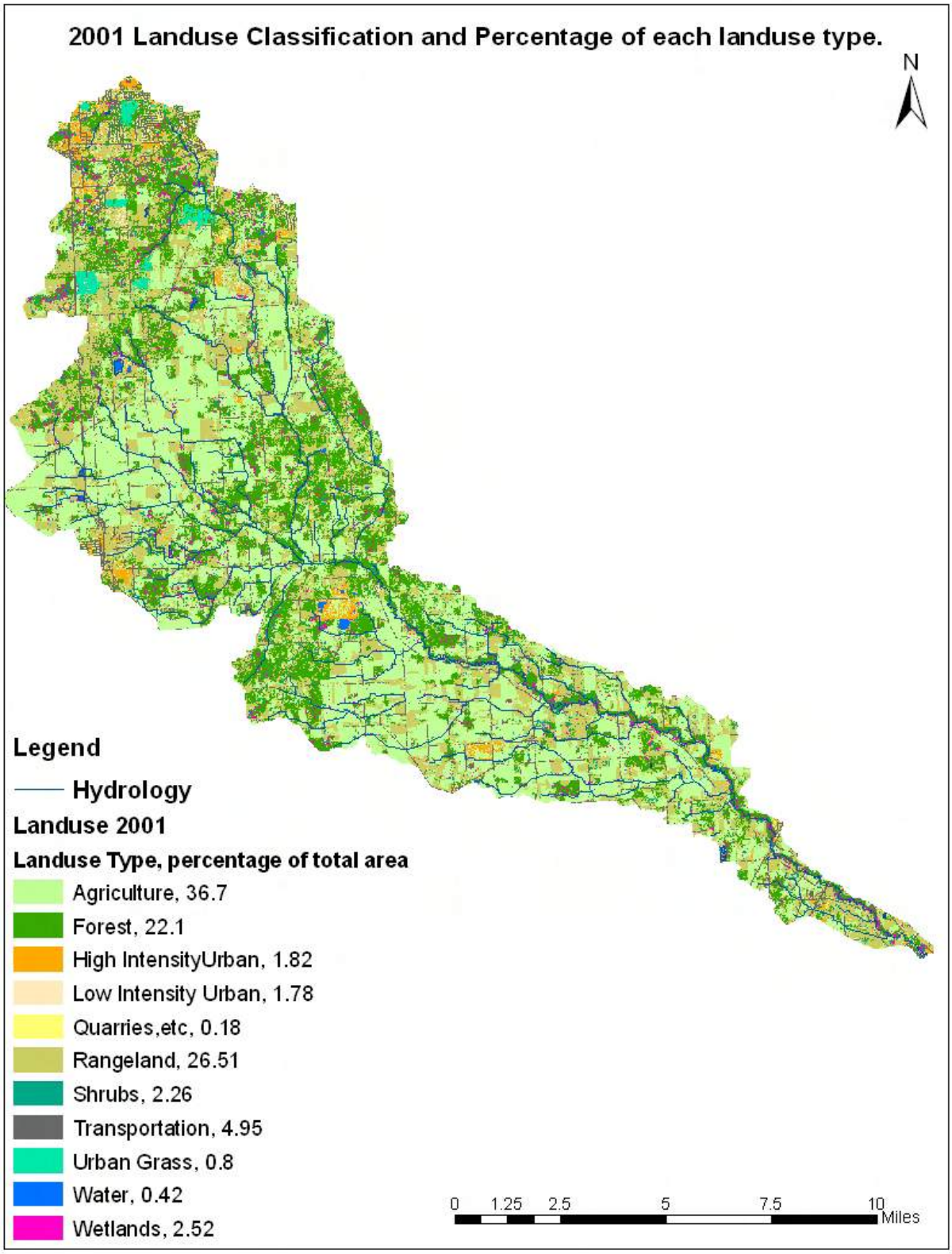

Figure 2.9: Map of the land uses in the Stony Creek Watershed in 2001 based on vegetative cover identified by satellite imagery. The image underestimates the amount of suburban land use where the tree canopy is at least 25% in residential areas.

Forest / Forested Residential / Shrubs
Over 24% of the watershed is classified forest or shrubs (Figure 9). There are fairly pristine stretches of forest, particularly along the major streams (Stony Creek and Paint Creek). The forest areas tend to correspond to coarser grained soils and generally hillier topography. A significant proportion of this category is actually forested residential areas or ones with significant tree cover, especially in the upper and central portions of the watershed. In general, forests provide good infiltration of stormwater, but forested residential areas are more likely to produce a fair amount of surface runoff, depending on how stormwater is managed in the area.

Rangeland / Grassland
Over 26% of the watershed is categorized as grassland. Some of this land is rangeland for raising animals (mostly cattle, horses, and sheep). A significant portion of this land, however, is probably agricultural fields that were fallow in 2001. Some of this land may also be farms that have been taken over by non-farming residents who have let prairie vegetation take over former agricultural fields. Prairie vegetation can absorb water well. Rangeland used for cattle can become more compacted by animals (leading to more runoff) and contain animal waste which could potentially contaminate surface water.

Urban / Transportation
About 9% of the watershed in 2001 was concentrated urban and impervious road surfaces. These areas are primarily concentrated in the upper watershed (the suburbs of Ann Arbor and Ypsilanti). To a lesser extent, there are concentrated urban areas around Milan, in the west central watershed and north of Monroe near the mouth of Stony Creek. As discussed previously, this category does not include residential areas with at least 25% canopy of trees. These areas collectively increase the amount of surface runoff in the watershed that can contain a variety of pollutants. This category, along with forested residential, is the most rapidly growing category in the watershed. Research has suggested that once a watershed attains roughly 8 to 10% imperviousness, streams start to exhibit severe erosion and severely increased flooding during rain events. As this land use expands, expect to find increasing problems with streams unless development takes place wisely.

Golf Courses and Urban Parks
Urban grass makes up close to 1% of the watershed. This grass is predominantly in the form of golf courses and a few parks. This category, however, would not pick up the numerous residential lawns that are included in the concentrated urban and forested residential categories. Use of fertilizers and pesticides on this type of vegetation can be a concern for watershed water quality.

Wetlands
Wetlands currently make up about 2.5% of the watershed area. Some wetlands are in the moraine areas in the upper watershed. Here, they are typically found in the low areas of this topography of undulating hills. Other wetlands are still concentrated along Stony Creek and, to a lesser extent, Paint Creek, Stony Creek's most significant tributary stream. The area had a much greater proportion of wetlands (about 50%) in pre-settlement times that were drained for agriculture and other uses. Wetland vegetation naturally cleans surface water. In addition, wetland areas provide natural buffers for water to be held by the landscape rather than sending

water quickly to streams when it rains. The loss of so much wetland in the watershed has significantly changed the hydrologic balance for Stony Creek.

Quarries
A few quarries exist in the central portion of the watershed totaling less than 1% of the watershed area, including one near Milan and one that is no longer operational in the center of the watershed. Since the quarries are pits, they would not affect surface water except that they draw down the water table (diverting baseflow to streams) and then discharge this groundwater into the surface water system, usually at higher volumes. As a result, pollutants normally found in groundwater can be detected in surface water. Although the percentage of land in this use is small, the impact on surface water quality can be very large.

Water
Less than a half percent of the watershed is in bodies of water. These features are mostly creeks and drains, discussed later. There are few open water bodies and none of significant size.

2.5 Community Profile

Census data from 2000 (Figure 2.10 on page 17) show the largest concentration or density of watershed residents living in the upper watershed (near Ann Arbor and Ypsilanti) and, to a lesser extent, farther south around Milan. Population has already increased dramatically since the census with the addition of hundreds of new homes in the upper watershed and will continue to increase. New developments are being constructed and others are in the planning stage.

Table 2.1 provides information on population for the two counties and the eight townships that make up most of the Stony Creek Watershed. The data on population and households are drawn from census figures and probably overstate population changes affecting the watershed since they reflect demographic changes for the entire jurisdiction, county or township, rather than just that portion of the jurisdiction in the watershed. Nonetheless, as is readily apparent, population has grown quite dramatically over the past two decades, especially in townships at the headwaters of the watershed in Washtenaw County.

Table 2.1 – Stony Creek Watershed Population and Population Change, 1980 - 2003

	1980	**1990**	**2000**	**2003**	**1990-2000 % Change**	**1980-2000 % Change**	**2000-03 % Change**
Monroe County	134,659	136,600	145,945	151,301	9.2%	83.8%	3.7%
Ash Twp.	7,688	4,710	5,048	5,793	7.2%	-34.3%	14.8%
Exeter Twp.	3,236	2,753	3,222	3,302	17.0%	0.4%	2.5%
Frenchtown Twp.	18,204	18,225	20,777	21,336	14.0%	14.1%	2.7%
London Twp.	3,266	2,915	3,024	3,182	3.7%	-7.4%	5.2%
Washtenaw County	264,748	282,937	322,770	340,406	14.0%	21.9%	5.5%
Augusta Twp.	4,643	4,415	4,813	5,971	9.0%	3.7%	24.1%
Pittsfield Twp.	12,997	17,650	30,167	32,855	70.1%	132.1%	8.9%
York Twp.	5,517	6,225	7,392	8,352	18.7%	34.0%	13.0%
Ypsilanti Twp.	44,511	45,307	49,182	52,138	8.6%	10.5%	6.0%

Table 2.2 provides similar information on households over the past two decades. Again, the data reflect continuing growth in the number of households throughout the watershed, with the exception of Ash Township (note that even in Ash Township the number of households has increased since 2000). Once again, the greatest increase in the number of households is evident in the townships at the headwaters of the Stony Creek Watershed.

Table 2.2 -- Stony Creek Watershed Households and Percent Change, 1980-2003

	1980 Households	**1990 Households**	**2000 Households**	**2003 Households**	**1990-2000 %Change**	**1980-2000 %Change**	**2000-03 %Change**
Monroe County	45361	46,508	53,772	57,000	15.6%	18.5%	6.0%
Ash Twp.	2556	1,588	1,803	2,138	13.5%	-29.5%	18.6%
Exeter Twp.	1021	861	1,092	1,146	26.8%	7.0%	4.9%
Frenchtown Twp.	6366	6,544	7,733	8,055	18.2%	21.5%	4.2%
London Twp.	939	919	1,009	1,085	19.8%	27.6%	6.8%
Washtenaw County	98172	104,528	125,232	133,807	17.5%	19.0%	29.2%
Augusta Twp.	1452	1,471	1,728	2,233	9.8%	7.5%	7.5%
Pittsfield Twp.	5797	7,013	11,817	12,924	68.5%	103.8%	9.4%
York Twp.	1218	1,416	1,901	2,193	34.3%	56.1%	15.4%
Ypsilanti Twp.	17259	17,637	20,194	21,668	14.5%	17.0%	7.3%

As evident in Table 2.3 below, the growth of households has outpaced the growth of population in almost all cases between 1990 and 2000. Since household size is decreasing, population has not been increasing as fast as households. But households drive the demands on land use. Thus, more households mean more demands for residential uses. And population and households drive commercial and other uses.

Table 2.3 – Comparison of Population and Household Change, 1990-2000

	1990-2000 Percent Change in Population	**1990-2000 Percent Change in Households**
Monroe County	9.2%	15.6%
Ash Township	7.2%	13.5%
Exeter Township	17.0%	26.8%
Frenchtown Township	14.0%	18.2%
London Township	3.7%	19.8%
Washtenaw County	14.0%	17.5%
Augusta Township	9.0%	9.8%
Pittsfield Township	70.1%	68.5%
York Township	18.7%	34.3%
Ypsilanti Township	8.6%	14.5%

Table 2.4 presents similar information on building permits over the past two decades, again reinforcing a general pattern of growth throughout the watershed. Notice that in some parts of the watershed, the pace of development has increased rapidly. For example, the number of building permits issued in London, Augusta, and Ypsilanti Townships in 2002 exceeded the annual average number of permits issued for the preceding four years. Indeed, the pace of construction has continued through 2003. For example, the number of permits issued in Augusta and Pittsfield Townships from January to October, 2003, exceeded the number for the entire year prior.

Table 2.4 -- Stony Creek Watershed Building Permits

	Bldg. Permit 1992-1996*	**Bldg. Permit 1997-2001***	**Percent Change 92/96-97/01**	**Bldg. Permit 2002**	**Bldg. Permit 2003** (As of October**)**
Monroe County	681	755	10.9%	748	461
Ash Township	25	29	16.0%	23	11
Exeter Township	18	16	11.1%	11	7
Frenchtown Township	112	106	-5.4%	69	33
London Township	15	21	40.0%	27	12
Washtenaw County	1911	2531	32.4%	2396	2010
Augusta Township	29	38	31.0%	39	54
Pittsfield Township	539	467	-13.4%	296	301
York Township	63	89	41.3%	60	43
Ypsilanti Township	275	372	35.3%	537	417

* Number reported is the annual average for the years in question.

The data on population, households and permits reinforce one another and confirm the assessment that growth is occurring in the townships that comprise the Stony Creek Watershed. The increased building, and corresponding increase in population, will increase the pressure on the remaining natural areas, wetlands, and waterways. In addition, there is strong potential for an increasing impact on water quantity and quality in the streams as the imperviousness of the landscape increases with construction of new roads, roofs, parking lots, sidewalks, and associated urban lawns.

Population growth and development is not only a concern for the upper watershed. Drinking water lines are to be installed up Stony Creek Road into Exeter Township from Monroe. With a public water supply, this part of the watershed could become a new area of development in the near future.

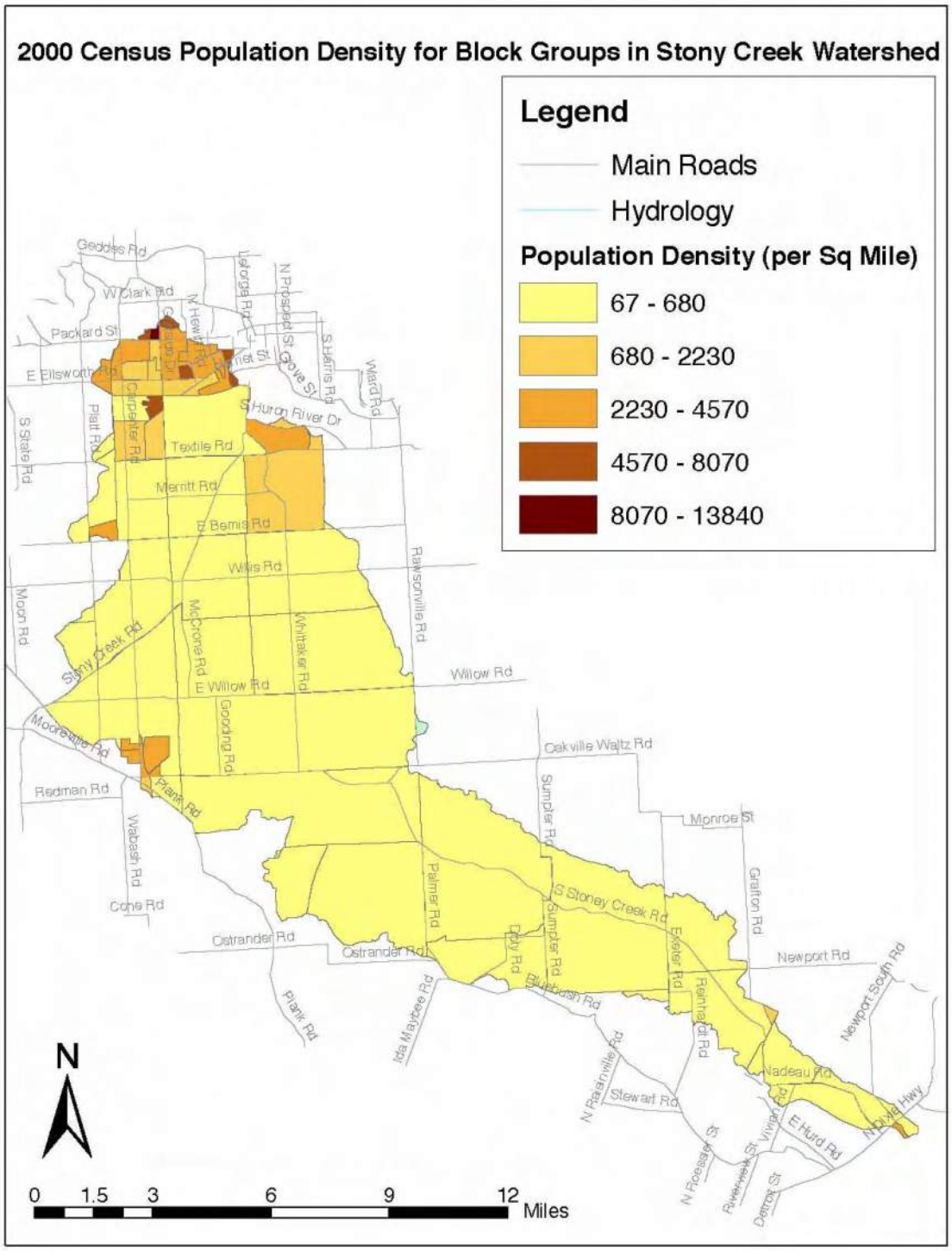

Figure 2.10: 2000 Census data show the largest concentration of watershed residents living in the upper watershed (near Ann Arbor and Ypsilanti) and farther south around Milan. Population has already increased dramatically this decade with the addition of hundreds of new homes and will continue to increase because new developments are on the way.

2.6 Rainfall and climate

Michigan's climate is strongly affected by the Great Lakes, which help ameliorate the typical extremes that most of the world's intercontinental areas experience. The greatest "lake effect" is in areas immediately adjacent to the lakes, with less influence farther inland. Stony Creek Watershed borders Lake Erie, but the watershed tapers to about 1 mile in the vicinity of this lake. As a result, the majority of the watershed experiences more of the inland extremes than otherwise might be expected from a watershed that directly feeds one of the Great Lakes. The greatest influence of the Great Lakes on the local climate is to contribute to cloud cover during late fall and early winter and therefore moderate daily low temperatures (Strommen, 1967, and Nurnberger, 1985).

There is one National Weather Service weather station in the Stony Creek Watershed, located in Willis on the border between Monroe and Washtenaw Counties – a central location in the watershed. Three other weather stations are located just outside the watershed in Ypsilanti and Ann Arbor (upper watershed) and Monroe (lower watershed). Summer temperatures seldom exceed 90°F with an average July high temperature of 83°F (slightly higher at Monroe). Winter low temperatures are regularly below freezing, but rarely fall below 0°F with an average January high temperatures of about 31°F (slightly higher in Monroe). The area does not often experience extended periods of extreme cold in the winter or similar periods of extreme heat and humidity in the summer (Strommen, 1967, and Nurnberger, 1985).

Average annual precipitation for the area is 30-32 inches per year (most at the Willis station). Precipitation generally falls regularly throughout the year with a relatively low risk of drought. More than half of the rainfall (about 18 inches) falls during the growing season (May-October). The driest month is February with less than 2 inches, while June is the wettest month with an average of about 3.5 inches at Willis. Summer precipitation generally comes in the form of thunderstorms or showers. Other months typically produce storms of lower intensity and longer duration (Strommen, 1967, and Nurnberger, 1985).

2.7 Hydrology

Water bodies

The major tributaries to Stony Creek include Paint Creek, Sugar Creek, and Buck Creek in Washtenaw County, and a series of drains mostly in Monroe County (Figure 2.11). Paint Creek originates in Pittsfield Township in the parking lot of Showcase Cinemas and flows through a heavily built up area of warehouses, strip malls and 5 lane roads. Paint Creek then passes through an area that has both older and newly developed and developing residential subdivisions. To the south, Paint Creek passes through farmland (which is quickly becoming subdivisions) until it reaches Stony Creek at the Washtenaw-Monroe County line. Sugar, Stony, and Buck Creeks all originate in York Township and pass through farmland, rangeland and newly developing land until they merge together within a couple miles of merging with Paint Creek. In Monroe County, a series of drains enter Stony Creek (including Amos Palmer Drain, Herkimer Drain, Ross Drain, and Robert Drain). These water bodies drain predominantly agricultural areas (mostly former wetlands).

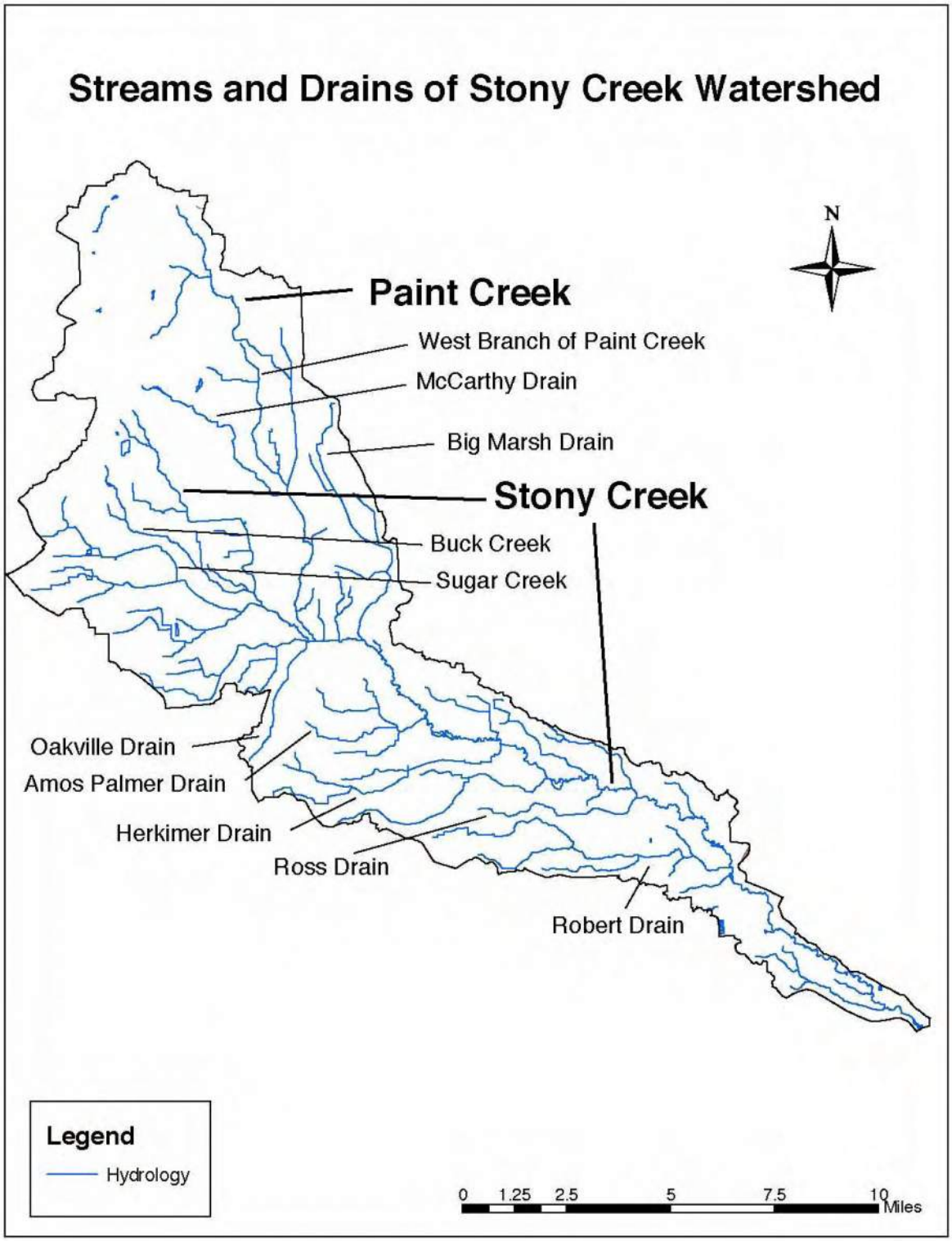

Figure 2.11: Map showing the location of Stony Creek and its major tributaries. The most notable and sizeable tributary to Stony Creek is Paint Creek, which drains the most heavily urbanized area in the watershed.

Discharge

The United States Geological Survey (USGS) has a monitoring station on Stony Creek where it crosses Tuttle Hill Road on the county line. This station is situated immediately downstream from the confluence of Paint Creek and Stony Creek. This station has been monitored regularly for discharge (volume of water per time) from 1970-1981, and then again for water year 2003 (from October 1, 2002 to September 30, 2003) as a part of a Monroe County groundwater study. During this period, discharge was measured continuously on Stony Creek using a pressure transducer and frequent measurements by USGS staff to ensure the proper relationship between pressure and discharge. For the full record (1970-81 and 2003), the annual mean discharge is 46.8 cfs (cubic feet per second), the highest discharge is 865 cfs (February 19, 1981), and the lowest discharge is 2.7 cfs (August 24, 1971). Figure 2.12 shows the streamflow over the 2003 water year. During this water year the mean discharge was 44.2 cfs, slightly lower than the mean annual discharge for the full period of record. The minimum discharge for water year 2003 was about 7 cfs (late July) and the maximum reached over 300 cfs (in mid-March). The discharge was generally greatest in the Spring (late March to June) and lowest during fall and winter (Figure 2.12).

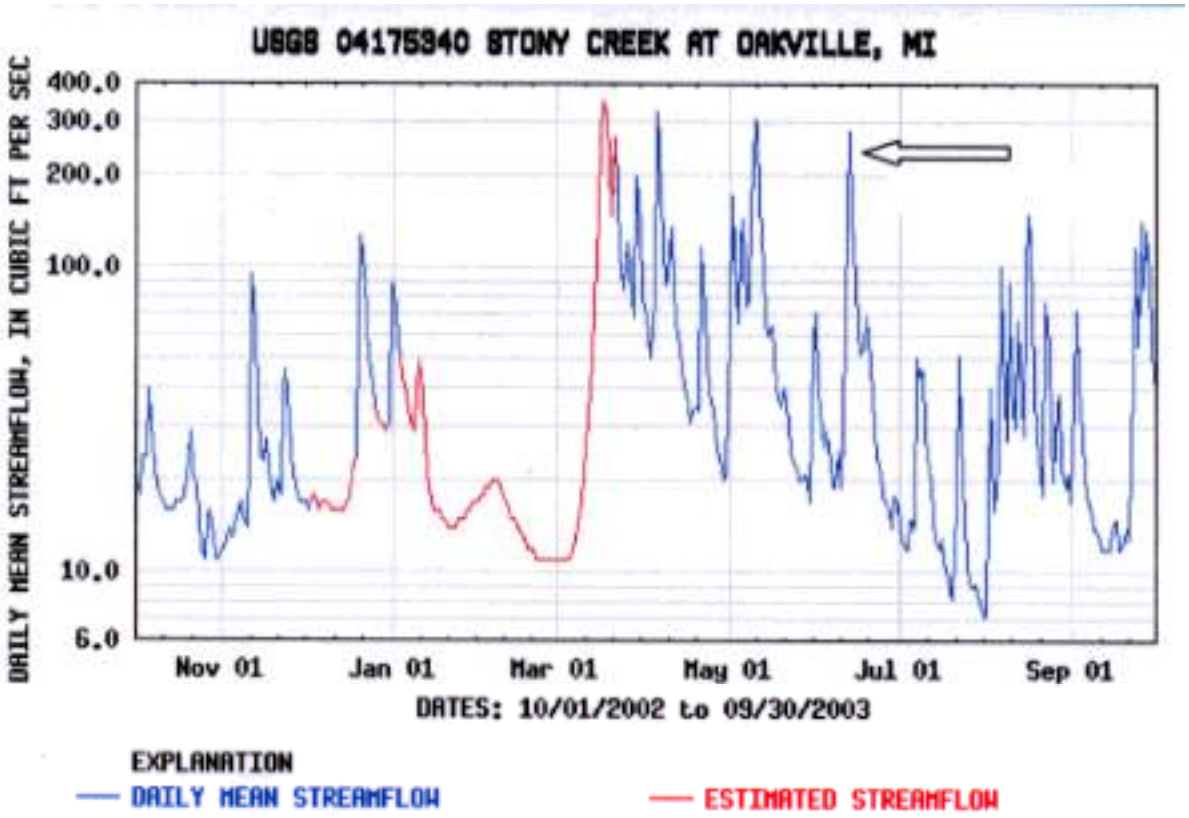

Figure 2.12: Graph showing discharge (volume per time of water) in Stony Creek over water year 2003 at Tuttle Hill Road on the county line. The curve for one rain event (indicated by an arrow above) is shown in Figure 2.13.

In general, the hydrograph of daily mean streamflow (Figure 2.12) shows a series of spikes in the graph that roughly correspond to rain events. Watersheds that experience a great amount of infiltration generally have a smoother graph (one with less rapid fluctuation). Figure 2.13 shows one of the "spikes" from the annual graph (Figure 2.12, spike indicated with an arrow) in greater detail with data recorded every 15 minutes over a period of 20 days. This graph of stream discharge from June 7-27, 2003, shows the response of Stony Creek to rainfall on June 11-13. A weather station near Milan reported rainfall amounts of 0.75 inches on June 11, 0.13 inches on June 12, and 0.80 inches on June 13. Given these data, it is safe to assume that the graph in figure 13 shows the response of approximately 1.68 inches of rainfall in the watershed, although summer storms are variable and may have dropped more or less rain over the watershed than at this one station.

Figure 2.13 shows that before the rain, groundwater was feeding the streams (baseflow) to produce about 20 cfs of discharge. After the rain started, the discharge increased to about 310 cfs within 24 hours – an increase of 15 times the pre-storm discharge. Note that this range of discharge values shows that within 24 hours the stream discharge was close to the lowest and highest values for the year. The stream returned to a discharge near the pre-storm discharge (baseflow) within about 5 days. This rapid response is shown by the high, sharp peak in the discharge curve (Figure 2.13).

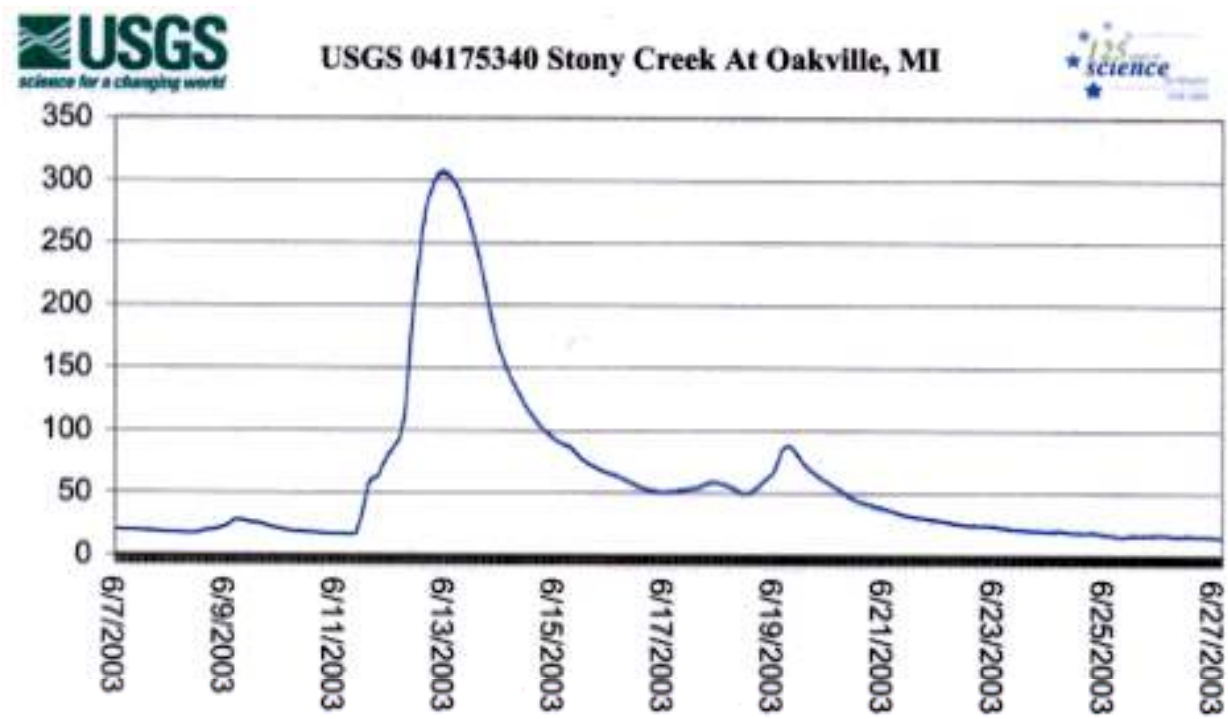

Figure 2.13: Graph showing discharge (cfs) vs. time (days) of the response of Stony Creek to rain over a few days starting June 11. Notice that the stream discharge increases rapidly and drops fairly rapidly again, typical of a watershed with low infiltration that produces a high amount of runoff.

Typically, this type of hydrograph response is produced in watersheds with low infiltration and therefore a high percentage of rain taking a fast path to streams over the land surface (runoff). The upper watershed has a fair amount of clay soils (Figure 2.5) that lead to low infiltration (Figure 2.6). In addition, the upper watershed is the most intensely urbanized part of the watershed (Figure 2.9), mostly around the creeks and drains that feed Paint Creek (Figure 2.11). The addition of rooftops, gutters, pavement, and compacted urban lawns drastically reduces the infiltration capacity of the landscape and produces much more runoff than other land uses. One additional factor is the loss of natural wetlands that help absorb surface runoff because of drain construction for development of agricultural fields. Drains increase the speed with which water is removed from the landscape and delivered to streams. Together, the clay soils, urbanized areas, and drained agricultural fields have led to a runoff problem in the upper watershed.

Flooding

The rapid response of the hydrograph to rainfall is an indication that flooding is a problem in Stony Creek. Robert Morawski, a watershed resident with agricultural property immediately upstream of the USGS monitoring station, claims that over 30 years ago Stony Creek did not overflow its banks some years, as is normal for streams in equilibrium. However, Mr. Morawski claims that Stony Creek has flooded an average of about 3 times a year since then. He sees this as an increasing problem over the years and does not think it is a coincidence that development has taken place upstream at the same time.

Mannik and Smith, Inc. published an engineer's report for the Intercounty Drainage Board in 1997 that addresses the flooding concerns in the Stony Creek Watershed (Buschmann, et al., 1997). In this report, they site that "residents claim that springtime flooding has been deeper and longer duration during the last few years than was previously experienced." The group analyzed rainfall data from the Ann Arbor area from 1970 to 1996 and showed that the average April rainfall was 27% greater for the 5 years preceding 1997 than for the 27 year period. The report noted that a number of agricultural fields in the central portion of the watershed encroached on the floodplains, making flooding more likely. Citing insufficient data to judge the impact of upstream development, the report indicated that logjams and blockages are "likely contributing factors to the flooding". They report that removal of those blockages would increase flow 25-40% for events up to the 2 year frequency rainfall. The report recommended removal of all blockages, plus dredging of some portions of the system. As a result, London Township proposed converting Stony Creek to an Intercounty Drain for the purpose of cleaning the creek. This discussion came to a halt in early 2003 when it was determined that members from at least one township from each county are needed to make such a proposal.

The Mannik and Smith, Inc. report indicated that the spacing between logjams increases downstream from 200-300 feet apart in Washtenaw County to 1300-3000 feet apart in the lower watershed. The decrease in the number of logjams downstream suggests that the cause of the logjams is upstream. Most likely, increased runoff from the urbanized headwaters has increased bank erosion and contributed to trees falling into the creek, resulting in logjams. The farther away from the urbanization, the lower impact of the increased runoff. This interpretation is consistent with other data collected during the course of the Stony Creek Watershed project, presented later.

Nonpoint Source Pollution
In addition to leading to flooding problems, runoff is responsible for picking up and delivering nonpoint source pollution to streams. If rain is allowed to infiltrate into the ground, vegetation and soil microbes help to clean the water as it slowly flows through the ground. Rapid flow on the surface of the landscape picks up pollutants such as sediments, fertilizers, pesticides, oil, grease, etc. and delivers it directly to the stream, quickly. This process is responsible for most of the pollution in the surface waters of the Stony Creek Watershed.

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Chapter 3: Water Quality Assessment

An attempt has been made to compile all readily available data on the Stony Creek Watershed that relate to water quality. The available data include water quality monitoring data from June 2003 through May 2004, a macroinvertebrate study conducted during the summer of 2004, and a road stream crossings inventory completed in July and August 2003, all included as part of the Stony Creek Watershed Project. In addition, studies conducted by other parties were studied and assessed including monitoring by the MDEQ for TMDL development, DEQ assessments of water quality in Stony Creek and Amos Palmer drain in response to effluent discharged by a local gravel pit. The overall view of the water quality of the Stony Creek Watershed is generally improving water quality in the downstream direction, indicating that the biggest problem areas in the watershed are from the urbanized and developing areas at the headwaters of the watershed.

3.1 Stony Creek Watershed Volunteer Macroinvertebrate Study 2004

Macroinvertebrates are visible insects and other organisms that lack an internal bone structure. The types and variety of macroinvertebrates that live in creeks, help determine the overall quality of the water in the Stony Creek Watershed. Some macroinvertebrates are sensitive to particular pollutants (such as some stoneflies, mayflies, and caddisflies), and other macroinvertebrates are pollution tolerant (such as the midge larva and the rat-tailed maggot larva). As a result, the presence of pollution sensitive macroinvertebrates or a wide array of macroinvertebrates in general indicates relatively good water quality, and the lack of the pollution sensistive macroinvertebrates or a narrow array of macroinvertebrate diversity indicates generally poor water quality.

In order to help determine the overall water quality in the Stony Creek Watershed, groups of volunteers collected macroinvertebrates from 6 locations along Paint and Stony Creeks between Ypsilanti and Monroe on Saturday, June 19, 2004. It rained especially heavily in the lower half of the watershed 2 days prior to the volunteer event, which made water levels unmanageably high, so sampling was confined to the upper watershed (sites 0, 1, 2, 3B, 4, 5, Table 3.1 and Figure 3.1). Subsequent sampling of 2 locations in the lower watershed were carried out soon thereafter, on July 1, 2004 (sites 7 and 9, Table 3.1 and Figure 3.1). The locations were selected to correspond to the sampling locations used in the water quality monitoring described above, with the exception of sites 0 and 3B. Site 0 was added for the June 19 event because it was unsafe for the volunteer groups to sample farther downstream than site 5 due to the conditions of the stream on the day the event was scheduled. Site 3B is less than a quarter mile downstream from sampling site 3, where permission to access the property for the study was denied. In this case, the closest downstream location was accessed as the best alternative to sampling at site 3.

The samples were collected based on the protocol of the Huron River Watershed Council's Adopt-A-Stream volunteer monitoring project. These samples were sent to the Huron River Watershed Council for identification to family by Jo Latimore, the resident macroinvertebrate specialist. Non-insects were identified to the categories used in the Michigan Department of Environmental Quality’s stream invertebrate survey protocol.

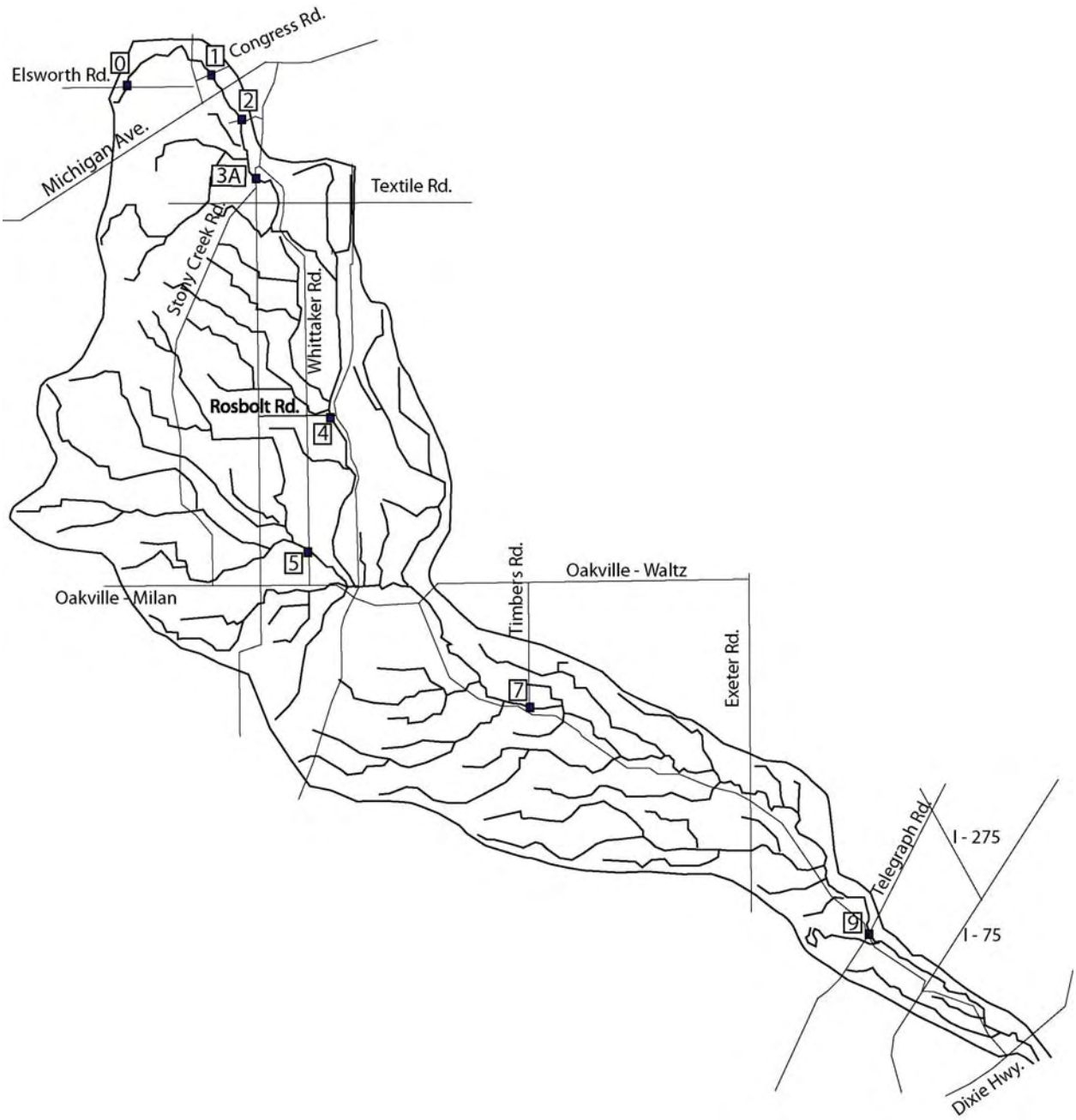

Figure 3.1: Summer 2004 volunteer macroinvertebrate study site locations, showing the distribution of sites within the Stony Creek Watershed.

Site	Stream	Location	Date Sampled
0	Paint Creek	Ellsworth Road	6/19/04
1	Paint Creek	Congress Road	6/19/04
2	Paint Creek	John C. Hart Parkway	6/19/04
3B	Paint Creek	Textile Road	6/19/04
4	Paint Creek	Rosbolt Road	6/19/04
5	Stony Creek	Whittaker and Liss Roads	6/19/04
7	Stony Creek	Timbers Road	7/1/04
9	Stony Creek	Telegraph Road	7/1/04

Table 3.1: Stream sites sampled for the volunteer macrionvertebrate study, summer 2004.

The invertebrate samples were analyzed in three ways: number of insect families, number of EPT families, and number of sensitive families. The number of insect families is an indication of the diversity of invertebrates found at the study sites, and a higher number indicates better stream quality. The EPT index refers to the number of families represented in each sample that belonged to the orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies). These orders have been documented to include families that are sensitive to stream degradation, and their presence and diversity are an indication of good stream quality. Finally, certain families of stream insects, both in and out of the EPT orders, have been identified as particularly sensitive to stream degradation (tolerance ratings of 0-2; Hilsenhoff, 1988). Their presence in the samples is an indicator of good stream health. A complete listing of the families present and their relative abundance is located in the complete report in the Appendix.

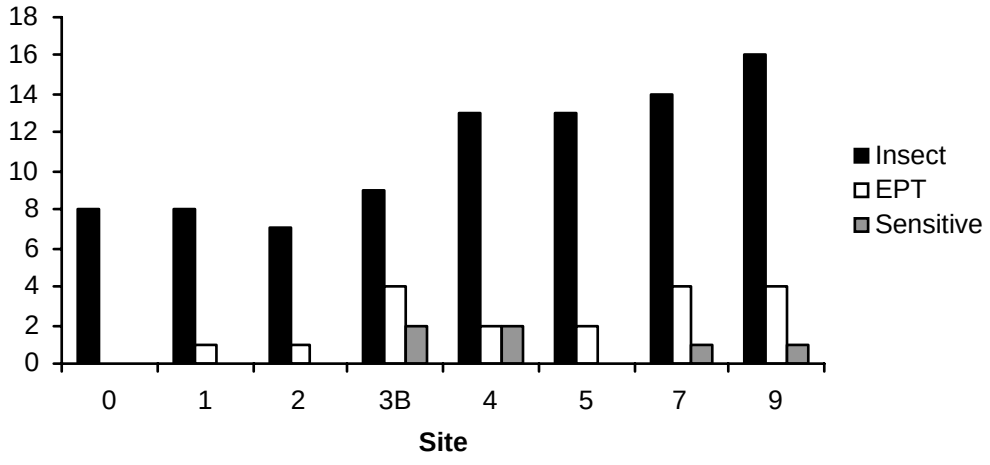

Figure 3.2: Benthic insect families found at each study stream site. Each category is a measure of stream quality. These results show generally improving water quality from the upstream (lower numbered sites) to downstream locations (higher numbered sites).

Insect data suggest that stream quality improves as you move from lower numbered upstream sites to higher numbered downstream sites (Figure 3.2 - Note that Figure 3.2 includes only the taxa included in the class "insect"; see Appendix A for the total taxa collected at each location including other classes of macroinvetebrates). The reliability of these data will improve with continual monitoring over a period of years to demonstrate trends in the condition of macroinvertebrates in the stream over time.

At most sites, water samples were taken before the collection of macroinvertebrates in order to take conductivity readings of the water samples. Conductivity is another measure of general water quality. It increases with the amount of dissolved ions, such as salts or metals. If the average conductivity measured at a site is 800 microSiemens (µS) or less, it is considered natural for stream water in this region. Conductivity over 800 µS may indicate the presence of toxic substances (of course, many toxins are not measured by conductivity). This measure is used as a red flag, signaling a need for further investigation of what is dissolved in the water. All but one of the sampled stream sites had conductivities of 805 or lower. However, site 2 measured 1058 µS on the day of sampling, and supported the lowest number of insect families, the lowest number of EPT families, and no sensitive species. These data suggest that site 2 is of relatively poor quality.

Site	Conductivity (µS)
0	Not sampled
1	Not sampled
2	1058
3B	805
4	717
5	727
7	781
9	742

Table 3.2: Stream water conductivity at the study sampling sites.

Together, the macroinvertebrate data and the conductivity readings suggest generally adequate water quality in the lower watershed, but problematically poor water quality in the upper watershed, where developed and developing areas are concentrated. These data help give rise to the determination, noted later, that the upper watershed poses the greatest threat to water quality in the watershed.

3.2 1995 and 1997 MDEQ macroinvertebrate, fish, and water quality surveys

Studies were conducted in 1996 and 1997 to determine the impact of effluent discharged by Londontown Inc – London Sand gravel pit into the Amos Palmer Drain in London Township. Water discharges directly into Stony Creek from Amos Palmer Drain about a mile from the gravel pit.

1995 MDEQ Study

In 1995, the Michigan Department of Environmental Quality conducted a macroinvertebrate study of Amos Palmer Drain and Stony Creek upstream and downstream of the Amos Palmer Drain input. The upstream assessment was conducted where Rawsonville Road crosses Stony Creek and the downstream location was where James Road crosses the creek. In Amos Palmer Drain, the habitat was rated fair (one point from poor), but the macroinvertebrate community was rated "poor" with 12 taxa present. Upstream of Amos Palmer Drain on Stony Creek, the habitat was rated "acceptable" tending towards poor (attributed to abundance of sand and muck from upstream landuses), and the macroinvertebrate community was rated "acceptable" trending toward poor (moderate impairment) with 17 taxa present, principally because of lack of available habitat. Downstream of Amos Palmer Drain, the habitat rating was "acceptable", with a macrioinvertebrate community rated "acceptable" trending toward poor, 19 taxa present. Because the macroinvertebrate habitat was better in the downstream location, it made it difficult to determine the effect of the discharge from Amos Palmer Drain, despite similar diversity in the upstream and downstream locations.

Fish collection was attempted at a couple of locations, but was not able to be completed for various reasons. Water chemistry data from 2 sampling dates in 1995 showed total dissolved solids and conductivity levels were elevated way above upstream levels for at least 2.5 miles downstream. Hydrogen sulfide was also found downstream of the gravel pit at toxic levels. Ammonia, calcium, magnesium and hardness were also elevated above the upstream value for at least 2.5 miles downstream.

The 1995 study concluded that the water quality and macroinvertebrate community in Amos Palmer Drain were extremely impaired. It was further determined that additional study was necessary to assess the greater impact on Stony Creek.

1997 MDEQ Study

In 1997, the Michigan Department of Environmental Quality conducted another macroinvertebrate study of Amos Palmer Drain and Stony Creek upstream and downstream of the Amos Palmer Drain input. As previously, the upstream assessment was conducted where Rawsonville Road crosses Stony Creek, but the downstream location seems to have been switched to a location closer to Amos Palmer Drain, apparently where Timbers Road crosses the creek (inferred from a map that is not specific about the location). In Amos Palmer Drain, the habitat was rated fair, but the macroinvertebrate community was rated "poor" with 2 taxa present. Upstream of Amos Palmer Drain on Stony Creek, the habitat was rated "fair" tending towards poor (attributed to abundance of sand and muck from upstream landuses), and the macroinvertebrate community was rated "acceptable" trending toward poor (moderate impairment) with 13 taxa present. Downstream of Amos Palmer Drain, the habitat rating was "good", with a macroinvertebrate community rated "acceptable" trending toward poor, 16 taxa present. Because the macroinvertebrate community should have been better in the downstream location based on the much improved available habitat, this was taken as a sign of a problem with water quality.

Fish collection was completed about 2.5 miles downstream where Stony Creek crosses Exeter Road. The fish community was rated "acceptable" with slight impairment, but was dominated by taxa that are tolerant of degraded conditions.

Water chemistry data showed total dissolved solids in Stony Creek over the standard 500 mg/L average and 750 mg/L maximum all the way to Exeter Road. Hydrogen sulfide was determined to be well over the standard 0.088 ug/L average and 1.6 ug/L maximum. Also, conductivity, sulfate, and calcium were elevated in Amos Palmer Drain and the downstream Stony Creek locations relative to the upstream Stony Creek location by Rawsonville Road.

The 1997 study concluded that the water quality and macroinvertebrate community in Amos Palmer Drain were extremely impaired. In addition, based on the similar findings documented in the previous study, the DEQ determined that discharges from London Aggregates was having a significant effect on water quality in Amos Palmer Drain and downstream in Stony Creek.

Comparison of MDEQ studies to 2004 volunteer study

Settlement of a lawsuit brought the discharge from London Aggregates to a close prior to the initiation of the Stony Creek Watershed Project in 2003, so it is possible that the water quality and macroinvertebrate communities improved since the 1995 and 1997 studies by the DEQ.

Comparison of 2004 data with studies in 1995 and 1997 shows that the taxa diversity is still lower upstream compared to downstream sites. This can be attributed to upstream sources of sediment impairing the macroinvertebrate habitat to a greater degree near the upstream source. Furthermore, based on the comparison of number of taxa in the 2004 study relative to the number of taxa in the earlier studies, the diversity of taxa found in most sampled locations in Stony Creek watershed is perhaps "acceptable" at best, and potentially "poor" at sites 0 to 3B where the total number of taxa is 12 or lower.

The only site that overlaps well between the 2004 study and the earlier studies is the site at Timbers Road (site 7 in the 2004 study). At this site, 19 taxa (14 insect varieties) were found in 2004 compared to 13 taxa found at a site presumed to be Timbers Road (or very nearby) in 1997. The most significant addition in the 2004 study was the identification of a caddisfly (Brachycentridae), considered sensitive to pollution that was not present in 1997. Nineteen (19) taxa were found in 1995 at the site further downstream at James Road. If anything, comparison of these data show the potential that the macroinvertebrate community has improved moderately near Timbers Road (compared to the 1997 study), although comparison is difficult based on the uncertainty of the exact location for the downstream site in the 1997 DEQ study. Conductivity values have definitely improved, considering that conductivity readings taken during the 2004 Macroinvertebrate Study show levels below 800 µS (Table 3.2, Site 7), compared to the elevated levels in the 1995 and 1997 studies.

3.3 TMDL development

In 2002, the Michigan Department of Environmental Quality (MDEQ) listed portions of the Stony Creek Watershed on the Federal Water Pollution Control Act, Section 303(d) list for being "impaired" with respect to water quality. They are under order from the Environmenal Protection Agency (EPA) to develop "total maximum daily limits" (TMDLs) for those portions of the watershed. Once developed, there will be requirements to improve the water quality. As a result, funding may be more readily available for making improvements in the watershed related to these problems.

TMDLs are to be submitted soon for approval for 2 portions of the watershed that are listed on the 303(d) list. The North Branch of the Amos Palmer Drain and lower Stony Creek are listed for TMDL development for total dissolved solids (TDS), hydrogen sulfide (HS), and poor fish and macroinvertebrate communities. The TDS and HS were particular problems when a local gravel pit was discharging groundwater into the Amos Palmer Drain. Community members brought and won a lawsuit against the gravel pit and stopped the discharge of the groundwater. These items may be dropped from the list because the waters are no longer significantly impaired for TDS and HS. A portion of Paint Creek is listed for TMDL development for low dissolved oxygen (DO), fish kills, and pathogens. From discussions with MDEQ agents, recent monitoring for pathogens has shown little cause for concern, so that item may be dropped from TMDL development as well.

3.4 Water Quality Monitoring

Water quality monitoring was conducted monthly from June 2003 – May 2004 at 10 sites (Figures 3.3 through 3.10). Bulk grab samples were taken from the surface of the fastest flowing part of the stream and transported in Nalgene bottles on ice back to the laboratory at Eastern Michigan University for analysis of nitrate, phosphorous, and total suspended solids. In the field, turbidity was measured using a turbidometer, and temperature, pH, dissolved oxygen, and conductivity were measured using probes that were calibrated in the lab prior to each sampling day. In 2003, samples were collected every 2 weeks at predetermined times during dry or wet weather. In 2004, an attempt was made to sample before, during, and after anticipated storms to determine the change rainfall had on water quality.

Sediment

Sediment transported in the streams was measured as total suspended solids. One liter grab samples were taken back to the lab and filtered. The sediment remaining on the filter is weighed to get the weight concentration of sediment per liter of sample. The sediments captured by this method are typically finer particles that are suspended at the top of the stream in flowing water.

There are currently no required maximum limits for the allowable concentration of sediment in streams of Michigan, although there is a desire to develop standards. In the absence of state mandated standards, the technical committee adopted standards that are suggested in the scientific literature for sediment concentration in streams.

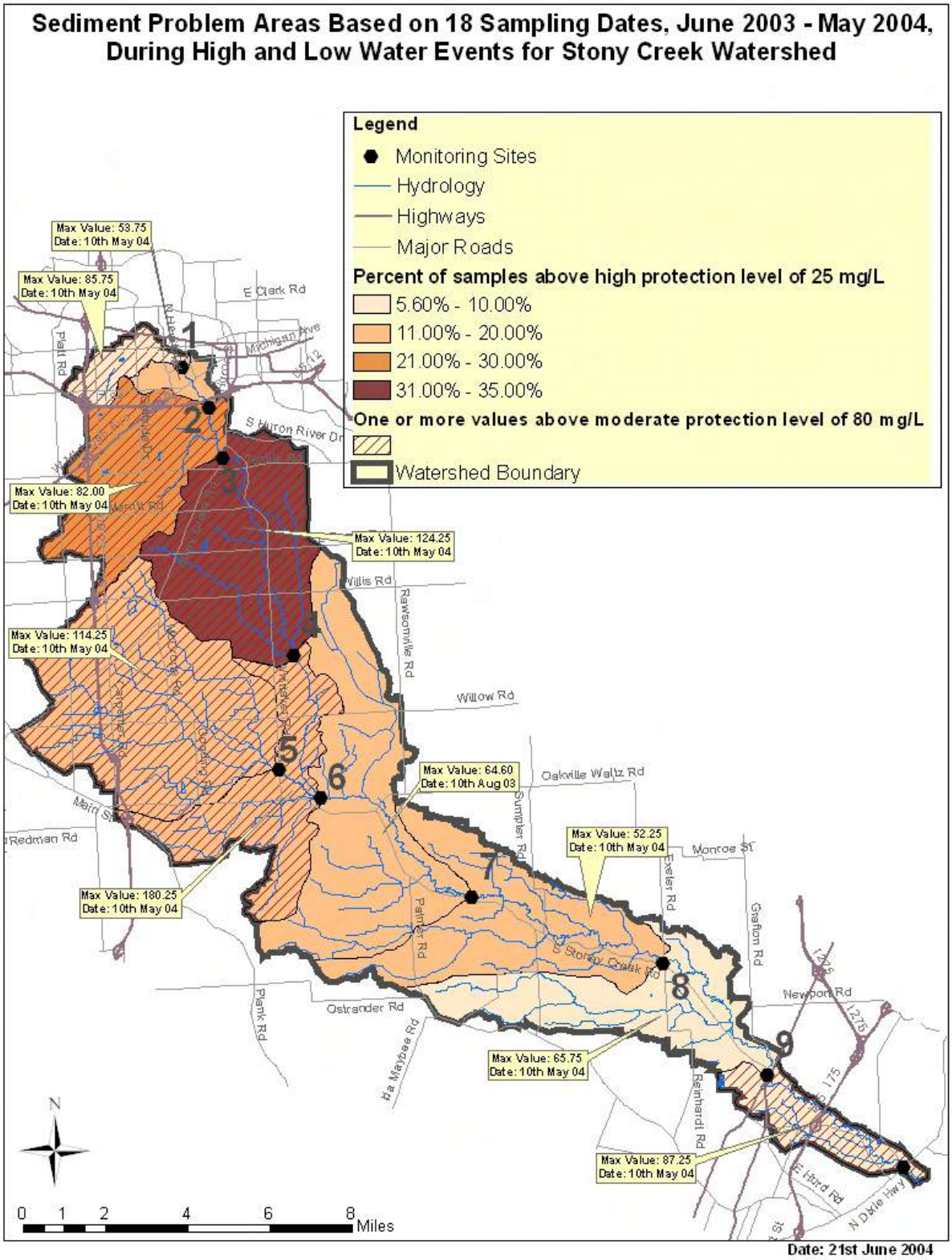

Figure 3.3: Map showing critical areas in the watershed for total suspended solids (sediment).

The recommendation of the National Academy of Sciences (National Academy of Sciences - National Academy of Engineering. 1973) is the following:

> Aquatic communities should be protected if the following maximum concentrations of suspended solids exist:
> · High level of protection 25 mg/l
> · Moderate protection 80 mg/l
> · Low level of protection 400 mg/l
> · Very low level of protection over 400 mg/l.

Therefore, the guidelines for maintaining a high water quality require low concentrations of suspended sediments. Higher concentrations than the 25 mg/l will result in lower water quality for macroinvertebrate communities.

Six of the ten sites had one or two sampling days with concentrations above the moderate protection level of 80 mg/l. However, 3 of these sites (sites 1, 3, 10, Figure 3.3) were within 8 mg/l of the limit on one day only (after exceedingly heavy rain on May 9-10, 2004). The other 3 sites (sites 4, 5, 6, Figure 3.3) had concentrations well over 100 mg/l and as high as 180 mg/l. At most sites, the increase in suspended sediment was 10 times or more greater than the suspended sediment load the previous day (Appendix). These sites are concentrated in the upper half of the watershed where the greatest amount of development is taking place. At site 6, the stream was out of its banks on May 10, 2004 and was passing over barren farm fields upstream of the bridge which may have increased the sediment concentration to a greater extent than the upstream locations where the stream was high, but still confined to the channel. Downstream locations on May 10, 2004 have wide floodplains with natural vegetation which would slow down the streamflow and would be less erosive during floods than barren farm fields. As a result, the sediment concentrations dropped off markedly in the lower half of the watershed even after drenching rains. The lower half of the watershed remained under the moderate protection level on all sampling days with the exception of the extreme downstream site in Frenchtown Township on one day of sampling after exceptional rainfall. No samples exceeded the threshold to very low protection (400 mg/l).

Each site was over the high protection concentration of 25 mg/l at least once. The worst locations for sediment concentration were the areas upstream of sites 3 and 4, where sediment concentrations were above 25 mg/l 21-35% of the sampling dates. These areas correspond to the greatest concurrent construction and land development. At site 4, there were only a few days when the stream was not cloudy with sediment on sampling days. Detention basins constructed for new developments may be somewhat effective at preventing all runoff from reaching the stream excessively fast, but they do not allow time for sediments to settle out in the pond before discharged to the streams, resulting in large amounts of suspended sediments to stay suspended in streams long after storms. The best sediment concentrations are in the extreme upper watershed with established neighborhoods and in the lower half of the watershed, where slopes are gentler and the stream is farther from the altered hydrology influence of urbanization and the sediment influx from eroding construction sites. In fact the only time sites 1, 9, and 10 were above the high protection concentration of 25 mg/l was on May 10, 2004 after drenching rains and high water, otherwise sediments concentrations at these sites were extremely low.

Nutrients

Nutrients are chemical elements that can stimulate growth of plants. Typical nutrients include nitrogen, phosphorus, and potassium. These nutrients are usually present naturally, but are often added to soils to aid in plant growth. Phosphorus is often considered to be the "limiting" nutrient because many plants find plenty of nitrogen and potassium in soils to thrive, but can only thrive if enough phosphorus is available. In this region of Michigan, however, phosphorus tends to be abundant naturally in soils, so nitrogen may be the limiting nutrient. Therefore, this study focused on these two potentially limiting nutrients to determine the potential nutrient problems in the watershed. Nutrients in water can lead to nuisance algae growth, potentially leading to fish kills, and can even be toxic for human consumption at high concentrations.

Phosphorus tends to attach itself to soil particles rather than becoming dissolved in water. Therefore, they tend to be carried to streams during rain events that erode sediment from the landscape. In contrast, nitrogen fertilizers tend to dissolve easily in water and are typically a major concern for groundwater contamination, although the abundance of tiled farm fields can allow nitrogen to enter the creek as the water is drained from fields toward the creeks and drains of the watershed.

For phosphorus and nitrogen monitoring, grab samples of creek water were taken from the point of fastest flow, stored in Nalgene bottles, and transported back to the Eastern Michigan University laboratory on ice. There samples remained in a refrigerator until analyzed in the lab for total phosphorus and the nitrate form of nitrogen.

There are not yet specific limits for phosphorus or nitrogen in Michigan streams. However, there are suggested limits above which problems with excessive plant growth may take place. These guideline values for phosphorus are 50 µg/l and for nitrogen 1 mg/l. Phosphorus is generally considered the greatest threat to surface water, whereas nitrogen is considered particularly threatening to groundwater quality.

<u>Phosphorus</u>
Phosphorus concentrations were above the suggested problem limit of 50 µg/l for 20 to 40 % of the sampling dates at all sites. The worst site represents area 4 (site 4, Figure 3.4) where the phosphorus concentrations were above 50 µg/l 40% of the time and the average value for all sampling dates was 62 µg/l, considerably higher than the next highest average phosphorus concentration. Phosphorus values at site 4 were generally low September through mid-March, but were otherwise high during the growing season. In fact, phosphorus values were low on March 24, 2004 after an extended dry period (6.61 µg/l), but jumped to a high level on the next two days after rain (61.4 µg/l, 91.2 µg/l respectively).

The second highest average phosphorus concentration (56.87 µg/l) was at site 1, where the phosphorus concentrations were over 50 µg/l 35% of the sample dates. Site 2, which was also over 50 µg/l 35% of the sampling dates, but had a lower average value (40.77 µg/l).

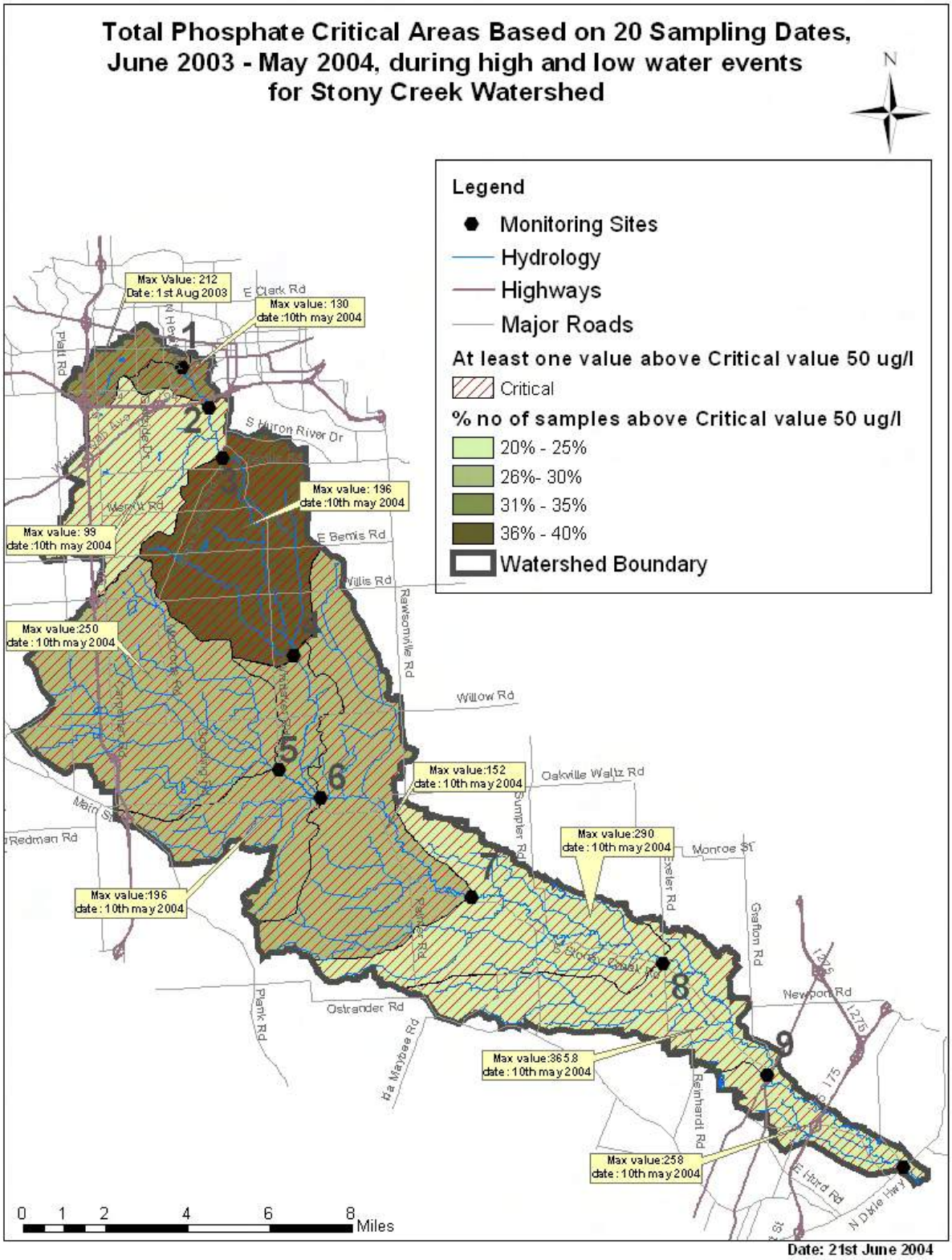

Figure 3.4: Map showing critical areas in the watershed for phosphorus concentration.

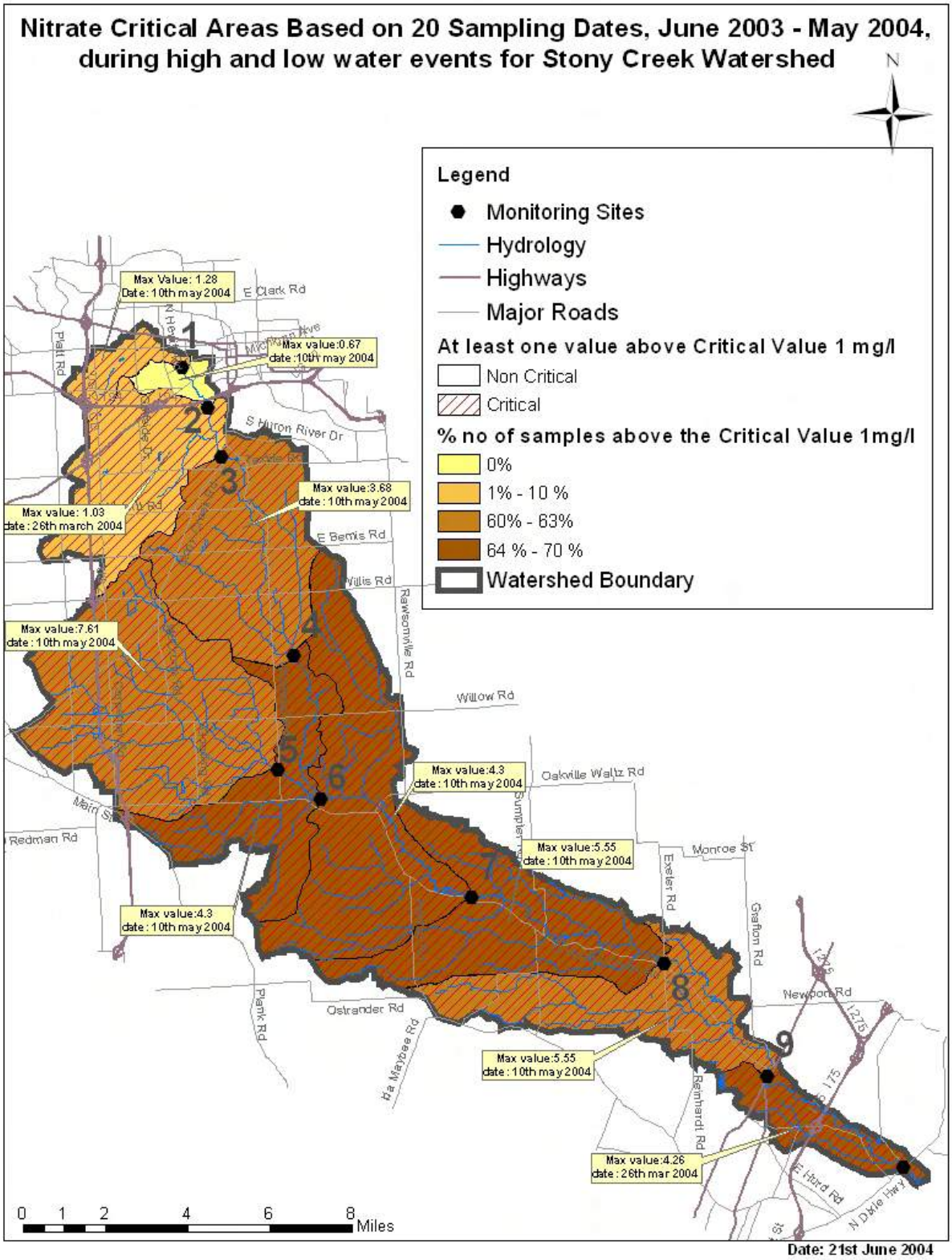

Figure 3.5: Map showing critical areas in the watershed for nitrate concentration.

The highest phosphorus concentration values were in the lower watershed, with values as high as 366 µg/l. These excessively high values all occurred on May 10, 2004, when the river was out of its banks in most of the lower watershed. Several farm fields were flooded causing especially high erosion of phosphorus-bearing sediments from the fields. Despite these high values on May 10, the average phosphorus concentrations range from 42-53 µg/l over the whole study period and were lower than 50 µg/l all but 20-30% of the sampling dates. Clearly there are problems with phosphorus entering the streams in the lower watershed agricultural areas, but the problems are generally less severe than at upstream monitoring areas 1 and 4.

The best site was represented by area 3, just upstream of area 4, where the average phosphorus concentration was about 25 µg/l, and the concentration rose above 50 µg/l on only 20% of the sampling dates. The land areas upstream of sites 1 and 2 are highly urbanized areas and the area upstream of site 4 is undergoing extensive suburban development (conversion from agricultural fields). The frequency and severity of phosphorus problems in these areas are generally worse than the predominantly agricultural areas in the lower watershed.

Nitrate

Nitrate concentrations were above the suggested problem limit of 1mg/l at least once at all sites except for site 2 (Figure 3.5). Site 3 barely exceeded the suggested limit only once (1.03 mg/l). Site 1, the third best site exceeded the suggested limit only twice with a maximum 1.28 mg/l).

Sites 4-10 had significantly higher nitrate concentrations that were over the suggested limit 60-70% of the sampling dates. The highest values for most sites came after the torrential rains early on May 10, 2004. The highest value (7.61 mg/l) came relatively close to the toxic value for human consumption. There were only a few days around September 2003 where the values were below 1 mg/l at most of these sites. Clearly the agricultural areas upstream of sites 4-10 have contributed high amounts of nitrate to the surface waters of the Stony Creek Watershed.

Dissolved Oxygen

Dissolved oxygen measures the amount of oxygen in water that is potentially available for aquatic life to use. The state of Michigan has standards for minimum dissolved oxygen levels in surface water. The standards are slightly more stringent for waters that feed the Great Lakes, because those standards have to be agreed upon by neighboring states and provinces. Since Stony Creek drains into Lake Erie, the standard of 7 mg/l holds for the entire watershed.

Dissolved oxygen was measured in the field with a probe that was calibrated in the lab before each sampling day. The dissolved oxygen levels were below the standard 7 mg/l at all but one site on July 4, 2003 (Figure 3.6). This was the only day that dissolved oxygen fell below the required level, however, a particularly hot day when water levels in the creek were excessively low following an extended period without rain. It is possible that the probe was poorly calibrated on that particular day, but the environmental conditions were such that low dissolved oxygen values could be anticipated. All in all, one day out of 16 with elevated levels suggests that dissolved oxygen levels may be a concern at times within the watershed, but probably is not normally a significant problem for sustaining a reasonable fish community.

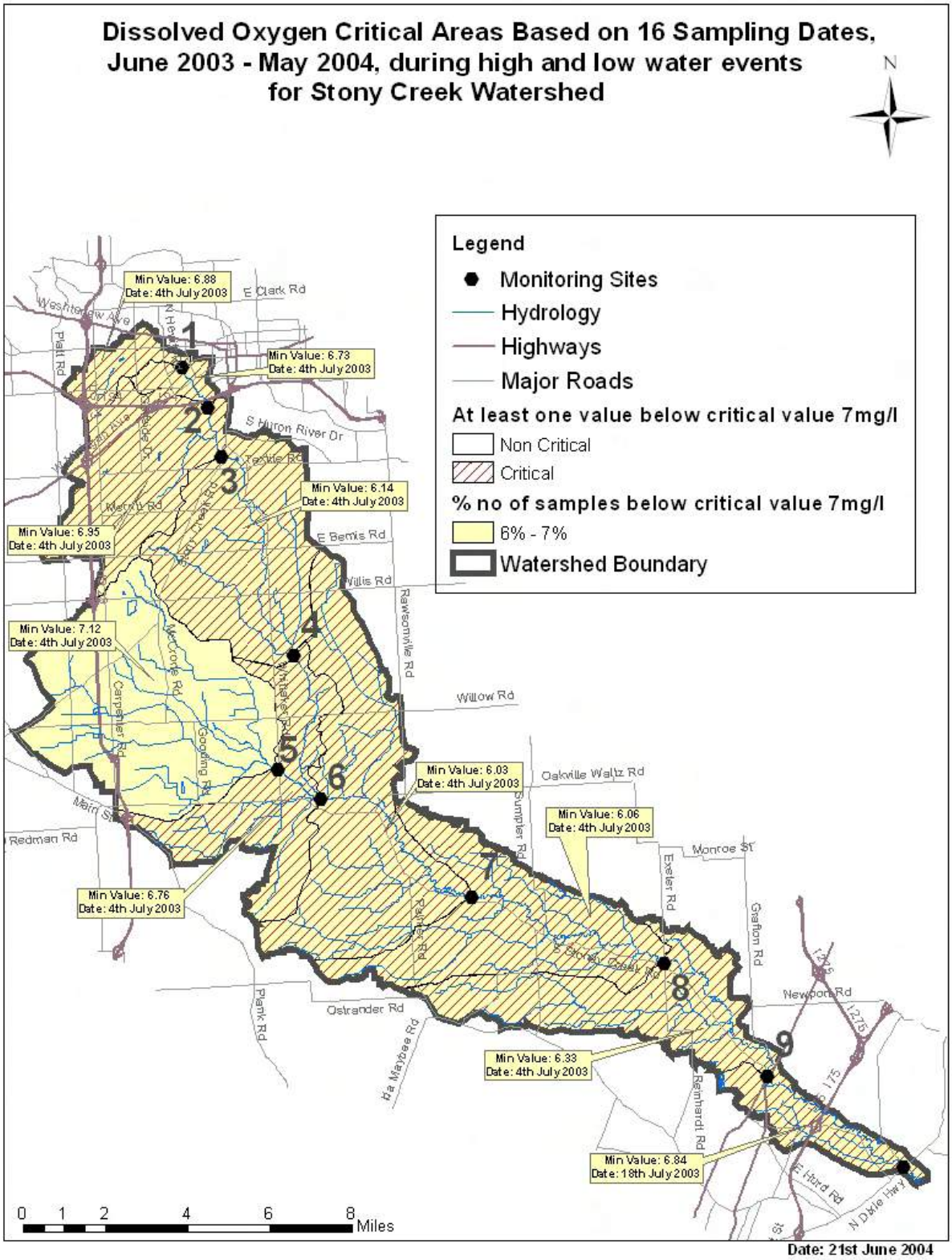

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Figure 3.6: Map showing critical areas in the watershed for dissolved oxygen concentration.

The findings of this study suggest that the development of a TMDL for dissolved oxygen (as described above for Paint Creek) may be worth investigating, but may not be necessary.

Temperature

The main criteria for evaluating temperature in streams of Michigan is based on the necessary temperature requirements for fish to survive. Obviously, there are different temperature requirements for warmwater fish species to survive versus coldwater species. Paint Creek (Figure 2.11), a major tributary to Stony Creek, is a designated coldwater stream, so there are more stringent temperature standards for Paint Creek. In contrast, the rest of the watershed is only required to meet temperature standards for warmwater streams.

Temperature requirements vary by month for both types of streams. Basically the temperature requirements are lower for January than for July because the stream temperatures should be lower in the winter than the summer.

Coldwater Fishery

Allowable maximum temperatures for a coldwater fishery in Michigan are as follows (in degrees Fahrenheit): Jan 38, Feb 38, Mar 43, Apr 54, May 65, Jun 68, Jul 68, Aug 68, Sep 63, Oct 56, Nov 48, Dec 40. All sites on Paint Creek have temperatures above the monthly allowable temperature limits for a coldwater stream on 15-40% of the sampling dates, most often in the most urbanized areas upstream of sites 1 and 2 (Figure 3.7). The temperatures strayed from the limits as much as 5.4 degrees Celcius (close to 10°F). The highest divergence from allowable temperatures came in late March 2004, which was in the midst of an unusually warm and dry period for this part of Michigan.

Warmwater Fishery

Allowable maximum temperatures for a warmwater fishery in Michigan are as follows (in degrees Fahrenheit): Jan 41, Feb 40, Mar 50, Apr 63, May 76, Jun 84, Jul 85, Aug 85, Sep 79, Oct 68, Nov 55, Dec 43. Not only was the upper portion of the watershed too warm for a coldwater fishery, it was too warm for a warmwater fishery at sites 1-3 for 5-10% of the sampling dates (Figure 3.8). The highest divergence from the allowable temperatures again came in late March 2004 when the temperatures reached about 3°F over the allowable limit. Most of the watershed, however, had adequate temperatures to maintain a warmwater fishery.

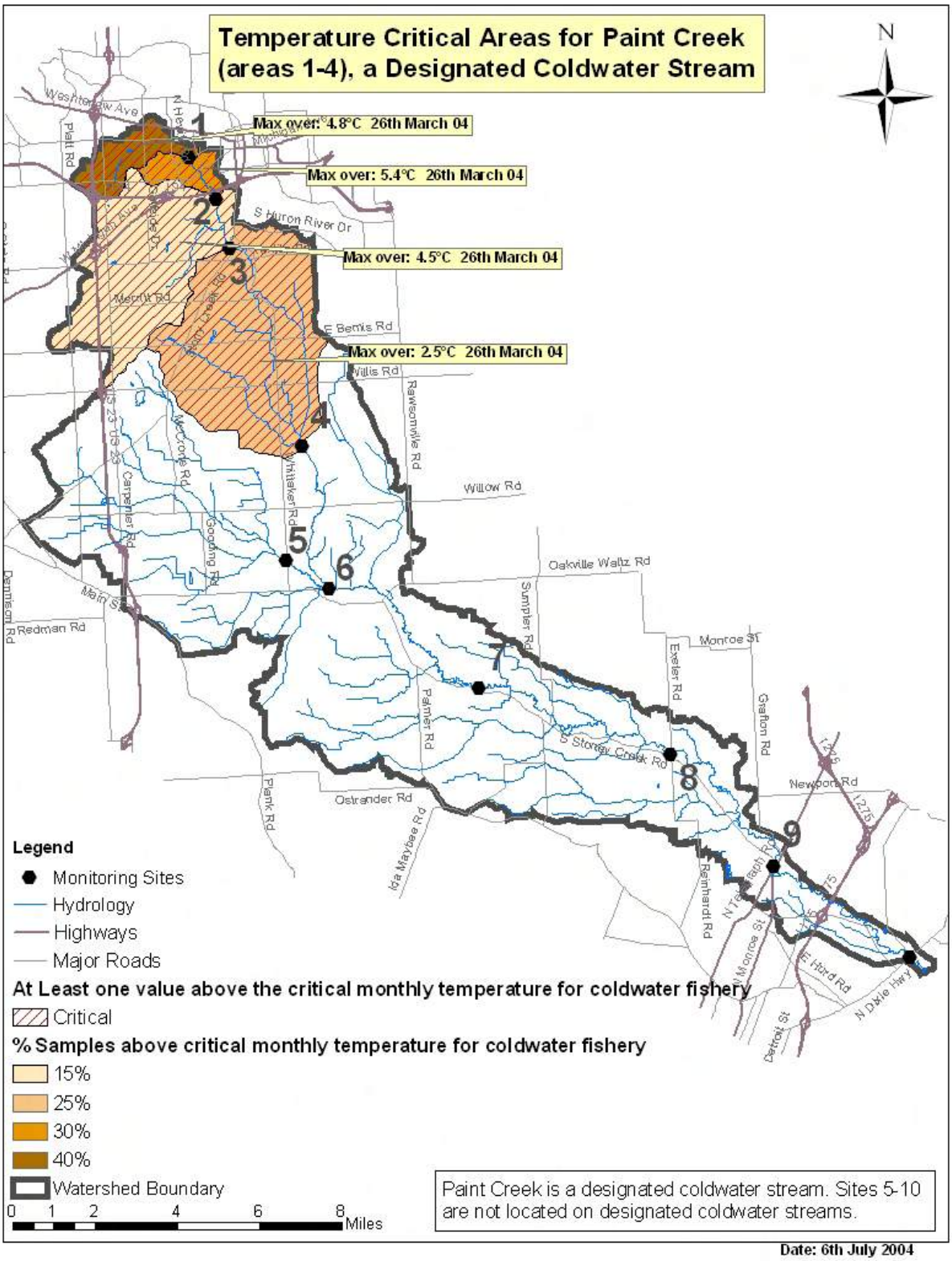

Figure 3.7: Map showing critical areas in the watershed for temperature for Paint Creek, a designated coldwater fishery.

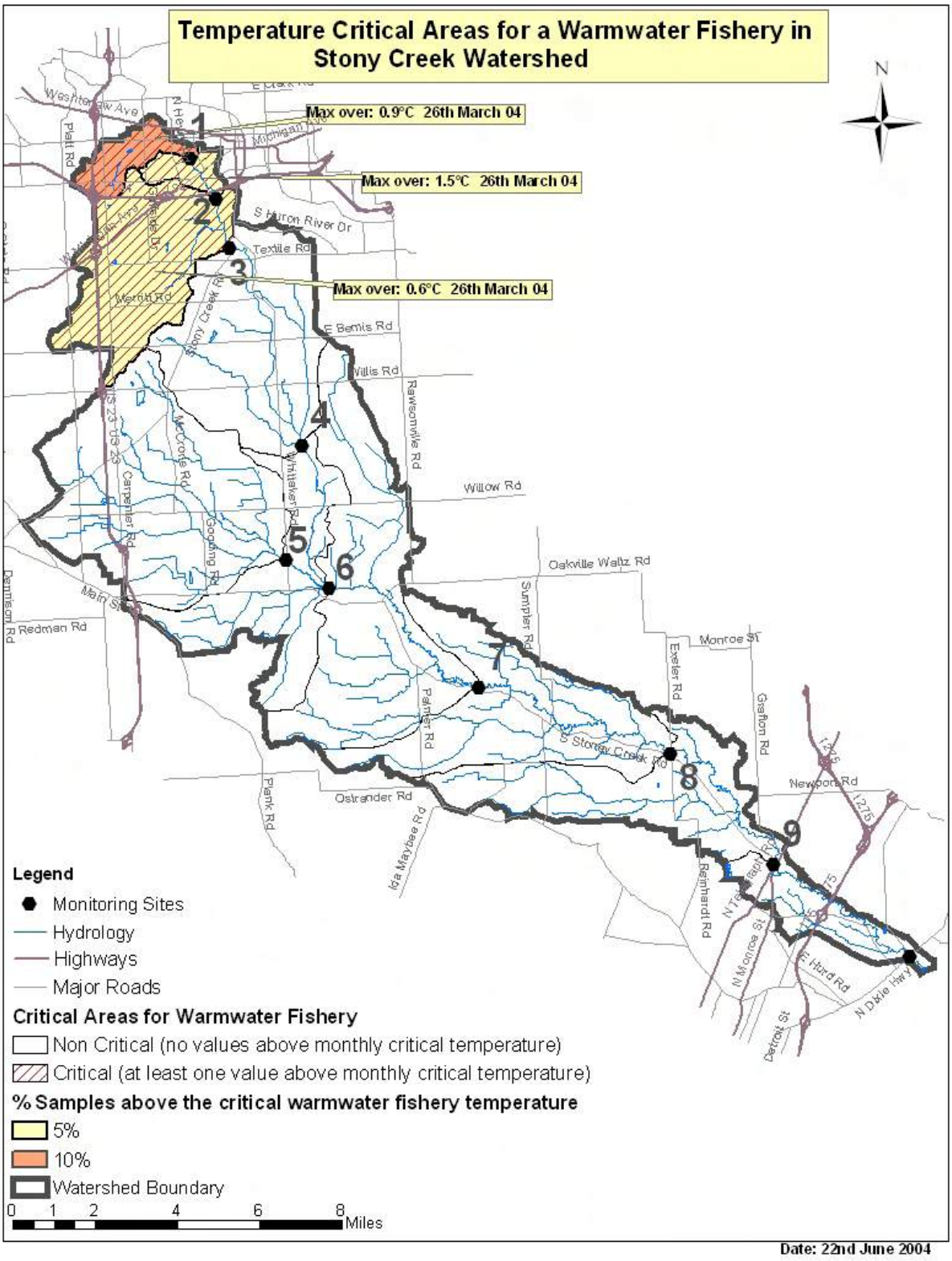

Figure 3.8: Map showing critical areas in the watershed for temperature for a warmwater fishery.

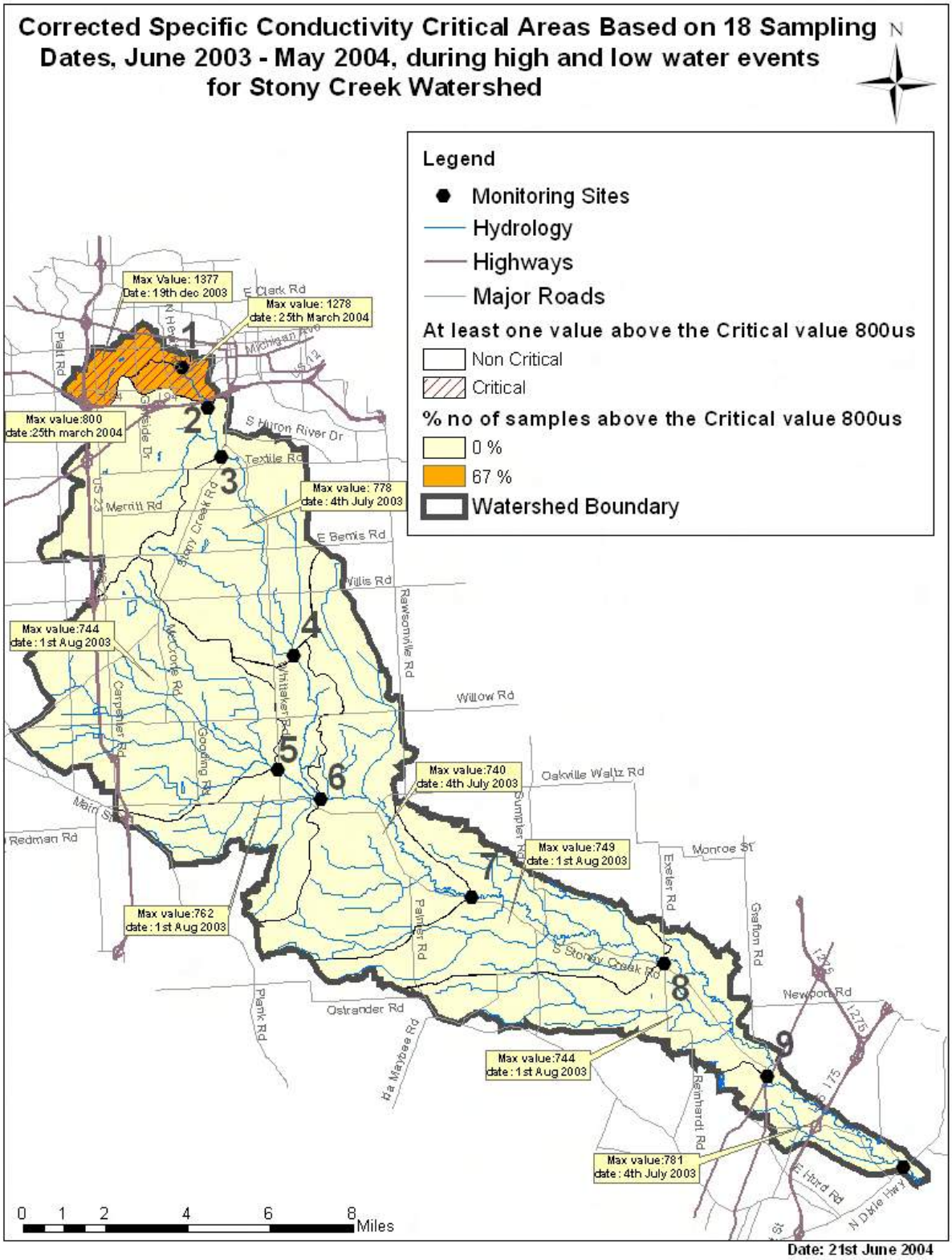

Figure 3.9: Map showing critical areas in the watershed for specific conductivity, a measure of the ease with which water transmits an electrical current that increases in polluted water.

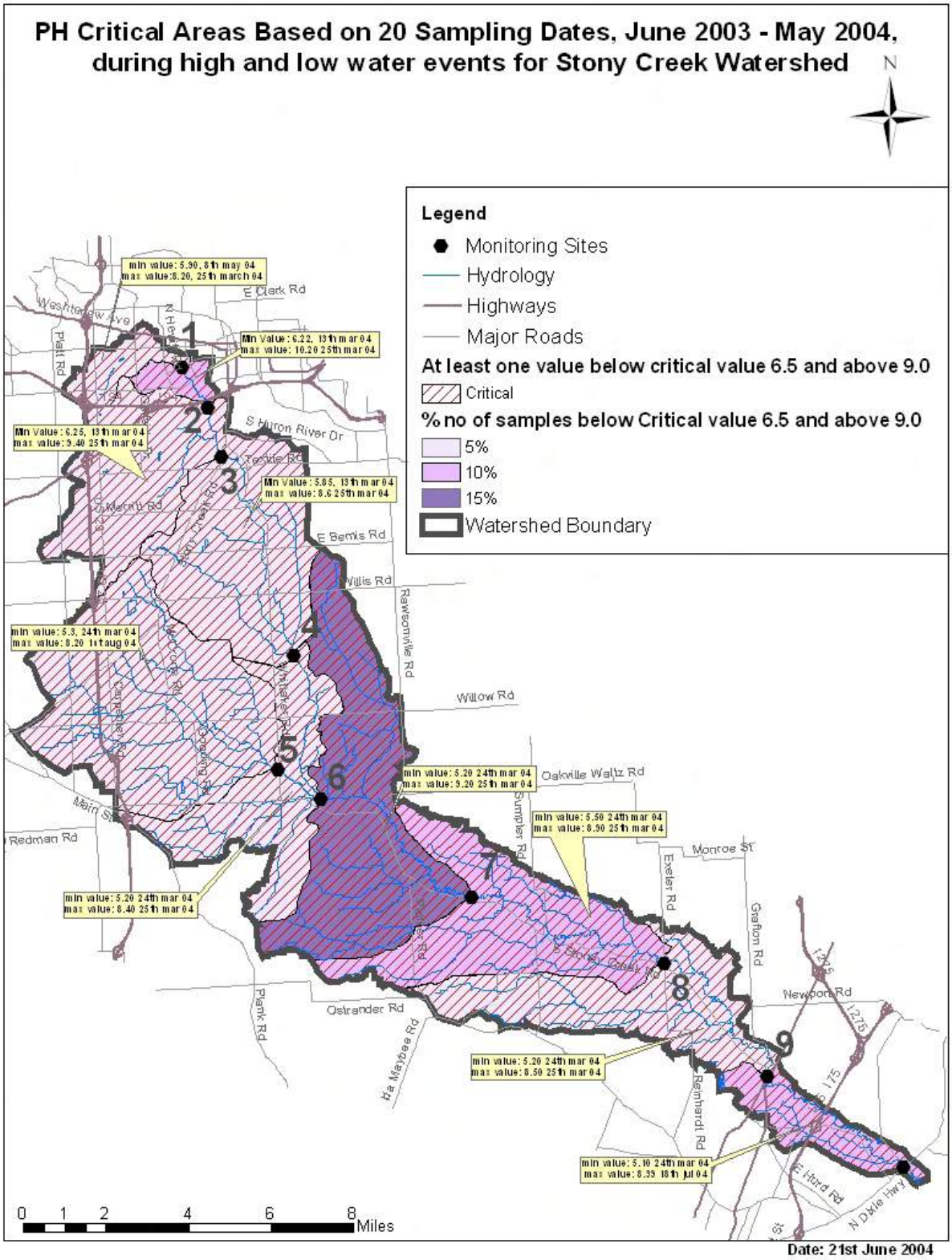

Figure 3.10: Map showing critical areas in the watershed for pH, the acidity (low pH) or alkalinity (high pH) of the water. Monitoring areas 2, 3, and 7 were the only sites to have values higher than the 9.0 allowable limit. All sites had one or two values lower than 6.5.

Conductivity

Conductivity measures the ability for water to transmit electricity, which is aided when contaminants such as oil, grease, metal, brine, salts are added to the water. As a result, higher conductivity values than normally found in a region can suggest that the water is polluted with some of these contaminants. The conductivity reading cannot tell which contaminants are present, but indicates generally polluted water. For the region around Stony Creek Watershed, conductivity values for healthy streams are generally below 800 microSiemens (µS).

Conductivity was measured in the field with a probe that was calibrated in the lab before each sampling day. Only sites 1 and 2 in the extreme upper reaches of Paint Creek, a major tributary to Stony Creek, have conductivity values above 800 µS (Figure 3.9). Not only were the values exceeded, but they were exceeded 67% of the time at values as high as 1377 µS. These data suggest that there is a considerable problem with generally polluted water in the extreme upper portion of Paint Creek. Site 3, downstream of these areas, reached 800 µS once, which was elevated relative to the approximately 750 µS that was the high value for the other 7 sites, but this one value does not represent a significant problem with these pollutants in this area.

pH

The measure of the acidity of water is pH and it can range in value from 0 to14. A pH of 7.0 is neutral water. Values of pH lower than 7.0 indicate increasingly acidic water as the value approaches 0, so very low numbers indicate strong acids. Values higher than 7.0 are increasingly basic with higher numbers indicating strong bases. Both acids and bases are caustic, corrosive substances that are not healthy for aquatic (or other) organisms. Michigan requires surface waters to have a pH between 6.5 and 9.0.

Acidity (lower pH) typically can result from acid rainwater entering the system, so acidity usually increases during rain events. Acidity can also increase due to respiration (breathing) of organisms in the water. Decomposition of organic material can similarly reduce pH. Acidity can be reduced (higher pH) by plant photosynthesis, which is most active during the day and during the growing season. Acidity can also be reduced by the addition of ammonia fertilizers and lime that are often added to agricultural fields and gardens.

In the field pH was measured with a probe that was calibrated in the lab before each sampling day. Monitoring areas 2, 3, and 7 were the only sites to have values higher than the 9.0 allowable limit, all occurring on March 25, 2004, after heavy rain. The highest value was 10.2 at site 2. The 9.4 value downstream at site 3 actually suggests pH improvement between the 2 sites. At site 7 the pH was 9.2 on that date. Other than the one date, the pH at these sites was well below the 9.0 allowable limit. Washing of fertilizers and lime into the streams in March may be responsible for the rise in pH after rain.

Each site had at least one day of pH below 6.5, usually occurring on March 24, 2004, before rain (Figure 3.10). At site 7, 8 and 10, the pH was also below 6.5 on March 13, 2004. The lowest recorded pH was 5.1 at site 10 on March 24, 2004.

3.5 Road Stream Crossings Inventory

In July and August 2003, a field survey was conducted by the Stony Creek Watershed Project staff. The survey involved a visual assessment of the creek and the adjacent land on either side of the creek in places where a road crosses the stream. Almost all "road stream crossings" in the watershed were surveyed (over 210) with a fairly uniform distribution over the entire watershed.

The survey was completed with a "Watershed Survey Data Sheet" using guidelines by MDEQ. Information gathered at each site include the type of streambed sediment (% various size particles) and the presence or abundance of aquatic plants, floating algae, filamentous algae, bacterial sheen/slime, turbidity, and oil. Other information recorded was width of riparian buffers, severity of bank erosion, % stream shading, important stream habitat, adjacent land uses, and sources of nonpoint source pollution and their severity. The data sheet is organized to allow a rapid qualitative assessment of each site that is easily comparable from site to site within the watershed. The most significant findings from the inventory are presented in maps and discussed below (see the Appendix for the full report)..

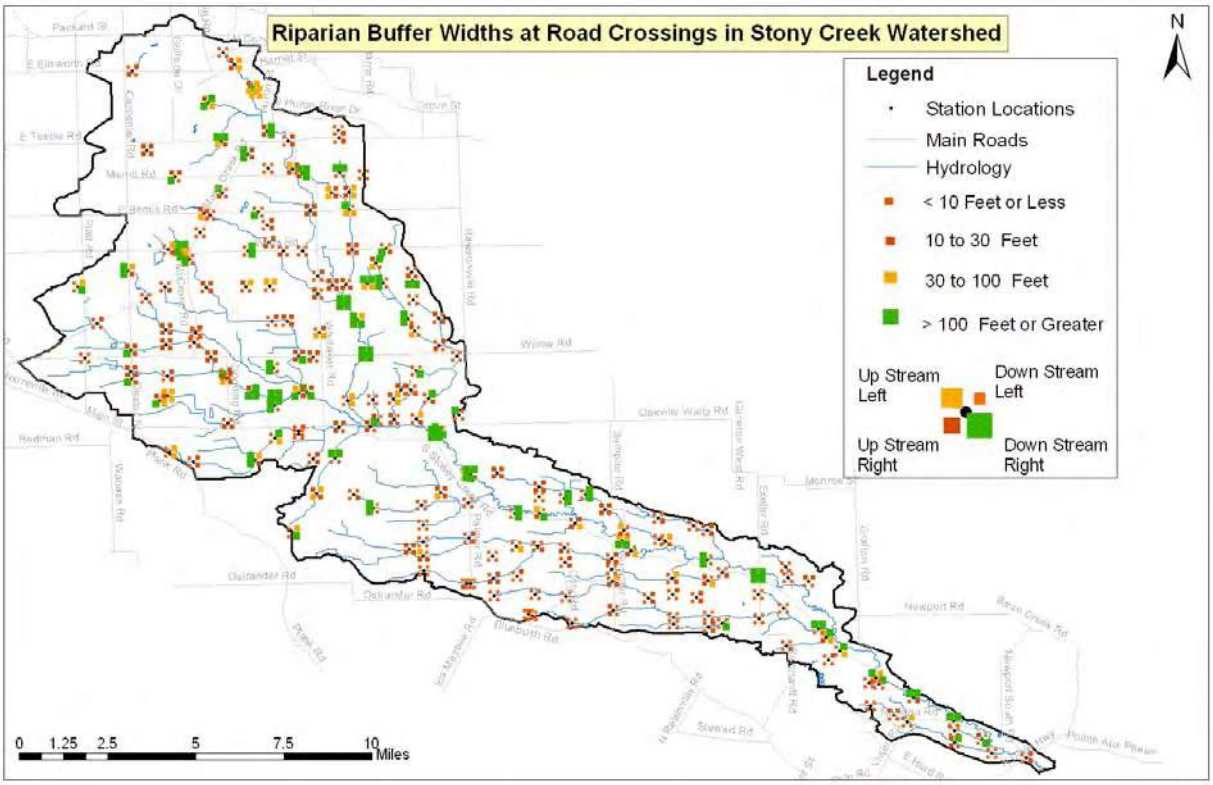

Figure 3.11: This map indicates a few locations with adequate riparian buffers greater than 30 feet (in green and yellow) and numerous locations with inadequate riparian buffers less than 30 feet (in orange and red).

Riparian Buffer Widths

Riparian buffers are areas along the edge of surface water bodies that are covered with grass, shrubs, or trees. This vegetated area acts as a barrier to runoff coming from adjacent areas. Vegetated buffers can trap sediments and pollutants that would otherwise find a direct route to streams and lakes. The best protection of the surface waters of Stony Creek from nonpoint source pollution would be attained with buffers at least 100 feet on each side of the stream and drains.

Buffers greater than 30 feet offer some protection, but buffers narrower than 30 feet subject surface waters to great risk of contamination from surface runoff. Figure 3.11 shows that a small fraction of the watershed has wide buffers between surface waters and adjacent land uses and most streams have buffers under 30 feet wide. Figure 3.12 shows the wide distribution of inadequate riparian buffers along agricultural fields within the watershed.

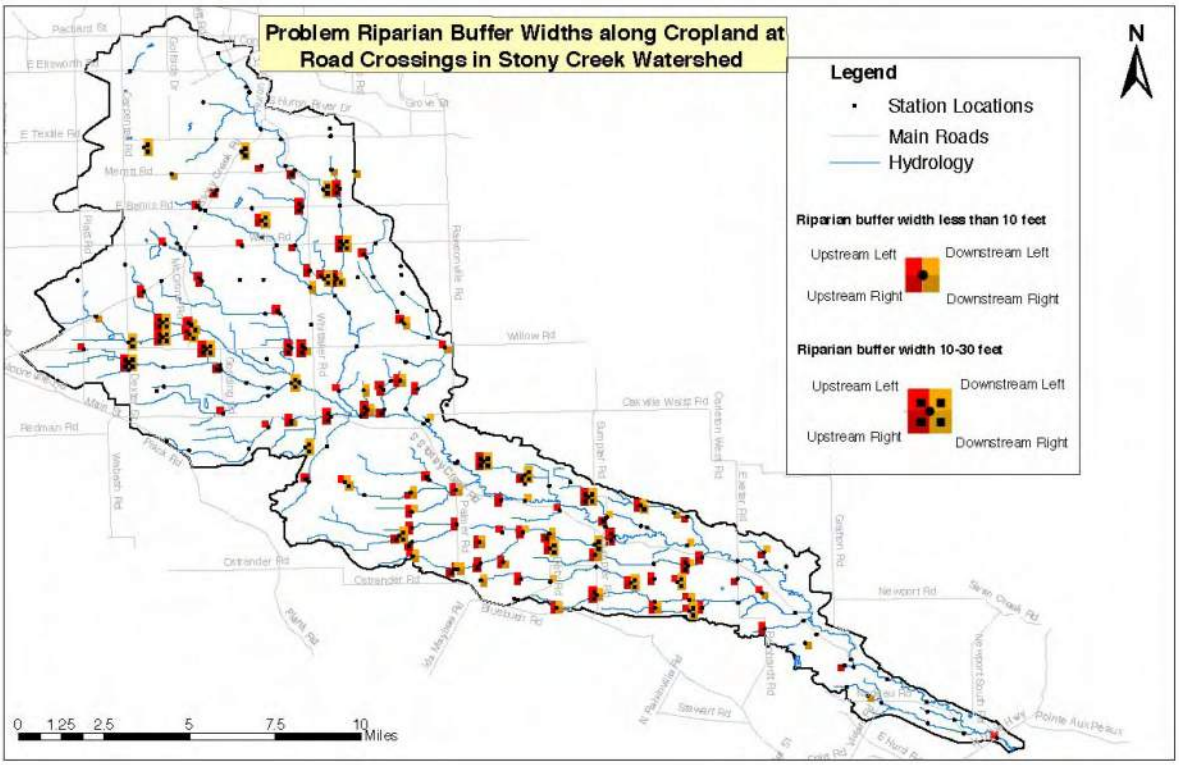

Figure 3.12: This map shows the location of problem riparian buffers adjacent to cropland in the Stony Creek Watershed. Particularly problematic are buffers less than 10 feet along streams and drains.

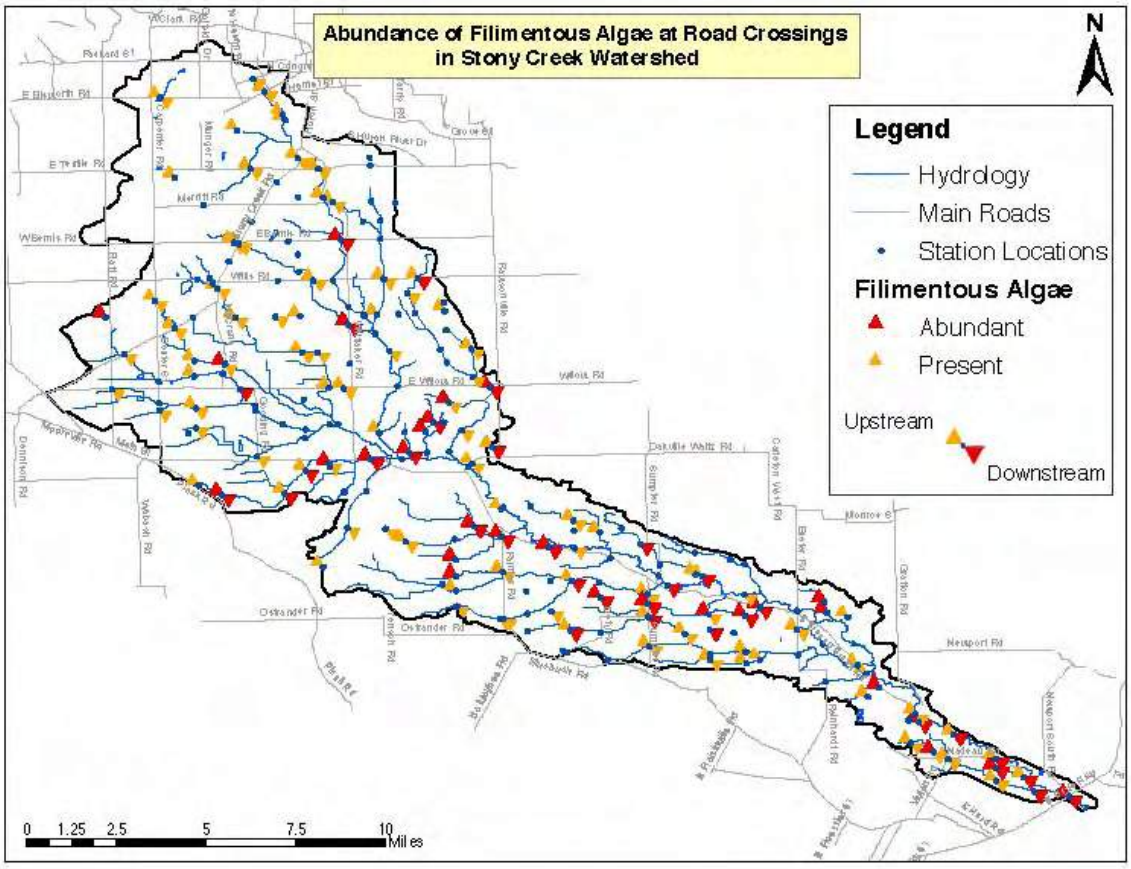

Figure 3.13: This map shows a number of road crossings in the Stony Creek Watershed with abundant filamentous algae, particularly in drains of the lower watershed.

<u>Abundance of Algae</u>

Typically algae growth is a problem in lakes, but can reach abundance in streams as well. Algae builds up in the watershed when excessive fertilizers or animal waste are added to surface waters or when there is inadequate flow to flush fertilizers out of streams and drains. Algae build-up can be an unattractive nuisance, but, more importantly, can lead to a drop in oxygen levels in the surface water that could eventually lead to the death of instream fauna. There are two types of algae that were identified as a part of the inventory survey. Filamentous algae attaches to the stream and floating algae hovers on the water surface. Figure 3.13 shows that filamentous algae is abundant in numerous parts of the watershed, particularly in the drains of the lower watershed. Figure 3.14 shows that floating algae is less common in the watershed, but is mostly concentrated in agricultural drains. One of the crossings where abundant algae was present is a site where cattle have access to the stream.

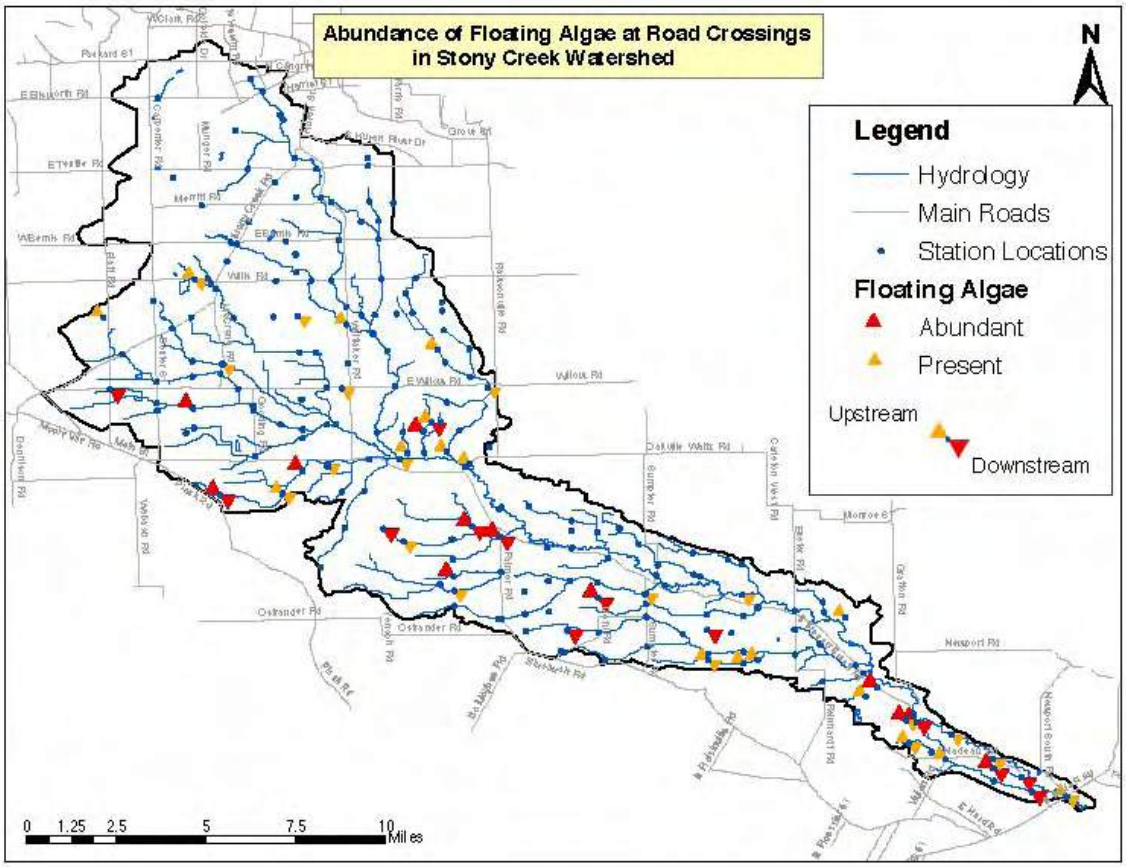

Figure 3.14: This map shows a few road crossings in the Stony Creek Watershed with abundant floating algae, particularly in agricultural drains of the lower watershed.

Bank Erosion

The sides of a stream channel are called banks; erosion is a normal process that takes place as a stream migrates from side to side or cuts into the streambed over time. Excessive erosion is typically caused by excessive flow fluctuation in streams or by the introduction of obstacles in the stream that diverts flow to the banks. Figure 3.15 shows areas of excessive bank erosion in the watershed. The areas of greatest concern are in the upper watershed where bank erosion is abundant. Locations where animals have access to streams have also been subjected to excessive erosion by animals trampling bank vegetation and damaging banks with their hoofs.

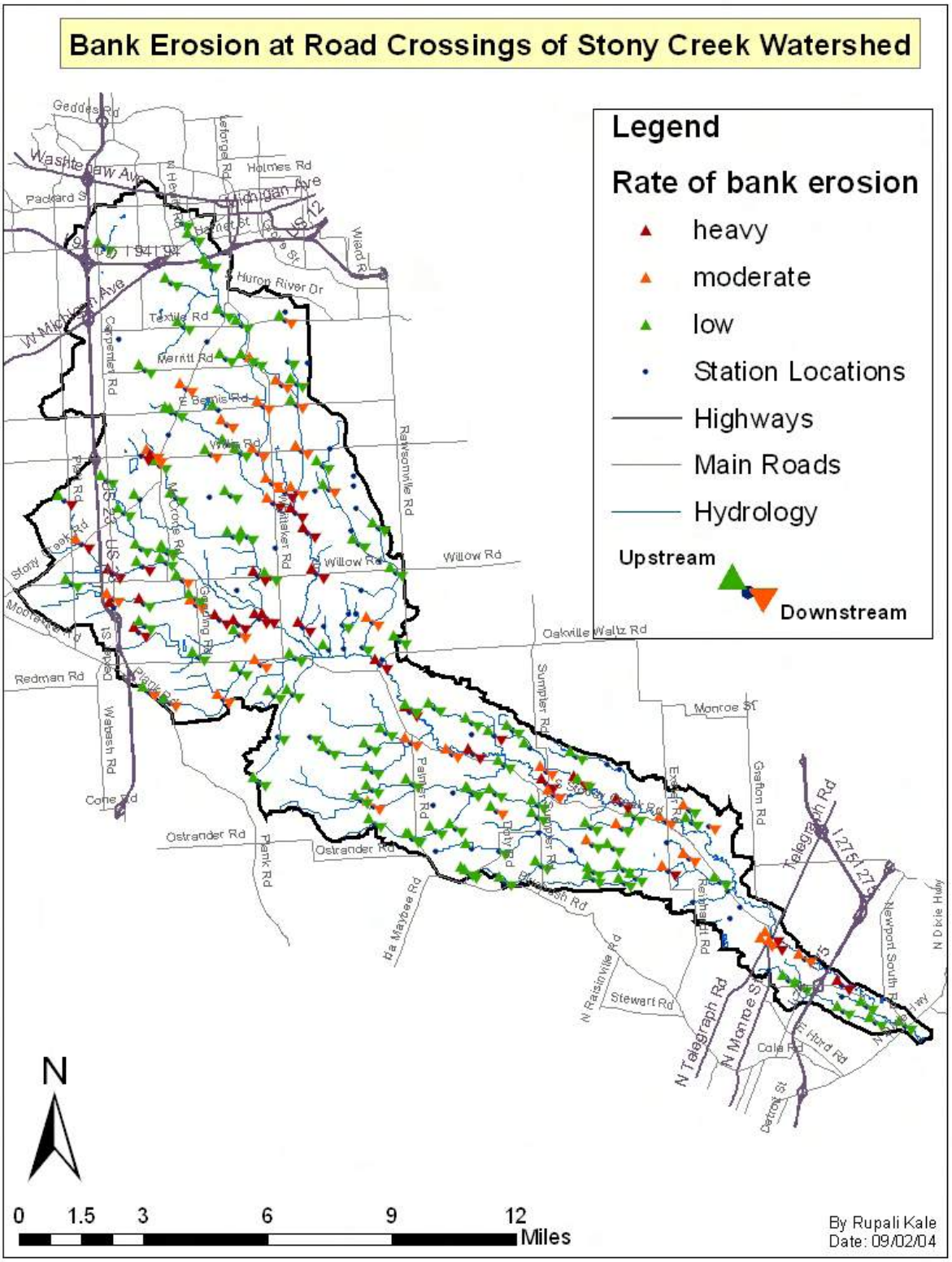

Figure 3.15: This map shows locations in the Stony Creek Watershed with abundant bank erosion, mostly concentrated in the upper watershed.

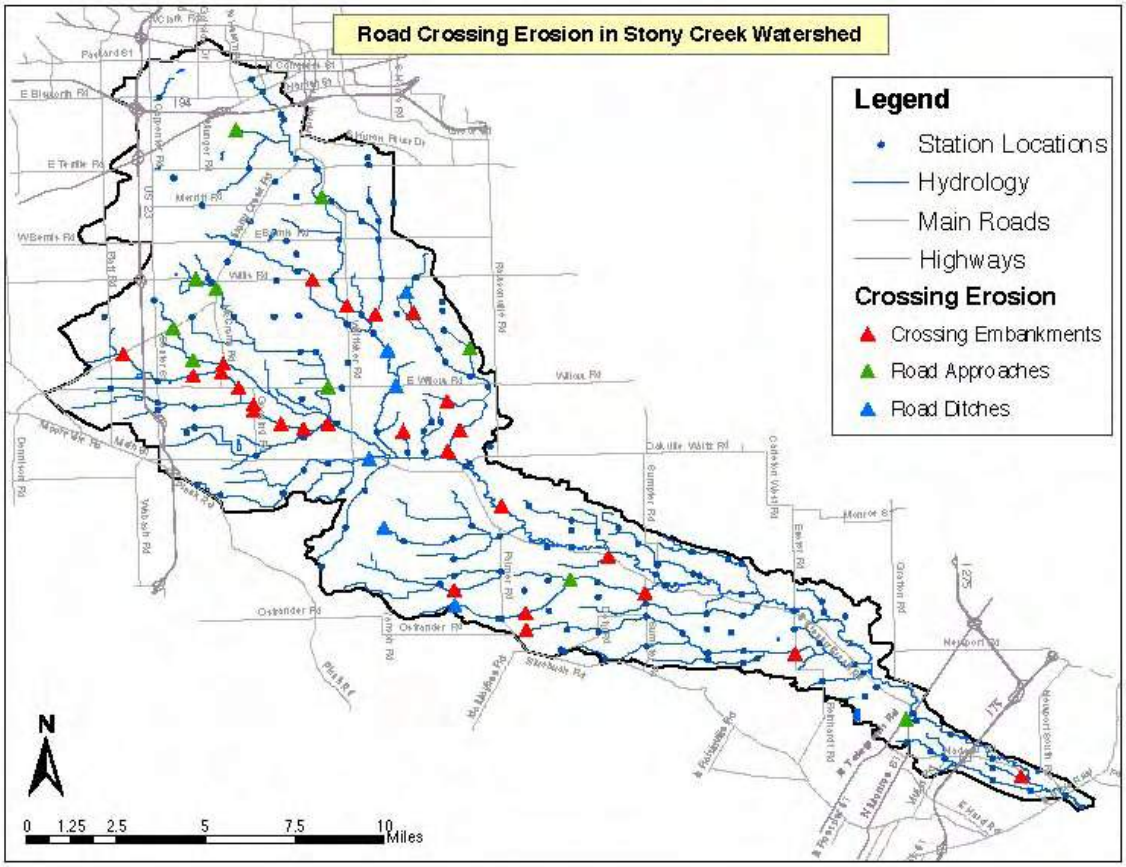

Figure 3.16: This map shows locations in the Stony Creek Watershed with abundant erosion of the road crossings, mostly concentrated in the mid-watershed.

<u>Road Crossing Erosion</u>

The locations where roads cross streams are often sources for sediment erosion. Problems related to the crossings themselves may be culverts or bridges that are inadequately sized to allow the flow volume to appropriately pass under the road. This problem could be because the crossing was designed inadequately or because altered hydrology is providing more flow than was normal at the time of construction. Aging crossings also wear out over time and may begin to provide inadequate protection of the embankment. In addition, gravel roads or roadside ditches near the crossings may be graded poorly and may begin to erode, providing additional sediment to streams at the crossing. Figure 3.16 shows a number of locations with erosion at road crossings in Stony Creek Watershed, mostly in the mid-watershed.

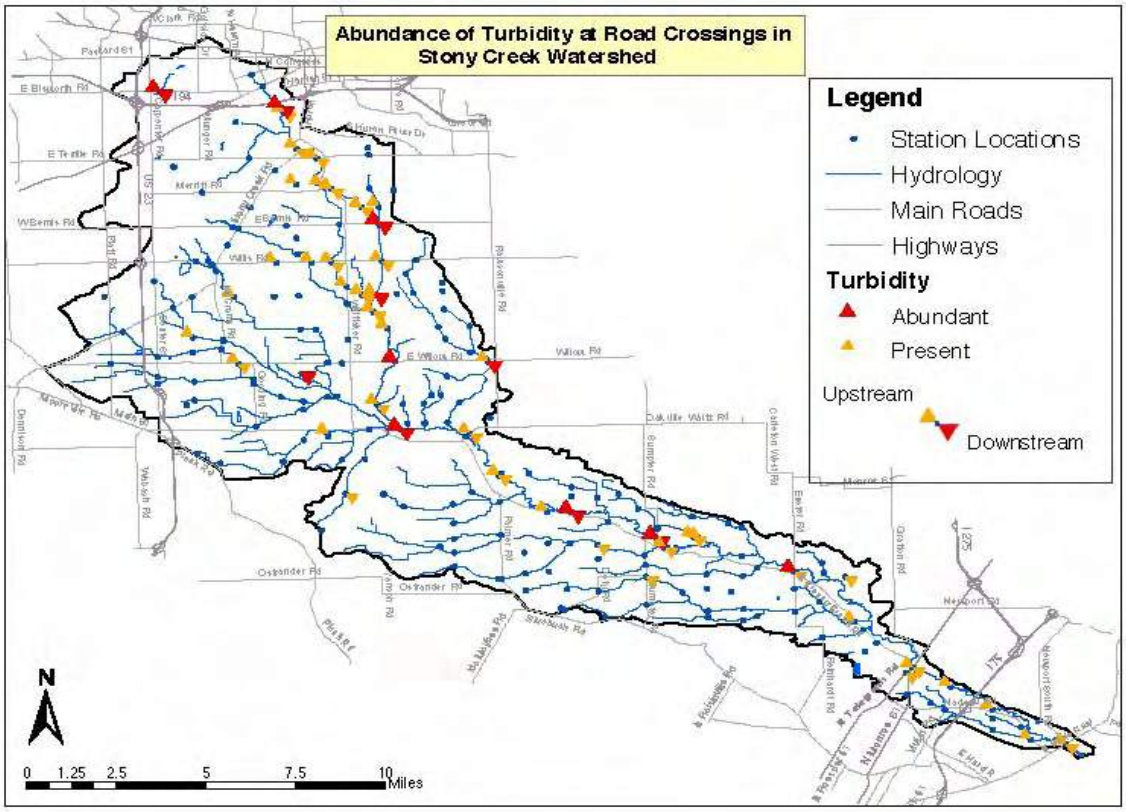

Figure 3.17: This map shows locations in the Watershed with abundant turbidity or suspended fine sediments in the water, mostly concentrated in Paint Creek and its tributaries.

Sediment

Sediment has multiple sources within the watershed. Sediment was documented in the watershed in two ways in this inventory survey: through turbidity and a visual estimate of grain size distribution on the stream bed. Turbidity is an indication of the clarity of surface waters. Low turbidity indicates clear water. High turbidity indicates water that has a number of suspended particles giving the water a muddy appearance. Excessive turbidity may prevent the bottom of the stream from being visible. Turbidity usually indicates that fine particle (silt and clay) are suspended in the water. Figure 3.17 shows locations where turbidity was present or abundant in the watershed. The most problematic portions of the watershed are branches of Paint Creek in the upper watershed. The map indicates turbidity farther downstream that was present because of high rainfall the day prior to surveying those locations.

Stream bed sediment was estimated visually at each site where the turbidity was low enough to see the bottom. This inventory measure can indicate the presence of sand as well as finer silts and clays commonly indicted with turbidity. Healthy streams are not covered in excessive sand, silt, and clay sized particles. Figure 4.18 shows that most of the streams and drains in the watershed are over 80% fine particles, most of these are more than 90% fines. The problem is fairly uniformly distributed across the watershed. Urban streams and agricultural drains alike are clogged with finer sediments and lack the gravels that apparently gave the watershed its name.

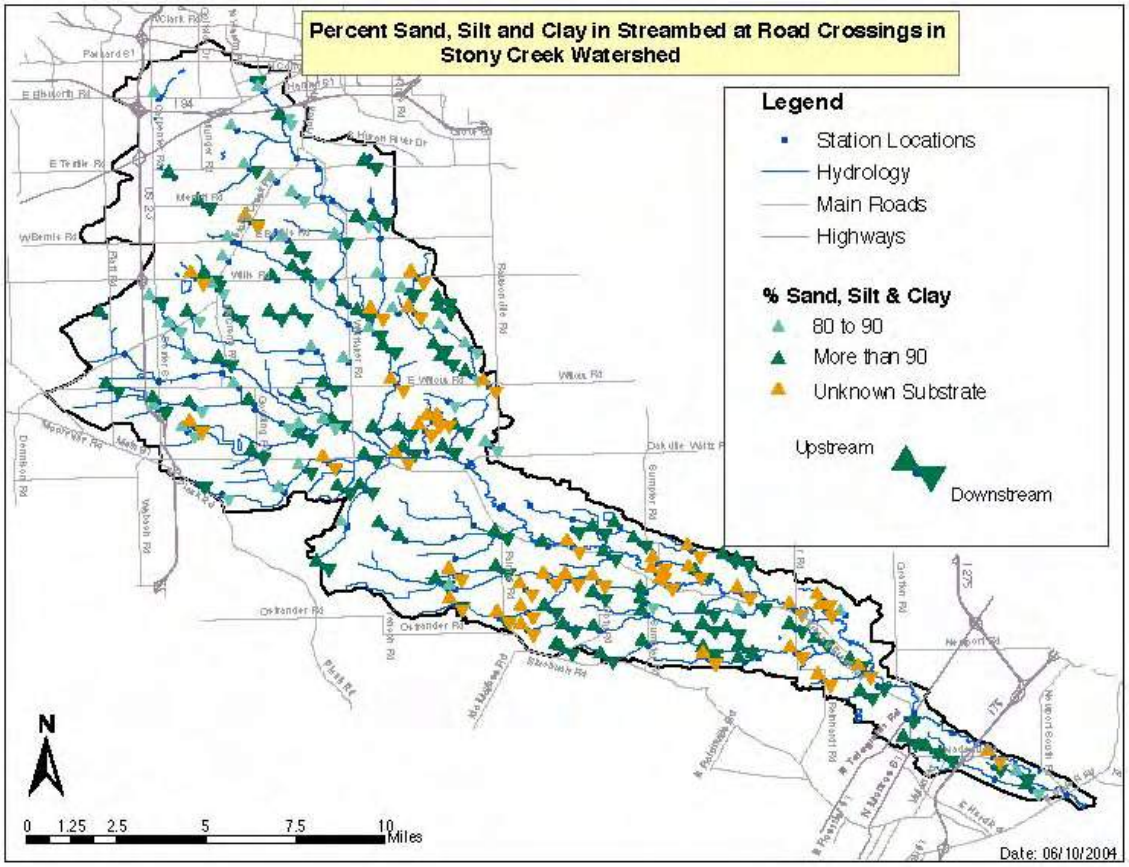

Figure 3.18: This map shows locations in the Stony Creek Watershed with abundant finer sediments and sand, distributed across the watershed.

<u>Stream Canopy</u>

Stream canopy is the measure of the degree of shading of the streams from overhanging vegetation, such as grasses, shrubs, and trees. Figure 3.19 shows that the stream canopy is remarkably extensive in most of the watershed. The upper watershed, where stream temperatures are most problematic (see section 3.4 above), has adequate canopy, so sources other than solar heating are likely responsible for the high temperature waters of Paint Creek. Lower in the watershed, the canopy is more frequently low to moderate, but stream monitoring (see section 3.5 above) indicates no apparent impact on stream temperature downstream of these locations.

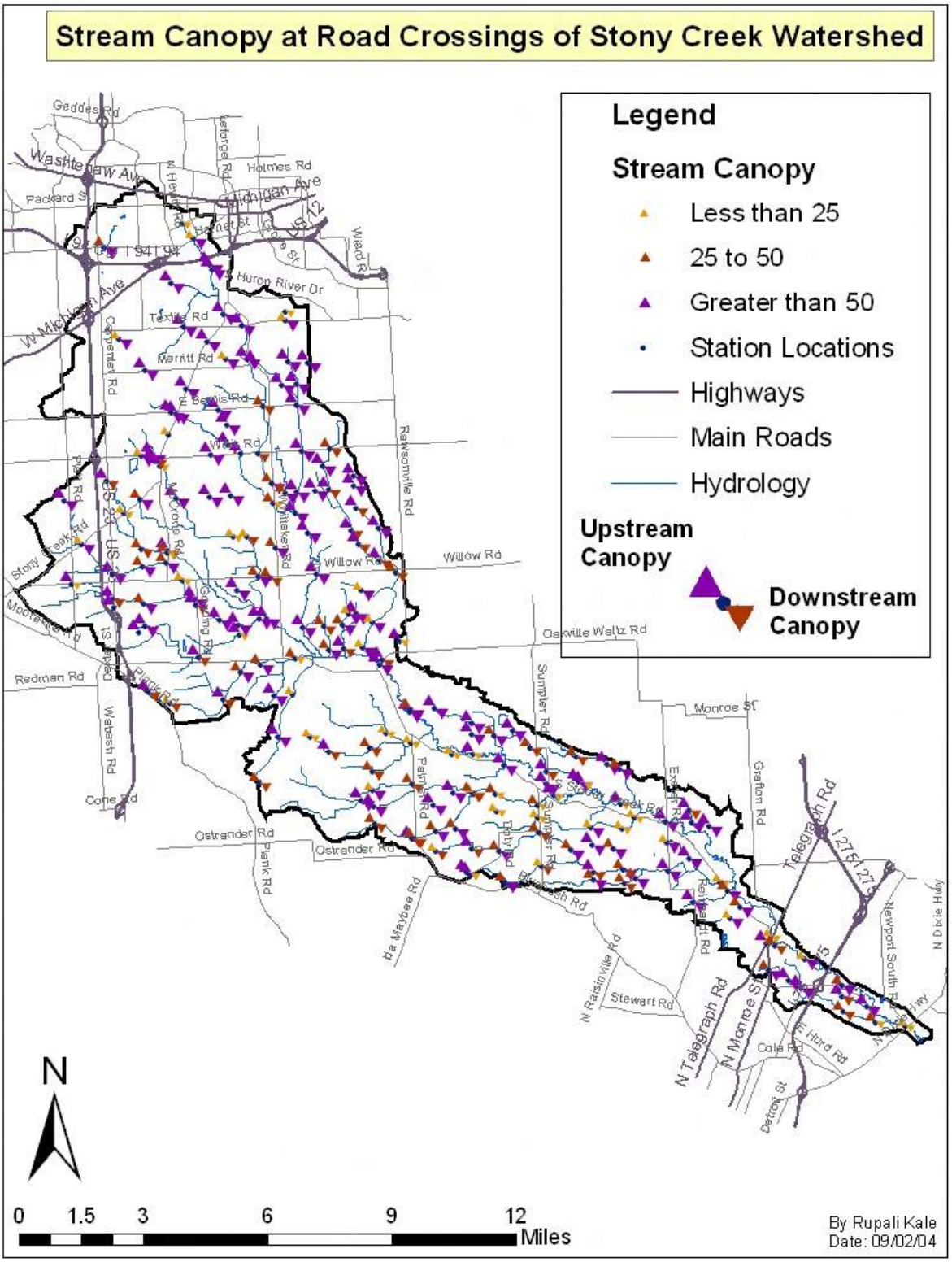

Figure 3.19: This map shows locations in the Stony Creek Watershed with abundant stream cover from overhanging vegetation. Areas of low to moderate stream canopy are concentrated in the lower watershed.

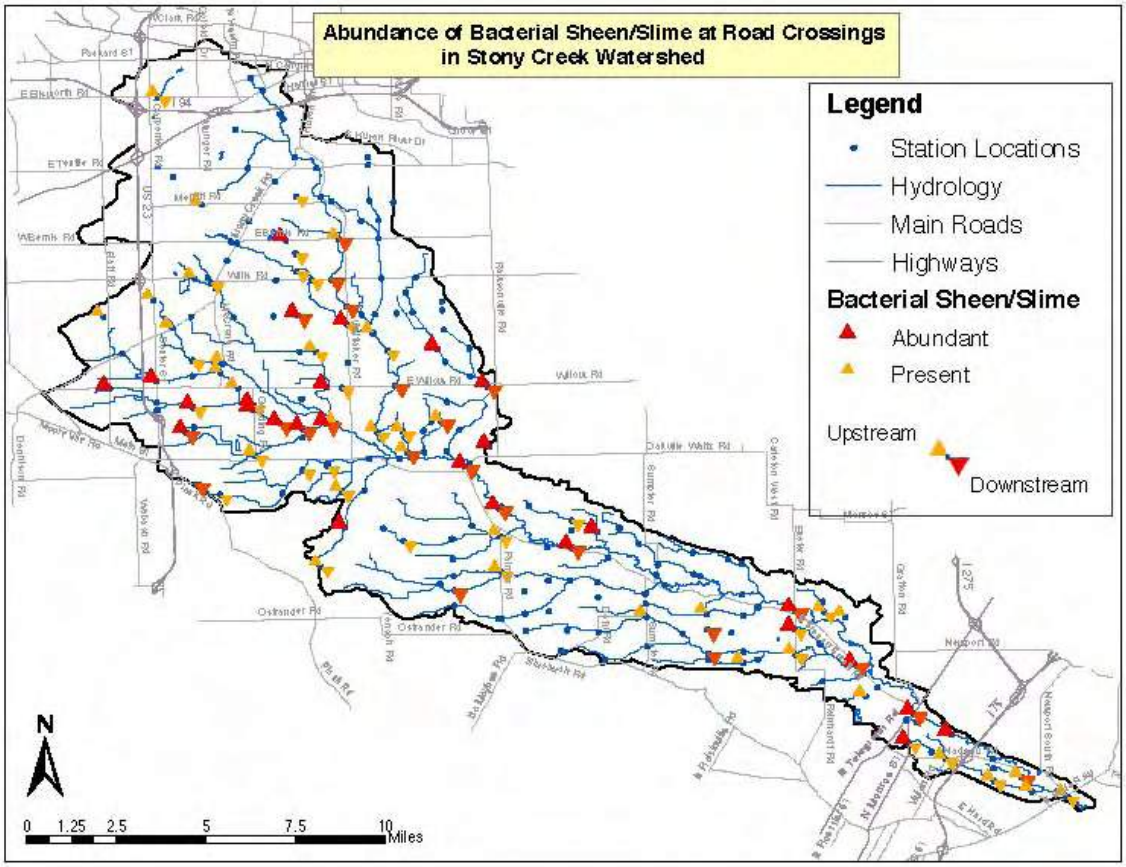

Figure 3.20: This map shows locations in the Stony Creek Watershed with abundant bacterial sheen and/or bacterial slime, mostly concentrated in the upper watershed along paint and Stony Creek.

<u>Bacterial Sheen and/or Slime</u>

Bacteria actively breakdown organic material that is present in streams. The rate of bacterial activity may also increase with the addition of phosphates in the water. When such activity is extensive a bacterial sheen may build up on the surface of a stream that looks like an oil film, but breaks up into clumps when poked. A reddish-orange bacterial slime may also build up on the streambed with abundant bacterial activity. Bacterial sheen or slime may build up in streams where extra inputs of organic material such as human or animal waste from malfunctioning septic systems or animal access to streams or from the added input of phosphates. Figure 3.20 shows a number of sites with bacterial slime or sheen, particularly abundant in the upper watershed.

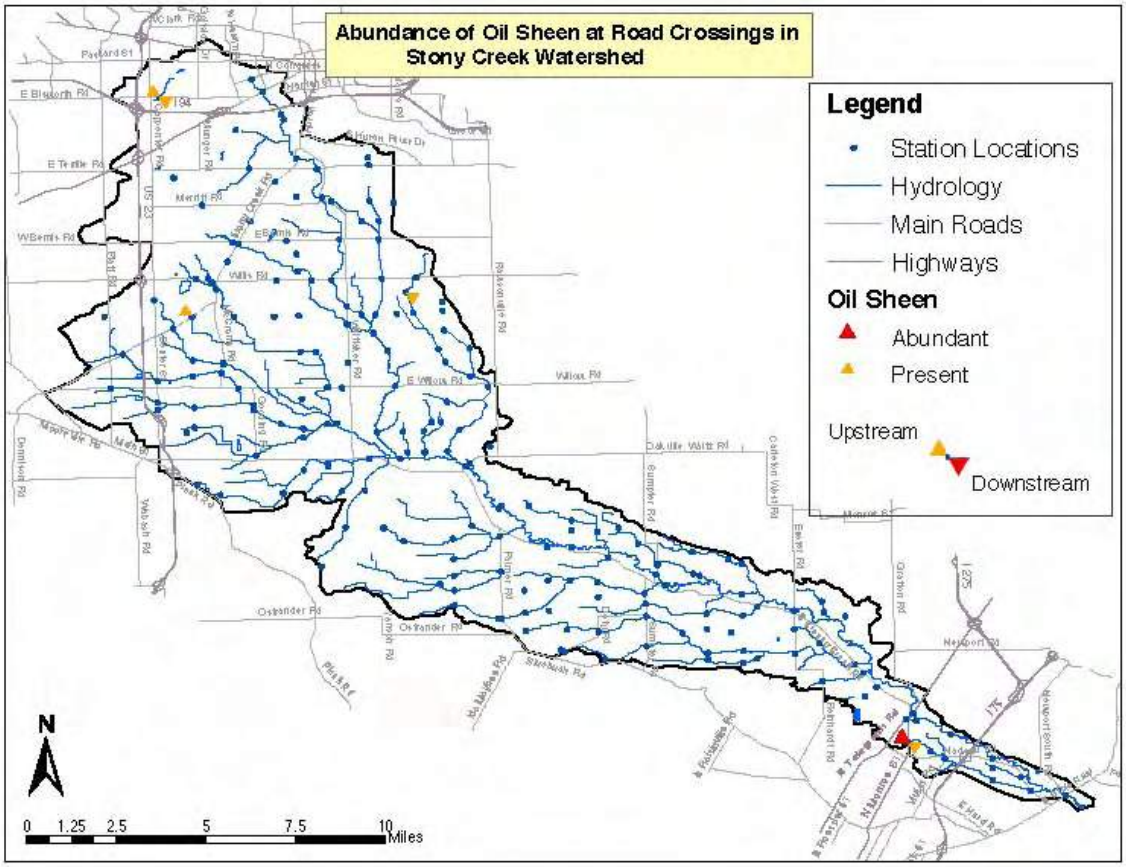

Figure 3.21: This map shows only a few locations in the Stony Creek Watershed with oil present in the surface waters.

Oil Sheen

Oil can wash into surface waters from parking lots and roads. Figure 3.21 shows only a few locations where oil sheen was identified at road crossings in the watershed. In the upper watershed, oil was identified in the water at perhaps the most developed crossing in the watershed, immediately downstream of an oil change facility. In the lower watershed, oil was found in the stream downstream of Telegraph Road.

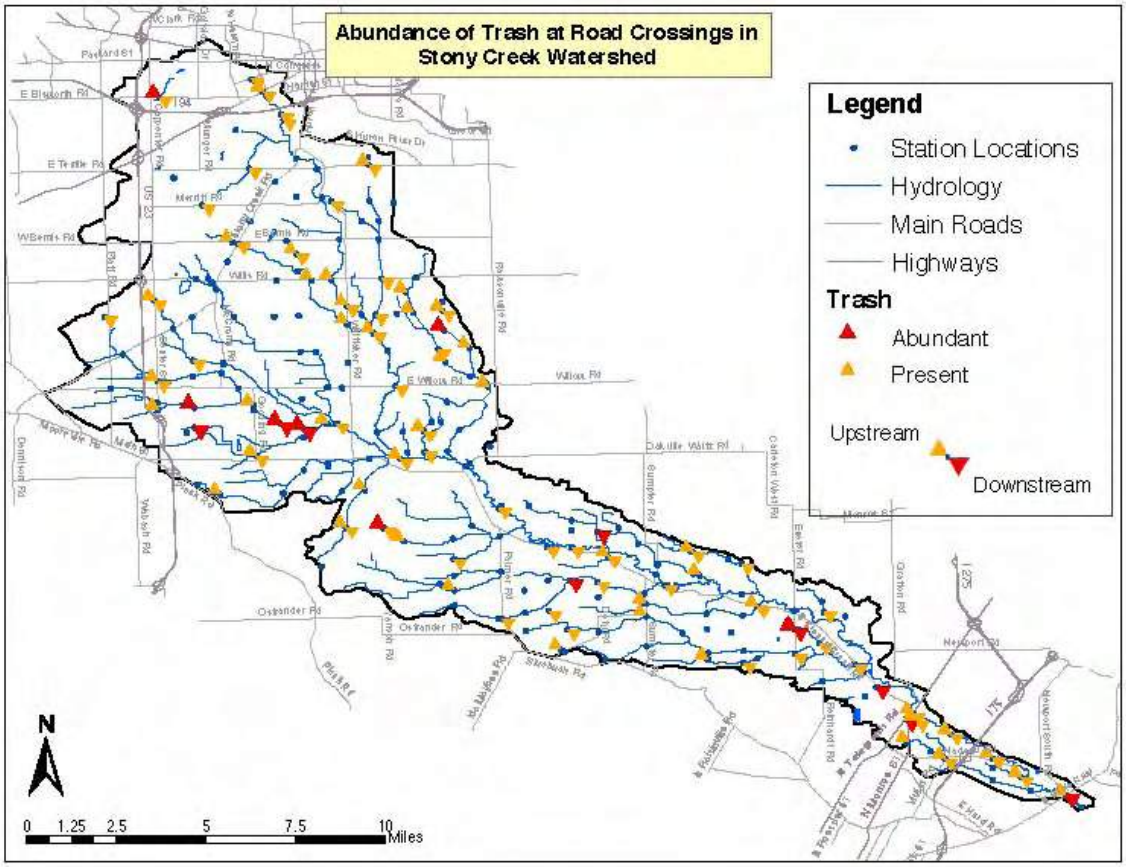

Figure 3.22: This map shows locations in the Stony Creek Watershed with abundant or present trash with distribution throughout the watershed.

<u>Trash</u>

Garbage thrown, blown, or washed into surface waters is aesthetically unappealing, but can sometimes add toxins to the water, depending on the type of trash. Figure 3.22 shows that excessive trash was found at a number of sites in the watershed and many others had trash present.

3.6 Summary

Generally, macroinvertebrate studies suggest that stream habitat and insect communities are poor in the extreme upper watershed, acceptable (trending toward poor) in the middle reaches, and more favorable in the lower watershed. Although the system is by no means pristine, some sensitive and pollution intolerant species are able to survive in the middle to lower reaches of the watershed. The general trend shows improving water quality conditions in the downstream direction.

Water quality monitoring and road stream crossings survey data suggest that sediment transport, phosphorus input, temperature, specific conductivity, and bank erosion are worst in the upper watershed where the land has been developed or is undergoing suburban development. There are, however, concerns about nutrients, sediment, and narrow riparian buffer widths in the lower watershed, but with an apparently less significant impact than the problems in the upper watershed.

References

MDEQ Staff Report, 1996. A biological survey of Stony Creek and Amos Palmer Drain, Monroe County, Michigan, September 13, 1995. Michigan Department of Environmental Quality, Surface Water Quality Division. MI/DEQ/SWQ-96/151.

MDEQ Staff Report, 1998. A biological survey of Stony Creek and its tributaries, Amos Palmer Drain and Ross Drain, Monroe County, Michigan, July 1997. Michigan Department of Environmental Quality, Surface Water Quality Division. MI/DEQ/SWQ-97/087.

National Academy of Sciences - National Academy of Engineering. 1973. Water Quality Criteria 1972. A Report of the Committee on Water Quality Criteria. Prepared for Environmental Protection Agency. Washington, DC

Chapter 4: Challenges and Project Goals

Identification of the most important challenges and goals of the watershed was left up to the community with the aid of project staff and the technical committee. This chapter outlines the process of establishing the priority of challenges and articulating goals for Stony Creek Watershed, and the role that the public, the steering committee, and the technical committee played in establishing those priorities.

4.1 Watershed Vision

Early in the planning process, the steering committee established a vision for the Stony Creek Watershed which this long-term planning effort will try to promote: "Creating and preserving a healthy watershed"

4.2 Designated Uses

All surface waters of the state of Michigan are designated for multiple uses and must be protected for each of those uses, including:

- Agriculture – water supply for farmland irrigation and livestock
- Warmwater fishery – maintains water quality for warmwater fish
- Aquatic life and wildlife – maintains water quality for other indigenous plants, animals, insects
- Partial body contact for recreation – sufficient quality for canoeing, boating, wading
- Total body contact between May 1 and October 31 – sufficient quality for swimming
- Public water supply – maintains safe drinking water
- Industrial water supply – water available for industrial purposes
- Navigation – supports navigation in waterways

The Stony Creek Watershed steering committee, composed of representatives from each township with significant area within the watershed boundary, has been held responsible by the state of Michigan for developing a management plan to protect surface waters for the above designated uses. The surface waters of Stony Creek Watershed, however, are not used for industrial water supply. In addition, the Stony Creek system is deemed not suitable for navigation by the steering committee. As a result, the steering committee recognizes that the last two designated uses listed above are not reasonably applicable to the Stony Creek Watershed and therefore decided to focus attention on the other designated uses.

Within the watershed, public water supply is currently limited to groundwater use. Residents of Monroe, MI, however, intake water from Lake Erie near the mouth of Stony Creek, so the Stony Creek Watershed can potentially impact the quality of the public water supply at that location. All other designated uses are clearly relevant to the Stony Creek Watershed.

In addition, Paint Creek (a major tributary to Stony Creek in Washtenaw County) has been designated as a trout stream and will therefore be protected as a coldwater fishery and considered an additional designated use of the that portion of the watershed.

As a result, the list of most important designated uses that the steering committee decided to address are the following:

- Agriculture
- Warmwater fishery
- Aquatic life and wildlife
- Partial body contact for recreation
- Total body contact between May 1 and October 31
- Public water supply
- Coldwater fishery

The decision to focus on the above designated uses was communicated to the public at the April 2004 public meetings and have been posted on the project website since the decision was made by the steering committee.

4.3 Challenges / pollutants of concern in the watershed

Based on 1) concern raised by the public to steering committee members and 2) data from the macrioinvertebrate studies, water quality monitoring, and the road stream crossings inventory (presented in Chapter 3), the technical committee and steering committee established the following challenges and pollutants of concern in the watershed:
- Altered hydrology – land use induced changes in stream function causing multiple problems
- Sedimentation / Soil Erosion – high input of sediment pollution to streams
- Nutrients – high input of fertilizers, etc. from multiple sources
- Pesticides – known use of pesticides throughout the watershed
- Temperature – high temperature of stream waters threatening fish populations
- Dissolved Oxygen (DO) – low dissolved oxygen levels threatening fish populations
- Oil/grease/metal/brine/salts – common materials washed off parking lots and roadways
- Pathogens – common challenge when fecal material enters surface waters
- Hydrogen sulfide (HS)/total dissolved solids – challenge of recent concern to residents
- pH – acidity considered potentially problematic for fish if too high or too low

4.4 Sources and causes of challenges / pollutants in the watershed

The sources and causes of the identified challenges to the Stony Creek Watershed are described below. The general sources of pollutants vary by land use with developed and developing areas and agricultural areas providing a number of potential sources and causes of challenges to the watershed. These sources and causes are outlined in Table 4.1 and discussed in the narrative that follows.

4.4.1 Altered hydrology

Developed and developing areas result in altered hydrology first by removing wetlands and natural vegetation that allow water to be stored on the land surface or slowly infiltrated into the land rather than flow overland during rain events. Deep roots of native vegetation and low intensity use of land allow the soil to be loose and hold much more water than developed land.

In addition, pavement and other urban structures (buildings, etc.) are impervious surfaces that do not allow infiltration of water into the ground. Natural streams are often removed or relocated during development which alters the natural drainage of land. The replacement drainage feature is usually straightened and often with a smoother surface (such as an underground tunnel) that speeds the flow of water from the area. Inadequate stormwater management allows water to reach streams more quickly. All of these causes of altered hydrology in developed and developing areas lead to higher peak flows that occur more rapidly after the beginning of a rain event than before development. Groundwater tables and stream flows between rain events tend to be lower than normal because water is less able to infiltrate into the ground to recharge the groundwater that feeds streams between storms.

Agricultural fields result in altered hydrology first by removal of wetlands and natural vegetation that allow water to be stored on the land surface or slowly infiltrated into the land rather than flow overland during rain events. Deep roots of native vegetation and low intensity use of land allow the soil to be loose and hold more water than agricultural land that becomes compacted by heavy equipment. Natural streams are often moved, straightened, and disconnected from their floodplains with the construction of drains, which are designed to move water rapidly from the area. Tiling of fields may also increase flow in streams because it is designed to keep water from ponding on the land surface. On the other hand, tiling of fields may reduce overland flow during some storms by discharging water directly into drains or streams rather than allowing water to pool up too quickly on the land surface. All of these causes of altered hydrology in agricultural areas lead to higher peak flows that occur more rapidly after the beginning of a rain event than before alteration. Groundwater tables and stream flows between rain events tend to be lower than normal because water is less able to infiltrate into the ground to recharge the groundwater that feeds the streams between storms. Agricultural land generally has a smaller effect on altering hydrology than developed and developing areas.

Point sources from gravel pits are another source of altered hydrology. Large gravel pits and quarries pump groundwater in order to excavate deeper below the land surface. Discharge of pumped groundwater into streams results in abnormally high discharge in surface streams.

Altered hydrology in Stony Creek has produced accelerated erosion of banks, loss of bank vegetation, and downstream log jams that have, in turn, locally altered the hydrology in the creek. In some areas, these log jams have built up enough that they impede flow and result in localized flooding during rain events. Log jams also slow the arrival of water downstream.

4.4.2 Sedimentation / soil erosion

Developing and developed areas result in known sources of sedimentation/soil erosion mostly as a result of construction. Soil is loosened and uncovered during construction that allows stormwater to pick up and carry sediments along the land surface. There are required sedimentation and soil erosion controls for construction in Michigan, but the control methods are often inadequate and inspection and compliance with permits is often insufficient. Once an area is developed, inadequate stormwater management practices allow large concentrations of water to carry high volumes of sediment off roads and other impervious surfaces into sewers.

Even detention structures that control the amount of water that enters streams from developed areas do little to control finer sediments from entering surface waters. In addition, inadequate riparian buffers during and after construction allow a close connection of the altered runoff producing landscape to the surface waters that may be a source of sediment to streams.

Agricultural fields result in known sources of sedimentation/soil erosion. Agricultural fields are without established vegetation for a portion of most of the year, which leaves the landscape prone to excessive soil erosion. Inadequate upland conservation practices result in unnecessary loss of topsoil that can work its way toward surface waters. Inadequate riparian buffers increase the likelihood that soil eroded off of fields will enter surface waters. In addition, wind can contribute to soil erosion, especially on the flatter landscape of the Stony Creek Watershed.

Eroding streambanks are known sources of sedimentation/soil erosion. Streambanks are eroding mainly because of high flow fluctuation caused by altered hydrology. With the faster arrival of water to the surface water system during rain events, greater flows are capable of greater bank erosion. This threat is expected to increase in the future with further development of the watershed. Some logjams in Stony Creek have been caused by bank erosion undercutting an unusually high number of trees. Logjams are large enough in many portions of Stony Creek to divert flow toward the banks, causing increased bank erosion. Insufficient vegetation on the banks, either by human or animal removal or by erosion induced by increased flow fluctuation, leaves the banks susceptible to erosion because vegetation stabilizes banks.

Eroding road stream crossings are known sources of sedimentation/soil erosion. Aging or inadequately designed road crossings can cause erosion of banks near the crossing, plunge pools downstream of the crossing, eroding road surfaces or roadside ditches leading up to the crossing or erosion of the fill over culverts, etc. Culverts that are inadequately sized can cause ponding upstream and erosive flows downstream of the culvert during rain events.

Livestock in streams is another source of sedimentation/soil erosion. Uncontrolled access of livestock can cause excessive erosion of streambanks and removal of vegetation on and near the banks of streams. These factors also accelerate soil erosion during rain events.

4.4.3 Nutrients

Agricultural fields are known sources of nutrients. Insufficient upland conservation practices and inadequate riparian buffers allow nutrients from fertilizer (often attached to soil particles) to wash off the landscape and into local streams. Sewage sludge applied to agricultural fields is a potential source for additional nutrients that could work their way to streams.

Homeowners in rural and urban locations are known sources of nutrients. Improper selection and application of fertilizers can result in the application of more nutrients than is necessary for healthy lawns and gardens. In addition, inadequate riparian buffers allow an easy pathway for those nutrients to reach streams during rain events. Some homeowners that have septic systems can contribute a suspected source of nutrients. Improperly maintained septic systems or use of poorly designed systems can release nutrients into the watershed that may work their way into streams.

Commercial lawns and golf courses are another known source of nutrients. Although generally managed more carefully than homes, regular application of fertilizers are common on these properties. Insufficient management practices and inadequate riparian buffers are suspected causes of nutrients entering streams.

Livestock in streams is another known source of nutrients in streams. Uncontrolled access allows livestock to deposit digestive waste directly into streams.

Storm sewers are suspected sources of nutrients to streams. Illicit connections of sanitary sewers to storm sewer systems may connect sewage to streams. Pet and animal waste may wash directly into streams through stormwater sewers with direct connections to streams.

4.4.4 Pesticides

Agricultural fields are known sources of pesticides. Insufficient upland conservation practices and inadequate riparian buffers allow pesticides (often attached to soil particles) to wash off the landscape and into local streams.

Homeowners in rural and urban locations are another known source of pesticides. Improper application and use of pesticides and inadequate riparian buffers allow easy pathways for pesticides to reach streams during rain events.

Commercial lawns and golf courses are another known source for pesticides. Although generally managed more carefully than homes, regular application of pesticides is common on these properties. Insufficient management practices and inadequate riparian buffers are suspected causes of pesticides entering streams.

4.4.5 Temperature

Runoff from hot, impervious areas is a suspected source of high water temperature. Solar heating is a suspected cause of high temperatures in Paint Creek. Loss of riparian canopy is the suspected cause of excessive solar heating, especially in tributary streams that feed Paint Creek.

4.4.6 Low dissolved oxygen (DO)

High temperature water can hold less oxygen than colder water. As a result, high temperature water leads to lower dissolved oxygen that can be critically low for the survival of fish. High nutrient concentrations can also lead to lower dissolved oxygen levels as increased plant growth (particularly algae) leads to a short-lived abundance of oxygen consuming organisms in the water. High concentrations of organic material from poorly operating septic systems, stormwater, feedlots, agricultural runoff, or urban construction leads to high rates of decomposition, an oxygen depleting process.

4.4.7 Oil/grease/metal/brine/salts

Impervious surfaces, especially those related to vehicle use such as roads, parking lots, and driveways, are known sources for a variety of pollutants such as oil, grease, metals, brine, and salts. Homeowners (urban and rural) contribute to this set of pollutants through improper oil disposal and vehicle maintenance and unsparing use of salt for snow removal.

4.4.8 Pathogens

Homeowners (urban and rural) are known sources of pathogens through improperly maintained or poorly designed septic systems that leak human waste into the watershed. Livestock waste is a known source of pathogens. Insufficient upland controls allow livestock direct access to streams or allow direct pathways from holding areas to streams. Pet waste is a known source of pathogens that can have direct access to streams through stormwater sewers. Waterfowl waste is a direct source of pathogens to streams. Agricultural fields that apply sewage sludge for fertilization are known sources of pathogens, although there are few fields within the watershed that are permitted to accept sludge. Human waste from sanitary sewers are a potential source of pathogens through illicit connections to storm sewers.

4.4.9 Hydrogen sulfide/total dissolved solids

The known source of hydrogen sulfide and dissolved solids in the Stony Creek Watershed is groundwater. The main cause for high amounts of these pollutants is groundwater pumping with direct discharge into streams that is associated with gravel pit and quarry operations.

4.4.10 pH

One suspected cause of low pH in the Stony Creek Watershed is acid rain. Coal burning power plants are largely responsible for producing acid rain, which can increase acidity of surface waters following storms. Another source of low pH is respiration (breathing) of organisms in the water. Decomposition of organic material can similarly reduce pH.
Acidity can be reduced (higher pH) by the addition of ammonia fertilizers and lime that are often added to agricultural fields and gardens. Acidity can also be reduced by plant photosynthesis, which is most active during the day and during the growing season.

4.5 Prioritization of challenges / pollutants

Prioritization of challenges / pollutants are shown below and in the major headings of Table 4.1. The public established this prioritization during two public forums in April 2004. The community members who attended the forums were educated about the planning process, the list of designated uses, the list of challenges / pollutants of concern in the watershed, and information related to each challenge / pollutant and how they relate to the designated uses of concern. The public was then asked to rank the challenges / pollutants according to <u>their</u> concern, based on the information provided.

The data was entered into a spreadsheet and averaged to create an overall priority list of challenges / pollutants in the Stony Creek Watershed. Following the forums, the steering committee approved the list of critical challenges.

1. Sedimentation / soil erosion
2. Altered hydrology
3. Nutrients
4. Low DO
5. Pesticides
6. Oil/grease/metal/brine/salt
7. Temperature
8. Hydrogen sulfide / total dissolved solids
9. Pathogens
10. pH

There were two public forums, one held in Monroe County and one held in Washtenaw County. The priority lists of each county were remarkably similar (see spreadsheet, Appendix), so averaging the concerns of all attendees seemed an appropriate gauge of the public concern. In fact, the top five priorities were the same in each county in almost the same order.

4.6 Prioritization of sources and causes of challenges / pollutants

Prioritization of the sources and causes of the challenges / pollutants was a collaborative effort between the public, project staff, technical committee and the steering committee members. First, the public was asked to discuss sources and causes of concern at the public forums. These comments, along with data collected from the monitoring and watershed inventory, were used by project staff to draft an initial priority table (similar to Table 4.1) of sources and causes of challenges and pollutants in the watershed. This table was distributed to the technical committee over the internet for additions, subtractions, and alterations. Over a period of several months, the table was changed repeatedly based on feedback from technical committee members and discussions at steering committee meetings. Ultimately, the table of prioritized sources and causes of each challenge / pollutant was approved by the Steering Committee.

4.7 Critical Areas

It was clear from the beginning of the project that the two main land uses that could pose the greatest potential problems for water quality were the residential/commercial developments that had or were taking place in the upper watershed, and the agricultural use which dominates most of the rest of the watershed. It was also evident that clay soils would produce the potentially greatest amount of polluted runoff directed toward surface waters of the watershed. Finally, the areas bordering surface waters posed the greatest threat to surface water contamination. As a result, the most critical areas of the watershed were initially considered to be 1) the developed and developing areas, and 2) agricultural areas, particularly where either land use was on clay soils and/or where land uses were not well buffered from surface waters.

Table 4.1: Known/Suspected Sources and Causes of Challenges in the Stony Creek Watershed

1. SEDIMENTATION / SOIL EROSION

Sources	Causes
Developing and developed areas	- Inadequate sediment / erosion control methods - Inadequate riparian buffers - Inadequate inspection / compliance with permits - Inadequate stormwater management
Agricultural fields	- Inadequate upland conservation practices - Inadequate riparian buffers - Flooding of fields - Wind erosion
Eroding streambanks	- High flow fluctuation - Some log jams divert flow to banks - Insufficient vegetation on banks
Eroding road stream crossings	- Erosive road / overpass surface - Old failing structures - Inadequately sized culverts for current flows
Livestock in streams	- Uncontrolled access

2. ALTERED HYDROLOGY

Sources	Causes
Developing and developed areas	- Imperviousness of landscape - Loss of wetlands and natural vegetation - Inadequate stormwater management - Natural streams removed/relocated with development
Agricultural fields	- Loss of wetlands and natural vegetation - Streams moved, straightened, and disconnected from floodplain) with construction of drains - Tiling increases flow in streams, but may reduce overland flow by reducing ponding of water on surface
Point sources (gravel pits)	- Discharge of pumped groundwater into streams
Log jams (locally)	- Bank erosion induced tree fall (from increased flow)

3. NUTRIENTS

Sources	Causes
Agricultural fields	- Insufficient upland conservation practices - Inadequate riparian buffers - Flooding of fields - Sewage sludge applied to agricultural fields
Homeowners, urban and rural	- Improper selection and application of fertilizers - Inadequate riparian buffers - Improperly maintained, poorly designed septic systems
Commercial lawns and golf courses	- Inadequate riparian buffers - Insufficient management practices
Livestock in streams	- Uncontrolled access
Storm sewers	- Stormwater sewers transport plant material and animal waste directly into streams - Illicit connections of sanitary sewer to storm sewer?
Waterfowl waste	- Direct access to streams

Table 4.1 (cont.): Known/Suspected Sources/Causes of Challenges in Stony Creek Watershed

4. LOW DO – Strongly correlated with stream temperature

Sources	Causes
Higher water temperature (see temperature sources and causes)	- High temperature water holds less oxygen

5. PESTICIDES

Sources	Causes
Agricultural fields	- Insufficient upland conservation practices - Inadequate riparian buffers
Homeowners, urban and rural	- Improper application and use - Inadequate riparian buffers
Commercial lawns and golf courses	- Inadequate riparian buffers - Insufficient management practices

6. OIL, GREASE, METAL, BRINE, SALT

Sources	Causes
Roads, parking lots, driveways	- Inadequate stormwater management practices - Road ditches drain directly to streams - Storm sewers and drainage paths connected directly to streams
Homeowners, urban and rural	- Improper oil disposal and vehicle maintenance - Salt overuse for snow removal

7. TEMPERATURE

Sources	Causes
Runoff from impervious areas	- Inadequate stormwater management
Solar heating	- Loss of riparian canopy (mostly tributaries)

8. HYDROGEN SULFIDE / TOTAL DISSOLVED SOLIDS

Sources	Causes
Groundwater	- Groundwater pumping and discharge from quarries

9. PATHOGENS

Sources	Causes
Homeowners, urban and rural	- Improperly maintained, poorly designed septic systems
Livestock waste	- Insufficient upland controls
Pet waste	- Stormwater sewers create direct path to streams
Waterfowl waste	- Direct access to streams
Agricultural fields	- Sewage sludge applied to agricultural fields
Human waste from sanitary sewers	- Illicit connections of sanitary sewer to storm sewer?

10. pH

Sources	Causes
Acid Rain lowers pH	- Coal burning power plants
Agricultural fields	- Addition of lime raises pH - Ammonia fertilizers may raise pH

As scientific data from monitoring and the watershed inventory emerged, and as public comments emerged from the public forums and in discussions between and among steering and technical committee members, the overall picture of critical areas that emerged is not much different than the initial areas of greatest concern. The most significant problem areas are the developed and developing areas in the upper watershed. The second most significant problem areas are the agricultural areas. This general order of priorities was acknowledged and supported by both the steering and technical committees.

4.7.1 Developed and Developing Areas

Developed and developing areas in the upper watershed were determined to be the most critical areas in the watershed because they are the areas with:

- the lowest general water quality according to the macroinvertebrate study, which showed increasing water quality away from the developed and developing areas
- the highest conversion to impervious areas that could alter the watershed hydrology
- the lowest infiltration rates in extreme upper watershed
- the most extensive erosion of banks (in Paint Creek and upper Stony Creek)
- the highest percentage of days with high sediment concentration during water quality monitoring
- the greatest turbidity during the watershed survey
- the highest percentage of days with high phosphorus concentrations during water quality monitoring
- the only indication of temperatures too high for a warmwater fishery, especially detrimental considering that Paint Creek is designated as a coldwater fishery
- the only indication of high conductivity that suggests generally polluted water

To make matters worse, these critical areas are in the upper part of the watershed, which means that the problems in this area impact the rest of the watershed. In addition, formerly agricultural areas are quickly being converted to developed areas in the upper watershed, which means that this most critical land use (and its nonpoint source pollution) is expanding and threatening larger portions of the watershed. Focusing on agricultural issues in the areas undergoing pressure from development would be a losing battle if the land converts to residential/commercial in the near future.

Conversely, development in the lower watershed seems to have a much lower impact on water quality because the bank erosion, gravel in streams, conductivity and other water quality indicators are not of particular concern in this area. In addition, the watershed narrows considerably in this area and there are few downstream areas within the watershed that are greatly affected by the development in the area. There are certainly sources and causes of nonpoint source pollution in Frenchtown Township, but the extent and impact of those sources are of much lower concern than in the upper watershed.

4.7.2 Agricultural Areas

Agricultural areas distributed throughout the watershed were determined to be the second most critical areas in the watershed because they are the areas with:

- many streams and drains with low buffer widths
- high alteration of hydrology with tiling, drain construction/maintenance, and loss of natural vegetation
- low gravel percentages in streams and drains
- high percentage of days with high phosphorus concentrations during the water quality monitoring
- an extremely high percentage of days with high nitrate concentrations during the water quality monitoring
- the greatest abundance of filamentous and floating algae
- areas with livestock contributing sediment erosion, nutrients, and pathogens to streams

The agricultural areas of greatest concern are in monitoring areas 5-8 (see figures 3.3 – 3.10), in particular the areas in Exeter, London, and the lower half of Augusta and York Townships, where the sediment and phosphorus concentrations are highest, and the buffer widths are typically low. These areas also are currently experiencing less pressure for development compared to agricultural areas that remain in the upper watershed.

Summary

As a result, the developed and developing areas of the upper watershed are considered to be the most critical areas in the watershed. The developed and developing areas in the lower watershed are of less concern. The second most critical area is agricultural fields, particularly agricultural areas in the Exeter, London, and the lower half of Augusta and York Townships.

4.8 Impaired / Threatened Uses and Project Goals

The Stony Creek Watershed has three designated uses that are impaired: 1) warmwater fishery, 2) coldwater fishery, and 3) aquatic life/wildlife. The threatened designated uses include: 1) agriculture, 2) partial body contact recreation, 3) total body contact recreation, and 4) public water supply. The pollutants or challenges that threaten and impair these uses include altered hydrology, sedimentation/soil erosion, nutrients, pesticides, high temperature/ low dissolved oxygen, oil/grease/metal/brine/salts, pathogens, and hydrogen sulfide/dissolved solids. Seven specific project goals emerged from this assessment and were approved by the steering committee. They are described below.

4.8.1 Restore the warmwater fishery

The first project goal is to restore a warmwater fishery by reducing hydrologic impacts, sedimentation and erosion, and reducing loads of nutrients, pesticides, and oil/grease/metal/brine/salt. The designated use of warmwater fishery is impaired by altered hydrology and sedimentation/soil erosion and is threatened by nutrients, pesticides, temperature/low dissolved oxygen, oil/grease/metal/brine/salts, and pH. Hydrogen sulfide/total dissolved solids from gravel pit discharges has impaired the warmwater fishery and pending future discharges threaten the warmwater fishery.

Altered hydrology impairs warmwater fishery by producing increased and more extensive flooding that scours the stream system and destroys fish habitat, in particular the loss of pools.

In addition, water levels are typically lower than normal between storms, resulting in lower flow volumes which sustain fish population.

Eroded sediments inundate the surface waters of the watershed with large amounts of fine to sandy sediment that may abrade fish fins and gills and cover stream gravels that are important for laying fish eggs. Sediments also fill in deep pools that are important fish habitat. Decomposition of organic sediments uses oxygen, so it can lower dissolved oxygen in streams creating a potential hazard for fish.

Nutrients have the potential to degrade the warmwater fishery by leading to a drop in dissolved oxygen that is necessary for a healthy fish population.

Pesticides threaten warmwater fishery by being potentially toxic for fish. In addition, pesticides can build up in the fatty tissues of fish and be transferred to humans and other animals that eat fish from these streams.

High temperatures stress even warmwater fish and can lower dissolved oxygen levels in the creek to potentially fatal levels.

The presence of oil/grease/metal/brine/salts can have adverse health consequences for fish if present in high enough concentrations for long enough durations. Some metals build up in the fatty tissues of fish and can trigger health consequences for the fish and those who eat them.

Hydrogen sulfide/total dissolved solids from groundwater can cause impairment of the warmwater fishery because they can be toxic for fish. There has been documented impairment of the fishery in Stony Creek due to this practice from the now closed London Aggregates gravel pit discharges into the surface water system.

Levels pH threaten the warmwater fishery if they remain outside the range that is suitable for many fish species.

4.8.2 Restore aquatic life/wildlife diversity

The second project goal is to restore aquatic life/wildlife by reducing hydrologic impacts, sedimentation and erosion, and reducing loads of nutrients, pesticides, and oil/grease/metal/brine/salt. The designated use of aquatic life/wildlife is impaired by altered hydrology and sedimentation/soil erosion and is threatened by nutrients, pesticides, oil/grease/metal/brine/salts, and hydrogen sulfide/total dissolved solids.

Altered hydrology impairs the aquatic life/wildlife by producing increased flows that scour the stream system, destroying aquatic habitat.

Eroded sediments inundate the surface waters of the watershed with large amounts of fine to sandy sediment that cover a variety of aquatic habitat, lowering the diversity of aquatic life.

Nutrients have the potential to degrade the aquatic life/wildlife by possibly leading to a drop in dissolved oxygen that is necessary for diverse aquatic life.

Pesticides threaten aquatic life/wildlife by being potentially toxic for aquatic life.

The presence of oil/grease/metal/brine/salt can have adverse consequences for aquatic life/wildlife if present in high enough concentrations for long enough durations.

Hydrogen sulfide/total dissolved solids can cause impairment of aquatic life/wildlife because they can be toxic for aquatic life/wildlife.

4.8.3 Restore the coldwater fishery in Paint Creek

The third project goal is to restore a coldwater fishery by reducing temperatures in Paint Creek in addition to the above improvements for a warmwater fishery. Paint Creek is a designated coldwater trout stream. The designated use of coldwater fishery is impaired by temperature/low dissolved oxygen, altered hydrology, and sedimentation/soil erosion and is threatened by nutrients, pesticides, oil/grease/metal/brine/salts, hydrogen sulfide/total dissolved solids, and pH.

All of the known impacts of the above challenges are described under "warmwater fishery" except for cold temperature streams. Coldwater fish cannot tolerate sustained warm water temperatures or potentially lower dissolved oxygen levels that higher temperature waters yield. Due to changes in land use, Paint Creek no longer maintains temperatures for warmwater fish, much less coldwater species.

The Department of Natural Resources used to stock Paint Creek with trout, but has refrained from such actions for several decades due to the degraded quality of Paint Creek. The steering committee recognized the desire to restore the creek to its former quality as a coldwater fishing stream, but also recognizes that this is a long term goal. Restoring a warmwater fishery is a more attainable first step toward reestablishing a coldwater fishery, so the committee decided to make this designated use a lower priority than the others.

4.8.4 Protect agriculture

The fourth project goal is to protect agriculture by reducing hydrologic impacts and soil erosion. The designated use of agriculture is threatened by altered hydrology and sediment erosion in parts of the watershed.

Altered hydrology impairs agriculture by producing increased and more extensive flooding of fields. In addition, lower groundwater levels means less available water during dry periods that is more expensive to pump from deeper sources underground.

Sediment erosion from agricultural fields threatens the designated use of agriculture. Inadequate upland conservation practices allow valuable topsoil to be depleted or washed away during rain events and can result in reduced yields from fields over time.

4.8.5 Protect for partial body contact recreation

The fifth project goal is to protect partial body contact for recreation by reducing loads of nutrients, pathogens, pesticides, and oil/grease/metal/brine/salt. The designated use of partial body contact for recreation is threatened by nutrients, pesticides, pathogens, oil/grease/metal/brine/salts, and hydrogen sulfide/total dissolved solids.

Known sources of nutrients include agricultural fields, homeowners (urban and rural), commercial lawns and golf courses, livestock access to streams, storm sewers, and waterfowl waste. Known sources of pesticides include agricultural fields, homeowners (urban and rural), and commercial lawns and golf courses. Known sources of pathogens include homeowners (urban and rural), livestock, pet waste, waterfowl waste, agricultural fields and a suspected source for pathogens is human waste from sanitary sewers. Known sources of oil/grease/metal/brine/salts include impervious surfaces and homeowners. The known source of hydrogen sulfide/total dissolved solids is groundwater.

Nutrients threaten partial body contact for recreation by possibly building up algae in surface waters that can interfere with wading and fishing.

Pesticides threaten partial body contact for recreation by being potentially toxic for humans.

Pathogens threaten partial body contact for recreation by increasing the risk for human and animal illness through open sores or other areas on the body.

The presence of oil/grease/metal/brine/salts can have adverse consequences for partial body contact because the water can become unpleasant and the presence of these may indicate the presence of additional pollutants from the urban landscape.

Hydrogen sulfide/total dissolved solids can cause impairment of partial body contact for recreation because hydrogen sulfide, in particular, is toxic at high enough concentrations.

4.8.6 Protect for total body contact recreation

The sixth project goal is to protect total body contact for recreation by reducing loads of nutrients, pathogens, pesticides, and oil/grease/metal/brine/salt. The designated use of total body contact for recreation is threatened by nutrients, pesticides, pathogens, oil/grease/metal/brine/salts, and hydrogen sulfide/total dissolved solids.

Nutrients threaten total body contact for recreation by possibly building up algae in surface waters that can interfere with swimming.

Pesticides threaten total body contact for recreation by being potentially toxic for humans. Some pesticides build up in human tissues and can lead to cancer.

Pathogens threaten total body contact for recreation by increasing the risk for human and animal illness through open sores or other areas on the body.

The presence of oil/grease/metal/brine/salts can have adverse consequences for total body contact because the water can become unpleasant and the presence of these may indicate the presence of additional pollutants from the urban landscape.

Hydrogen sulfide/total dissolved solids can cause impairment of total body contact for recreation because hydrogen sulfide, in particular, is toxic at high enough concentrations.

4.8.7 Protect public water supply

The seventh project goal is to protect public water supply by reducing hydrologic impacts and by reducing loads of nutrients, pathogens, pesticides, and oil/grease/metal/brine/salt. The designated use of public water supply is threatened by altered hydrology, pesticides, nutrients, pathogens, oil/grease/metal/brine/salts, and hydrogen sulfide/total dissolved solids. The public uses groundwater as a water source in parts of the watershed.

Altered hydrology impairs public water supply by reducing groundwater levels. This means that there is less available water during dry periods that is more expensive to pump from deeper sources underground.

Nutrients threaten public water supply by being toxic or lead to "blue baby syndrome" at high concentrations in drinking water.

Pesticides threaten public water supply by being potentially toxic for humans. Some pesticides build up in human tissues and can lead to cancer.

Pathogens threaten public water supply by increasing the risk for human and animal illness through drinking contaminated water.

The presence of oil/grease/metal/brine/salts can have adverse consequences for public water supply because they can cause health consequences at high concentrations. Some metals are toxic or build up in fatty tissues to produce long-term health problems. In addition, the presence of these pollutants may indicate the presence of additional pollutants from the urban landscape.

Hydrogen sulfide/total dissolved solids can cause impairment of public water supply because hydrogen sulfide, in particular, is toxic even at low concentrations.

Chapter 5: Recommended Management Strategies

Strategies or management practices that help to decrease surface water pollution are called Best Management Practices, or BMPs. These BMPs can be structural, vegetative, or managerial. Structural BMPs are constructed structures that can help improve water quality by limiting soil erosion or better controlling stormwater. Vegetative BMPs use vegetation to control stormwater or filter pollutants. Managerial BMPs are ways of managing the land through policies or operational procedures that improve water quality. Together, these best management practices can help improve water quality compared to many of the practices that are in place today. Table 5.1 outlines all of the strategies described in more depth in the following pages. Education and information strategies and evaluation strategies are discussed in more detail in the following chapters.

The recommended strategies listed in Table 5.1 are based primarily on monitoring areas (from the water quality monitoring described in chapter 3). Figure 5.1 shows landuses within each monitoring area with pie charts to show the percentage of each landuse in each area. Strategies that are primarily for developed and developing areas are targeted primarily for areas that have a high percentage of urban landuse or that have undergone a fair amount of construction since 2000 (when the data for the map were collected). Along similar lines, strategies for agricultural areas are targeted for monitoring areas with a large percentage of agricultural area in the watershed.

5.1 General Strategies

<u>Develop Stony Creek Watershed Council</u>
Establish a Stony Creek Watershed Council under the Michigan Local Rivers Management Act 253 of 1964. Establishment of the Watershed Council will encourage continued cooperation among local Stony Creek Watershed jurisdictions in discussing issues related to Stony Creek and its water quality. The council can also coordinate, receive grants, or help other groups carry out many of the recommendations laid out below. It is highly recommended that a full time employee be hired to coordinate all activities recommended in this plan. This individual can be responsible for ensuring the plan is sustainably implemented and revised according to need.

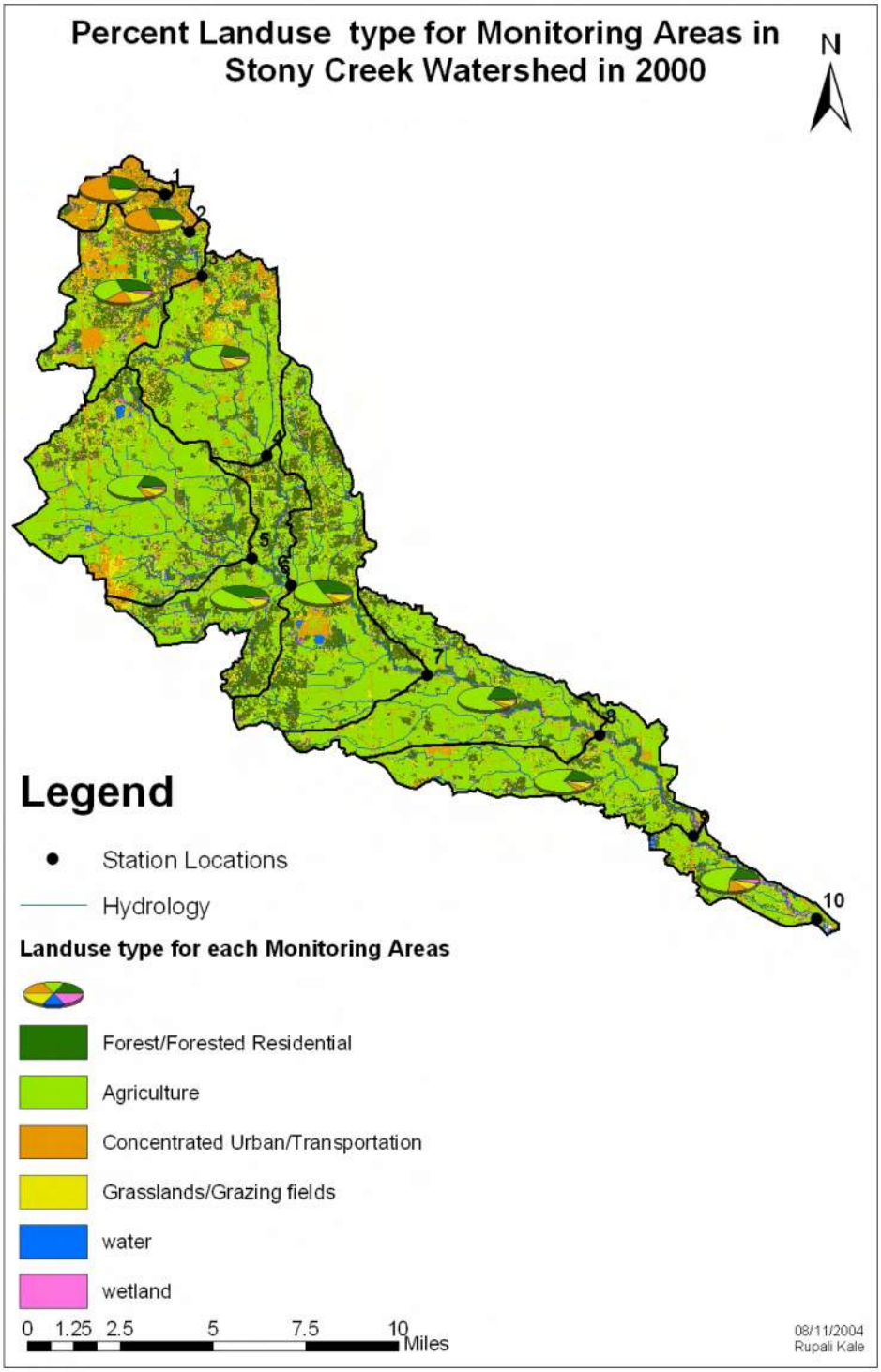

Figure 5.1: This map shows the percentage of landuses present in each monitoring area in 2000. Note the upper watershed has the highest percentage of concentrated urban landuse and the rest of the watershed is mostly agricultural, with the exception of monitoring area 4, which has undergone a transformation from agricultural to residential since the data were collected for this map.

5.2 Developed and Developing Areas

The primary focus of the watershed management plan is on developed and developing areas because the greatest concentration of surface water quality problems originates from these areas.

Hydrologic Study of the entire watershed
A hydrologic study of lower Stony Creek (almost entirely in Monroe County) was conducted in 1996 to address issues related to flooding. However, the upper portion of the creek system was not included during the study. With the developed and developing areas that are prevalent in the upper watershed, these areas are likely the ones most responsible for causing the downstream problems. In order to adequately address the problems of altered hydrology that lead to flooding, a comprehensive study of the hydrology of the entire watershed should be conducted to help refine the interaction of precipitation, infiltration, surface runoff, stream discharge, and storage. The study would refine information about water velocity, discharge, flood elevations, channel erosion, storm drains, bridges, and culverts. This study can also help refine the location and severity of particularly problematic source areas that result in high flows and bank erosion. In addition, a new hydrologic study of the lower watershed can help determine the effect of the log jam removal that took place during the summer of 2004 as a result of a local lawsuit. The new study could help determine whether significant log jams that are causing bank erosion and problematic local flooding should be removed.

Implement Consistent Stormwater Management Standards
Development and redevelopment proposals are subject to a range of storm water management regulations depending on the location, size and use of the property. Road Commissions, municipalities and Drain Commissioners may have overlapping jurisdiction, but separate storm water standards. Many of these standards are designed to protect downstream flooding. Typical flood control requires that the 10-year storm be detained on site and released slowly after a rainfall. Less common are requirements that detain the more common smaller storms that affect water quality.

In addition to flood control, first flush and bank full treatment should be implemented to protect downstream water quality. First flush is the initial water that washes off the landscape during a storm, which typically is the most polluted because it picks up all contaminants that are sitting around at the surface. It is recommended that the first flush be directed into the ground where many of the contaminants can be partially cleaned by soil bacteria before the water reaches streams. Bank full treatment refers to holding enough water on site to prevent high water flows that do not result in flooding, but that are highly erosive of the stream banks. These erosive flows are more frequent after development unless stormwater management addresses the bankfull floods as well as the 10 year flood. It is recommended that local communities apply the Washtenaw County standards to all new developments. The goal is to keep as much water as possible onsite during rain events across the entire watershed to prevent problems associated with altered hydrology.

Low Impact Development (LID) Roundtable Discussion

There are numerous local ordinances that control the way development takes place, however, many of those ordinances require specifications that were originally designed for drainage or other goals that do not adequately address the quality and quantity of water that enters streams during rain events. For example, the allowable width of roads is usually designated in county or city ordinances. Wide roads increase the amount of water that runs quickly to streams. Roads that have low traffic volumes could be much smaller and make a smaller impact on local streams.

A roundtable discussion of LID strategies among local planning commissioners and elected officials in all the watershed townships could help in educating township boards about LID strategies and could help watershed jurisdictions work toward a common set of strategies to limit the impact of new developments on the watershed streams.

Enhance Site Plan Review

Local communities can revise site plan review standards to include the 100-year floodplain, location of water bodies, location of slopes over 12 percent, site soil types, location of landmark trees, groundwater recharge areas, vegetation types within 25 feet of water bodies, woodlands and other vegetation on site, and site topography, if applicable.

Local Open Space (Natural Areas) Easement

Counties or townships may accept or purchase easements from private landowners for open space and resource conservation purposes, essentially the purchase of development rights. Land owners may also donate easements to land conservancies. Upon transferal of an easement to the local government or land conservancy, restrictions are placed on the use of the property as open space (natural area) or resource conservation. Uses are enforced and restricted so that the land can provide benefits to the landowner and the watershed, primarily in the form of continuing to aid in infiltration of water that can help sustain groundwater levels, and reduce pollution of surface water.

Natural Features Ordinance

Local communities can adopt ordinances that explain the importance of protecting key natural features and how they will be protected by law. Local protective ordinances can be better adapted to local conditions and more protective than state and federal protections. This process can provide a framework for land development while protecting key features. Among the features that may be considered for protection may be floodplains, woodlands, farmland, and open space (natural areas). Large parts of Stony Creek and Paint Creek have natural features that are rare in Southeastern Michigan -- a wide wooded floodplain that is intact. This natural feature is a treasure that should be protected by local ordinances. Not only is the floodplain a beautiful area, it helps prevent flooding of areas further downstream, helps improve water quality, and provides a wonderful habitat for wildlife. County planning offices or the Huron River Watershed Council can provide sample ordinance language to help protect the floodplain and other natural features in the watershed.

Wetlands Ordinance

Destruction of wetlands causes a change in the natural hydrology that degrades water quality and the character of nearby streams. During storms, wetlands take in stormwater, thereby preventing the water from taking a rapid route to streams that results in high peak flows. In addition, wetlands capture sediments and pollutants and provide clean water to groundwater storage and are also home to a variety of wildlife. Wetlands are a natural treasure for outdoor enthusiasts. Today, only a tiny fraction remains of the original natural wetlands that made up at least half of the Stony Creek Watershed. Federal and state laws protect some wetlands (in counties with 100,000 or more people, wetlands 5 acres or larger, and wetlands within 500 feet of a water body). Smaller wetlands require local wetland ordinances for protection. Together, many small wetlands can help provide a cleaner, healthier watershed. Model wetlands ordinances can be obtained from the MDEQ Michigan Coastal Zone Program or the Huron River Watershed Council. All townships should adopt a more protective wetlands ordinance.

Construct and Maintain Stormwater Retention/Detention

Design, construct, and maintain stormwater retention/detention structures that meet or exceed county drain rules. These structures can limit the flow in the creek system during storm events either by temporarily storing runoff for gradual release (detention) or encouraging infiltration (retention - preferred). Wet detention ponds (below) provide for both control of water volumes as well as water quality by partially cleaning water before it is released to the local stream.

Construct/Maintain Wet Detention Ponds

Wet detention ponds are stormwater control structures that maintain a pool of water with emergent aquatic plants planted around the border. This type of system controls water volumes as well as water quality by partially cleaning water before it is released to local streams. Particles settle in the basin while dissolved material is removed from the water by biologic uptake. The structure is designed to retain water from each storm and treat it until the next storm displaces that water. Overflow channels are established for extraordinarily high water volumes. A vegetated buffer should be installed around the structure to decrease goose habitat and to increase the aesthetic appeal of the structure. Proper maintenance is required for 5-10 years after construction to ensure the proper establishment of wetland vegetation in the pond.

Bioretention Systems

Bioretention systems are lowered vegetative parking lot islands or shallow landscaped depressions that clean stormwater runoff before sending it on to the stormwater conveyance system. Runoff is directed toward the bioretention systems where it filters through the vegetation, mulch, and soils. The system is designed with an emergency overflow directed to a stormwater conveyance system for inputs higher than the designed capacity.

Infiltration Systems

Infiltration systems include infiltration trenches, infiltration basins, and permeable pavements. An infiltration trench can be constructed in residential areas where curb and gutter would otherwise be considered. The trench has no outlet and is filled with rock overlying permeable soil. Incoming water infiltrates in the trench, but must be pre-treated by passing through a swale or detention basin prior to entering the infiltration trench.

An infiltration basin captures most surface water from small storms for infiltration into the ground rather than discharged to a stream. The result is improved water quality and quantity in local streams. Use of permeable pavement allows water to infiltrate in developed areas that would otherwise produce 100% runoff (impermeable pavements).

Grassed/Vegetated Swales

Grassed/vegetated swales are vegetated channels that run along residential roads or highways that receive stormwater runoff. They are similar to traditional drainage ditches, but they have gentler downchannel slopes and flatter side slopes. They are basically designed to slow down the conveyance relative to traditional drainage ditches to enable water to be filtered as it passes through the vegetation and infiltrates into the substrate soils.

Disconnect Directly Connected Impervious Areas

Residential areas are often designed principally to move water off-site as quickly as possible. Lawns are graded toward the street and gutter downspouts and footing drains/sump pumps have been routed directly to the stormwater conveyance system. Planning developments that direct downspouts and sump pump toward green spaces or rain barrels can reduce peak flows in local streams by preventing rapid connection of water discharges to the stream system. Planning departments can encourage this practice by including it in their Zoning Ordinance.

Municipal and Residential Rain Gardens

Rain gardens are attractive landscaping that use native wildflowers, shrubs, and grasses in a depression in a lawn or along impervious surfaces such as driveways, sidewalks and beyond roof downspouts. Rain gardens pool the first flush (the most contaminated) stormwater and clean the water by forcing it to filter through roots and soil. Using plants native to the area means that plants, once established, require little effort to maintain. A municipal rain garden is proposed for the Ypsilanti Township Public Library using volunteers from the community to help establish the garden. This rain garden can serve as an example of the concept for the community. Hopefully, community involvement in the project will encourage community members to establish their own residential rain gardens at home.

Green Roofs

Green roofs are durable, easily maintained roof systems that support plant growth. With carefully selected plants, a green roof will last much longer than a traditional roof, provide energy efficiency savings, as well as significantly reduce the runoff normally prevalent with traditional roof systems. A green roof has recently been constructed on the Ford Motor Company's Rouge Plant in Dearborn, Michigan and the Malletts Creek Branch of the Ann Arbor District Library.

Alternative Road Specifications (for low-traffic roads in new developments)

Roads within new housing developments are often designed to uniform specifications whether the road experiences heavy or light traffic volumes. By permitting narrower widths than county road standards for low-traffic roads in new developments, the imperviousness of the landscape can be reduced while producing the side benefit of safer residential roads for walking and playing children.

Soil Erosion and Sedimentation Control Enforcement: Mudbuster Program

Michigan has long had regulations in place to minimize the negative impact of soil erosion during construction of 5 acre or larger lots. These Soil Erosion and Sedimentation Control (SESC) measures include sediment trapping devices (silt fences, filter fabric on drain inlets, and catch-basins) and erosion control efforts (soil stabilization). These efforts are planned for construction sites, but are often enforced inadequately. One way to ensure the enforcement of SESC regulation is to hire an adequate staff for enforcement efforts. A more cost-effective means of improving SESC enforcement would be reviving the Mudbuster Program. This program, supported by the Washtenaw County Drain Commissioner's office, would train volunteers to inspect construction sites daily (on the way to work, for example) and to report suspected violations to the Mudbuster Program Coordinator (possibly even documenting with digital photos). This coordinator can then pass on relevant information to enforcement officers for action.

Sand and Organic Filter

A sand and organic filter can be constructed beyond the outlet of settling basins. Larger particles settle out in the settling basins, but finer sediments take a long time to settle out. Therefore, a second chamber filled with sand, a sand/peat mixture, or other filtering medium can help remove finer particles and/or dissolved pollutants (depending on the filtering medium) before discharge to streams.

Street Sweeping

High-powered street sweeping of roads and parking lots removes sediments and other pollutants which might otherwise make their way to nearby streams during storm events. Street sweeping is particularly recommended during (or prior to) spring snowmelt in cold climate areas.

Golf Course Nutrient Management

In order to maintain their turf, golf courses tend to use fertilizers and herbicides that often wash into local streams. The Michigan State University-Extension offers a golf course nutrient management program that certifies golf courses that use environmentally sensitive buying and landscaping practices such as alternative turf management, reestablishment of wetland and watercourse buffers and retrofitting of water hazards to stormwater detention basins. All current and future golf courses should become certified members of the program.

Native Vegetation Restoration Program

Native vegetation within the Stony Creek Watershed has mostly been converted to agricultural and urban vegetation to which people apply cultivation chemicals. Native plants require less water and maintenance because they are adapted to the local climate, improve infiltration, stabilize soils, and provide habitat for native insects and wildlife. A native landscaping ordinance can reduce the barriers to planting native vegetation in residential and commercial areas. As a part of the Mill Creek Watershed Plan, a Native Vegetation Restoration Program was proposed that would enable trained staff to provide technical services to the community related to native landscaping. This program could also be involved in restoring portions of the Stony Creek Watershed with native vegetation.

Illicit Connection Correction
There are often unintentional or purposeful connections of sanitary sewers or other sources directly to stormwater sewers (that drain directly to streams). Phase II Stormwater management communities are required to disconnect these illicit connections to ensure that only stormwater enters stormwater sewers.

5.3 Agricultural Areas

The secondary focus of the watershed management plan is on agricultural areas because the second greatest concentration of surface water quality problems originates from these areas. Most of the recommendations listed below are recommended to be refined after the Inventory of Agricultural Conservation Practices is completed and specific areas can be targeted for implementation efforts. Most of the estimates of level of effort for Agricultural strategies come from percentages of agricultural acres determined from the inventory of Mill Creek Watershed completed recently in a nearby location with characteristics similar to the Stony Creek Watershed.

Inventory Agricultural Conservation Practices
A comprehensive inventory of agricultural conservation practices should be conducted across the agricultural areas of Stony Creek Watershed to determine what practices are being used and where they are being used, and to identify areas where conservation practices are not currently being used, particularly where those practices could provide clear benefits to farmers and to the quality of surface water. This inventory should be completed by trained professionals from county soil conservation districts. Following the inventory plans for agricultural conservation implementation efforts can be more specifically defined by concentrating on the areas of greatest need and greatest potential impact.

Riparian Buffer
Riparian buffers are vegetated areas alongside streams or other water bodies that provide a physical separation of the water body and bordering land uses. Buffers slow runoff velocities and remove pollutants such as sediment, nutrients and pathogens. USDA programs help pay for these practices for eligible landowners. Refer to Figure 3.12 for the location of problem buffer widths identified in the watershed survey. Priority should be given to buffers less than 10 feet wide, then where buffers are less than 30 feet wide.

Grassed Waterways
A grassed waterway is a broad, shallow channel constructed or maintained on farmland to move surface water without causing surface soil erosion. Often, grassed waterways are constructed in previously existing low areas in a field. Maintaining a vegetated cover helps protect soil erosion and the development of rills and gullies. USDA programs help pay for these practices for eligible landowners.

Grade Stabilization Structures
A grade stabilization structure is used to drop the elevation of a channel (like a grassed waterway) to a lower level without inducing erosion of the channel and gully formation. Often,

the structure consists of a cross-channel embankment or dam with an outlet pipe at the base to drain the upslope channel to a lower elevation. USDA programs help pay for these practices for eligible landowners.

Conservation Cover

Conservation cover involves establishing and maintaining permanent vegetative cover to protect soil and water resources and is useful for land that is retiring from agricultural production.

Conservation Crop Rotation with Cover Crop and Mulch/No-till

Conservation tillage methods such as mulch or no-till, are effective methods for reducing soil erosion on agricultural fields because the soil is not broken up and exposed on the surface. Cover crops are vegetation grown solely to protect the ground from being exposed before harvest crops grow on the land. Unfortunately, these tillage methods can lead to problems such as soil compaction, perennial weeds, plant disease, and slow early season growth. Crop rotation, planting a recurring sequence of crops in the same field, can increase yields dramatically over planting a single crop year after year. Research has shown that the benefits of crop rotation can overcome the difficulties associated with conservation tillage. As a result, these three practices, together, make an effective approach to maximizing yields while minimizing damage to the environment.

Nutrient Management

This BMP involves managing the amount, source, form, placement and timing of the application of nutrients and soil amendments on agricultural lands. The goal is to maximize the nutrient benefits to crops while minimizing excess nutrients that cause environmental damage. Efficiency is the key and ultimately increased profits are common. Through voluntary measures called Generally Accepted Agricultural Management Practices, or GAAMPs, agricultural landowners can obtain guidelines for nutrient and pesticide application and storage, manure management, groundwater protection, and many other agricultural BMPs. County Conservation Districts have outreach programs for landowners to learn about such recommended practices. This program should be used as much as possible to control potential pollutants from impacting local streams.

Waste Storage Facility

Waste storage facilities are embankments, pits or other structure used to temporarily store liquid or solid waste until it is spread on the land. The temporary storage helps keep it safely stored so that is does not wash off the landscape into local streams. USDA programs help pay for these practices for eligible landowners.

Livestock Use Exclusion

Water quality can be degraded when livestock have direct access to streams. Animals cause erosion by continued trampling of stream banks and by removing riparian vegetation. These sediments wash into streams and cause sedimentation problems. Livestock with stream access also add nutrients and pathogens to the water through their waste. Livestock continue to have access to the Stony Creek system in a few places. Fence installation and maintenance should take place to keep livestock at least 25 feet from local streams and drains. USDA programs help pay for these practices for eligible landowners.

There is one recommended location for implementation of this practice based on the watershed survey: upstream of the first crossing north of Arkona Road on Sanford Road (near Milan). Cows have regular access to the stream and have caused tremendous erosion as well as added nutrients and pathogens to the stream via animal waste entering the stream directly.

Vegetative Filter Strips

A vegetative filter strip is an area, generally at the lower end of a field, of grass or other permanent vegetation that is intended to trap sediments and other pollutants by slowing the velocity of sheet flow and by providing some infiltration into the ground. Filter strips can also be used to prevent wind erosion with 1) a Cross Wind Trap Strip – Field, a wind resistant vegetative cover established in one or more strips across the prevailing wind erosion direction or 2) a Cross Wind Trap Strip – Filter, a wind resistant vegetative cover established adjacent to waterways across the prevailing wind erosion direction. USDA programs help pay for these practices for eligible landowners.

The level of effort needed for vegetated filter strips was calculated as follows:

1. Stream length (est. 158 miles = 834240 ft) % Ag acres (56%)
2. #1 X 2 (for both sides of stream)
3. #2 X (% of stream length still needing treatment)*
4. #3 X 30 (avg. width of strips in feet)
5. #4 divided by 43,560 (to convert feet to acres)

Total = about 13 acres

* = For Mill Creek, this figure was 1.3% of the Agriculture acres, estimated by examining aerial photos and calculating the amount of untreated stream length in several representative areas, then extrapolating this calculation across the entire Agricultural area. Since the Stony Creek Watershed has a greater percentage of stream length still needing treatment, the number used in this calculation was 2%.

Purchase/Acquisition of Development Rights

A Purchase of Development Rights ordinance is a government initiative that limits development by obtaining the development rights of property. This initiative helps protect natural areas or agricultural land and guides development toward other areas more suitable for development. It is important to identify areas that should be protected, then purchase the development rights or properties outright. Purchase of Development Rights could also help establish or maintain greenways for wildlife or recreation. Land owners may also donate or sell development rights to a Land Conservancy or Land Trust.

5.4 Stream Channels and Roadways

Road/Bridge Surface Stabilization

Many roads in the watershed are not paved. These unpaved roads often become eroded and road materials find their way into local streams. By altering grading practices, selecting new road/bridge surfaces, or retrofitting bridges, erosion at road surfaces at the sites identified in the road stream crossing survey can be improved to prevent sediments from entering streams. See Appendix "road approaches" for recommended locations for implementation.

Soil Stabilization at Road Crossing Embankments

In a number of places in the watershed the road crossing embankments are eroding and dumping sediment directly into the stream. The erosion is created either by water running off road surfaces during storms or by high stream flows cutting into or around an embankment. The locations identified in the road stream crossing survey should be stabilized. In some cases, altered hydrology may be responsible for the problem, thus completion of a hydrologic study prior to stabilization of these structures would be beneficial. See Appendix "crossing embankments" for recommended locations for implementation.

Culvert Replacements

During the course of the road stream crossing inventory, several problems were noted that resulted from undersized culverts, including the ponding of water upstream by the culvert and downstream erosion associated with increased flow velocities created by increased upstream pressure on the system. In order to correct this problem, a hydrologic study must be completed to determine the impact of upstream development on these downstream crossings. Only then can a properly sized culvert be designed that will allow the proper flow of water under roads. See Appendix "perched culvert" for recommended locations for implementation.

Bank Restabilization

Places in the watershed, particularly downstream of urban areas, are experiencing destabilizing stream bank erosion. In places, the banks should be stabilized to prevent further erosion. In order to adequately address the problem, however, the hydrology should be studied first. Stream bank stabilization works either by reducing the force of the flow or increasing the strength of banks. If high peak flows are the problem, then the hydrology should be stabilized before attempting to stabilize the banks. Stream banks can also be stabilized by engineering methods such as installing riprap, deflectors and gabions. Bioengineering uses vegetation to stabilize stream banks. Vegetating stream banks can increase their strength because roots hold the material together, plants provide a barrier to the force of the water, and plants can remove water from banks. Vegetation can also provide other benefits, such as shading the stream and providing habitats for aquatic and terrestrial wildlife. Biotechnical methods involve the paired use of biological and high-tech materials for reinforcement. Stabilization methods using vegetation help to improve habitats and aesthetics. Refer to Figure 3.15 for the priority sites for bank restabilization. The most important sites are north of Oakville-Waltz Road on Paint Creek and Stony Creek.

In some places in the watershed logjams can be so large that they contribute to the erosion of the banks and add sediment load to the stream conveyance system. In cases where logjams are contributing considerable harm to the banks, it could be recommended to remove them after completion of a hydrologic study of the entire watershed.

Implement Alternative Drain Practices and Rehabilitation

Many of the problems in the watershed are caused by channelization of streams for the purpose of rapid drainage of the land. Drainage is the job of the Drain Commissioners; however, there are opportunities to return some drains to a more natural condition. In places where agricultural areas are being converted to urban uses, especially in Ypsilanti and Augusta Townships, opportunities exist to implement alternative drain practices and rehabilitation. To restore hydrologic function to the creek in areas converting to urban uses, drainage tiles can be broken in developing areas in conjunction with rehabilitation of drains. In addition, alternative drain practices can be implemented in agricultural areas. One way to improve drainage with a smaller impact on peak flows is to construct larger drains with a built in floodplain. In this way, water can leave fields rapidly, but spend more time in drains before contributing to downstream flows.

Ash Tree Removal and Restoration in floodplains

The emerald ash borer is killing ash trees that grow in the forested floodplain of the Stony Creek Watershed. Concern has been raised that the trees will die and fall into the creek, destabilizing banks and causing large logjams. Stabilization of banks and flow of water is threatened by this sudden die-off of infected trees. In order to prevent these problems, removal of some dying or dead trees that threaten to fall into the creek is advisable. Removal of trees should be followed by tree replacement with appropriate native vegetation through a program such as the Michigan Department of Natural Resources Emerald Ash Borer grant program, funded by the USDA Forest Service. This program provides up to $20,000 per community to replace trees lost to the infestation. Michigan Department of Agriculture programs provide free wood disposal of Ash trees requiring disposal.

5.5 Educational Outreach

I&E: Yard care, native landscaping, Septic System Maintenance, Vehicle Maintenance and oil disposal

“I & E” stands for Information and Education. By educating the public about the ways in which current behaviors might affect the watershed and informing them about some alternatives, a change in behavior is likely to result. Many watershed residents use pesticides and fertilizers without knowing how much to use, or realizing that there are other ways to achieve the same result without using chemicals. Septic System failures can be devastating to water quality (and to a homeowner's financial situation). Educating the public about proper and prudent septic system maintenance can help avoid problems. A variety of toxic fluids are contained within vehicles. The impact of those fluids on the watershed can be minimized when citizens are informed about ways to lessen those impacts. The education and information plan is further detailed in Chapter 6.

5.6 Monitoring and Stewardship

An evaluation process will provide measures of the effectiveness of strategy implementation (outlined above) at achieving watershed goals. Evaluation methods can document successes in implementation efforts or can show where improved strategies are necessary to make a positive impact on water quality. The main recommended programs include water quality, macroinvertebrate, and hydrologic monitoring. Volunteers from the watershed should be utilized where possible to promote education and stewardship while producing cost-effective usable data to help evaluate/reevaluate the plan strategies. The monitoring and stewardship plan is further detailed in Chapter 7.

Chapter 6: Public Information and Education

The public plays a vital role in watershed management plans because the public is often inadvertently the cause of some pollution of surface water. As a result, the support and cooperation of the public is necessary to make a positive impact on water quality in the watershed. This section of the watershed management plan outlines the public education strategy to reach target audiences and to track the impact of education efforts. The goal of the public education plan is to 1) increase awareness of water quality issues in the watershed, 2) deliver key messages to target audiences about ways to reduce the pollution of the watershed, 3) increase public actions that contribute to increased water quality for the watershed, and 4) ultimately reduce pollution in the watershed.

6.1 Target Audience and Message Priorities

In the Stony Creek Watershed, the priority areas of concern are residential areas, particularly the urban and urbanizing areas in the upper watershed. As outlined earlier in this watershed management plan, these areas reflect the greatest concentration of the major pollutants of concern in the watershed and the greatest concern about altered hydrology that impacts the rest of the watershed. As these developed areas expand in the watershed in the near future these issues of concern will increase, underscoring the importance of educational efforts. As a result, the primary target audience for education is homeowners in the developed and developing areas of the upper watershed.

The main issues and concerns that need to be communicated to these homeowners include:

1. General awareness of water quality issues and challenges in the watershed;
2. Beneficial lawn and garden practices such as mowing habits, fertilizer and pesticide use, yard waste disposal, landscaping with native plants and water conservation;
3. Housekeeping practices and disposal of toxic wastes; and
4. Surface water retention by retaining water with rain barrels and washing cars on lawns.

Rural residents can benefit from this same information. Septic maintenance, however, is of greater concern for rural residents, especially those living along the creek system. Education about septic system maintenance is best performed during sale of properties using septic systems and is performed at very low cost. Although septic systems are not as great a concern for the watershed as urban lawn and housekeeping practices, education efforts are generally cost-effective.

The second priority areas of concern are agricultural areas. Many farmers have adopted conservation techniques that limit the impact of farming practices on surface waters. However, many local farmers could be better informed of the benefits of conservation practices and opportunities such as:

1. Advantages of and opportunities for buffer and filter strips;
2. Impact of tillage methods;
3. Importance of agricultural soil erosion and sedimentation control practices;

4. Impacts of fertilizer/pesticide use and alternative options;
5. Impacts of livestock waste and alternative options; and
6. Opportunities for farmland conservation partnerships.

6.2 Marketing Plan

The marketing plan for the Stony Creek Watershed can be broken into four types of market outreach: publicity, direct mail, paid print advertising, and retail promotions (see Table 6.1). It is important to note that these marketing vehicles are designed to run concurrent, thus "flooding" the market with messages in short bursts (called "flights") throughout the year. For example, marketing efforts related to lawn care practices are concentrated in the early spring, when purchasing decisions are being made for the coming season.

Publicity through local radio, cable TV, newspapers, and newsletters, as noted in Table 6.1, promotes the watershed management plan to the public and generates general awareness of the watershed and ways to protect the watershed. This is a no-cost way to reach a large number of watershed residents while increasing awareness of the Stony Creek Watershed to the broader community. The DVD suggested for cable TV is on managing turf in the home landscape, developed by Kevin Frank, a turf grass specialist in the MSU Crop and Soil Science Department.

Direct mail puts information about water quality in the hands of each individual who can make an impact on water quality in the watershed. The Huron River Watershed Council (HRWC) has developed color coded "tip cards" with effective messages about water quality on a variety of topics including lawn and garden care, automotive care, home toxics disposal, and protection of storm drains. These tip cards can be distributed to Stony Creek Watershed residents at a minimal charge since there are no design or development costs; only printing and mailing costs are noted in the estimate. The HRWC also produces a calendar for their residents with tips for improving water quality by making changes in home management practices. This calendar can be adapted for the Stony Creek Watershed and distributed to residents at minimal cost. A riparian brochure could be developed to inform residents who own property on the creek system of special considerations for land bordering surface waters.

Septic system education is best done through handouts. Often people buy homes with septic systems without the knowledge to properly maintain the systems. When property with a septic system changes hands, a handout provided by a realtor can help the new resident take proper care of this important protector of water quality. Distributing information in this fashion means that the information can go right into the hands of those who may need it most before problems arise. As noted in Table 6.1, the cost is minimal for distributing material during a home transaction.

Handouts can also be provided to farmers and other visitors at County Fairs to educate them about the benefits of and opportunities for conservation practices on farms and rural homesteads. Having a booth or distributing flyers at a county fair can be a cost-effective way to reach this audience.

Paid print advertising in local newspapers can reinforce information that is sent directly to homeowners. The advertising is intended to encourage watershed awareness and highlight information from the tip cards to increase the likelihood that residents absorb information and remember to make desired changes in home and garden habits.

Promotion of soil testing through print advertisement and flyers can increase participation in the MSU-Extension soil testing program. Many residents do not realize that their lawns and gardens may already have abundant amounts of some nutrients and lacks other nutrients. Soil tests can help residents find the appropriate blend of fertilizer that is needed for their lawn, yielding a cost-effective application that reduces the potential pollution of surface water in the watershed (Table 6.1). Partnering with the Soil Conservation Service or the Extension Service may provide a cost effective means of making this information available.

Promotional and trade partnerships must be cultivated, leveraging existing funds to obtain increased exposure. For example, a retailer may assist with advertising costs and/or a customer satisfaction survey.

Evaluative mechanisms are specified in Table 6.1. These include tracking coupon redemptions, evaluation forms, tracking phone calls, and monitoring the number of soil tests conducted in the watershed. Partnerships will also be critical to expanding evaluative capacity. For example, asking a toxics drop-off facility to survey participants shortly after a related media campaign can help determine where people get information regarding toxics, plus allows for monitoring changes in the number of drop-offs.

This proposal suggests an ambitious multi-faceted marketing plan for the Stony Creek Watershed. Should the level of funding required to implement such a plan not be available, revisions should be made to reduce both the scope and cost of the plan. Concentrating resources over a short period of time (i.e. 4 weeks) may help preserve the market impact despite reduced placements.

6.3 Other Educational Opportunities

A number of other opportunities for education and information sharing have been included in the recommended strategies described in Chapter 5. For example, the proposed construction of a municipal rain garden by the Ypsilanti District Library and multiple private rain gardens within the watershed offer hands-on opportunities for the public to learn about water quality and to learn how to make a positive impact on the watershed through construction of rain gardens. Similarly, a roundtable discussion among planning commissioners, elected officials and interested residents regarding Low Impact Development models is an opportunity for a Stony Creek Watershed facilitator to engage and educate the community about development issues that impact water quality.

Evaluation techniques outlined in Chapter 7 also offer opportunities to engage the public in stewardship of the watershed. In addition, they provide opportunities to educate the public about ways individuals can help minimize their contribution to water pollution.

Chapter 7: Implementation and Evaluation

Chapter 5 and 6 of the watershed management plan identifies a number of specific steps to be taken to address the pollution problems in the Stony Creek and its tributaries and the challenges posed to the watershed itself. The following section identifies a suggested timeline for action and a later section describes the concomitant evaluation efforts that will need to be undertaken to assess the impact of steps taken.

7.1 Implementation Efforts

The recommendations for action of the Stony Creek Steering Committee described in Chapter 5 and 6 represent an ambitious agenda for addressing and ameliorating the problems identified over the course of two plus years of assessment and planning. Collectively they represent a long-term agenda for action, though presented in terms of a five year action plan. As noted below, it will also require creation of a monitoring program and periodic evaluation to assess progress toward the goals spelled out by the Steering Committee.

In considering the extensive action agenda, however, it is clear that there are both short term and long term steps toward improving water quality in the Stony Creek system and the quality of life in the Stony Creek Watershed. The following section identifies those deemed immediate first steps.

7.1.1 Short Term Actions

Several immediate steps should be taken to begin the process of implementing the Stony Creek watershed management plan. Each will require initiative on the part of one or more of the communities or groups in the watershed to secure funding and support local efforts.

Stony Creek Watershed Council: The first step in implementation involves organizing and developing a formal watershed council. The foundation for such a step has been established in the form of the Stony Creek Steering Committee that has functioned over the past two years. The watershed council would build on the foundation, with additional membership to represent other key stakeholders in the two county region, including environmental groups, agricultural and farm interests and development and real estate interests, among others. Once this broader membership is established, next steps include drafting a set of by-laws and filing the legal paperwork to secure 501c3 status. The nationally recognized Huron River Watershed Council has indicated a willingness to assist in this development process, and a number of volunteers and residents in the Stony Creek watershed have worked with the HRWC in the past.

The intent is to establish a broad based continuing entity that can serve as:

- Catalyst—initiating or prompting action by others to secure support for the recommended strategies included in the management plan;
- Facilitator—bringing together interested groups, governmental bodies and residents to bring visibility to the challenges facing the Stony Creek watershed and the need for collective action;

- Coordinator—insuring that efforts across the watershed are coherent and cost-effective, avoiding duplication and building on the success of one another;
- Advocate—securing appropriate action on a whole range of measures designed to minimize the impacts of development on the watershed and the quality of the water in the creek system.

Just as important, a continuing entity like a watershed council can serve the important roles of monitor and evaluator noted explicitly in the narrative in Chapter 7.

Hydrologic Study of the Watershed: As noted in Chapter 5, many decisions about necessary strategies for improving conditions in the watershed require better information on flow conditions in the creek system; e.g., erosion, flooding, log jams, and so on. Thus, a second immediate action step is to secure funding for and complete a comprehensive study of the hydrology of the entire creek system. Parts of the creek system have been studied in the past, but a comprehensive study is warranted to guide decisions on implementation. Such a study could take several months but is integral to subsequent decisions by the newly formed Stony Creek Watershed Council.

Other Analyses: Two other important areas of analysis identified in the watershed management plan warrant immediate attention. One involves an inventory and assessment of local development standards and ordinances covering wetlands, open space, natural features and drainage. Given the diversity among the many units of government in the watershed, there are different development standards, and in some instances, no local ordinances or regulations governing wetlands or natural features. The analysis should identify "best practices" in the watershed and build consensus around a common and consistent set of regulations by municipal units across the watershed. There is considerable diversity among the eight townships in the watershed, for example, ranging from densely settled urban residential areas to primarily rural and agricultural areas. But, developing a common set of local ordinances will protect the watershed, the interests of current and future residents, and the needs of developers who are looking for consistent and equitable treatment from local governments.

A second area of analysis designed to guide decisions on action relates to agricultural areas in the watershed. The Steering Committee identified a number of specific strategies related to agricultural practices that can prevent pollution from entering the creek system What is required first, however, as noted in Chapter 5, is a detailed inventory of agricultural practices and areas designed to allow targeting of effort by the new Stony Creek Watershed Council.

Information and Education: A third broad set of short run actions involve the recommended information and education strategies. As noted in Chapter 6, many of these involve minimal effort and limited costs, since most of the materials have already been developed and will require simple adaptation for use in the Stony Creek watershed. Yet implementing a small number of such efforts offers several benefits. It will alert residents in the watershed to the emerging collaborative effort under the auspices of the Stony Creek Watershed Council, provide visibility and contact information for the new council, and establish a baseline for an expanding information and education efforts over time.

7.1.2 Long Term Actions

As the above discussion suggests, immediate efforts are devoted to creating a capacity for continuing action and supporting further study designed to facilitate targeting of attention and action across the watershed. Longer term efforts are devoted to BMP's in both developing and agricultural areas designed to reduce run-off and minimize pollution. These include development of retention/detention, infiltration and bioretention systems at selected locations in the watershed and in conjunction with development as well implementation of advanced agricultural practices in targeted areas.

Similarly, given limited resources in the two local Road Commissions and the long lead time required to integrate proposed road stream crossing improvements into capital improvement plans, soil stabilization, culvert replacement and bank restoration strategies are viewed as long term efforts.

Finally, monitoring and evaluation efforts will of necessity be ongoing, a key role of the new Stony creek Watershed Council, as the next section suggests.

7.2 Evaluation

An evaluation process will provide measures of the effectiveness of strategy implementation (outlined above) at achieving watershed goals. Evaluation methods can document successes in implementation efforts or can show where improved strategies are necessary to make a positive impact on water quality. In addition, if practices can be shown to be successful, support can be more easily garnered for sustaining or expanding the successful efforts within the watershed. Finally, involving the public in appropriate elements of the evaluation process can also constitute an effective public information and education strategy.

7.2.1 Qualitative Evaluation Methods

Qualitative methods of evaluation can be used to determine whether water quality goals are being met or whether progress is being made toward those goals. These methods can also be used to determine whether the watershed plan needs to be revised if little progress is being made. Qualitative measures of success can show that the programs put in place may, over time, have a positive effect on stream conditions, even if quantitative measures (discussed in the next section) show little improvement over a short time frame.

Table 7.1 shows a list of qualitative evaluation methods that can be used to assess programs that are put in place as part of the implementation of this watershed management plan. These methods can be used to measure the success of implementing structural or vegetative BMPs, educational efforts by mail or in person. The road stream crossings survey is designed to enable comparisons between surveys performed by multiple trained individuals and had been performed by volunteer groups in the past. Performance of this qualitative data collection method by volunteers can be a learning opportunity for the community as well as provide a method of qualitative evaluation of the watershed plan implementation.

7.2.2 Quantitative Evaluation Methods

Quantitative measures of evaluation can determine the long-term progress and effectiveness of the cumulative efforts of implementation of the watershed management plan. A monitoring effort of this scope will need support at the county or state level and a regional perspective. Monitoring water quality across the watershed can show progress or lack thereof of watershed initiatives toward attainment of the ultimate goal of watershed management—improved water quality. Recommended quantitative assessment methods include water quality monitoring, a volunteer-based ongoing macroinvertebrate study, and hydrologic monitoring. Details about each of the recommended programs should be defined as a part of the application process as funding is sought for implementation.

Table 7.1: Qualitative Evaluation Methods

Evaluation Method	Program/Project	Measured	Implementation
Public Surveys	Education efforts by mail	Concerns, knowledge, behaviors	Before and after surveys by mail. Trends can be shown by repetition of surveys over time.
Written Evaluations	Education programs, volunteer programs	Awareness, knowledge	Evaluations completed on-site at the end of an event that asks what was learned, ways to improve the program
Photographic Evaluation	BMP installations	Before and after conditions.	Take photographs of before and after conditions to show visual improvements.
Participation Tracking	Public education and volunteer events	Number of people participating. Geographic distribution of participants.	Have sign-in and evaluation sheets, count those in attendance at events or pass through gardening stores as a result of educational efforts.
Stream Surveys	Road stream crossings survey performed by trained volunteers from the public.	Turbidity, bank erosion, algae growth, potential sources of pollution.	Teach volunteers to use MDEQ standardized form, organize an event to perform the inventory, analyze results.

<u>Monitor Water Quality</u>

In order to determine whether implemented strategies are having a positive effect, water quality should be monitored 5–6 years after implementation of recommended watershed strategies. A follow-up study, conducted at the stations used in the Stony Creek Watershed Project water quality study, can provide comparison of water quality before and after BMP implementation. In addition, baseline data should be collected in additional locations before implementation of new BMPs. Monitoring should include dry and wet weather events and seasonal variation. Total suspended solids, phosphorus, nitrogen, conductivity, temperature and dissolved oxygen should be considered. Ideally, pesticides should be monitored as well as they are a suspected pollutant of high concern within the watershed, but there is no data to determine the degree of the problem. Volunteers from the watershed should be utilized where possible to promote education and stewardship while producing cost-effective usable data to help evaluate/reevaluate strategies.

Monitor Macroinvertebrate Diversity / Develop Evaluation Model like HRWC Program
Macroinvertebrate studies are relatively easy ways to track trends in water quality over time. It is strongly recommended that an ongoing macro-invertebrate study be developed and carried out twice a year (in the spring and fall). This study should be completed with the help of volunteers from the community in order to help educate the public about the water quality concerns in the watershed while producing quality data for evaluation of the watershed improvement strategies. The number of locations included in the study should increase around areas that are specifically targeted for BMP implementation. In order to complete such a study, a model needs to be created to evaluate the significance of the data collected, such as the one used by the Huron River Watershed Council's Adopt-A-Stream Program. Once completed, the model can be used indefinitely to evaluate the quality of streams in the Stony Creek Watershed. The data can be used to show the effectiveness, or lack thereof, of implemented BMPs.

Hydrologic monitoring
Considering that altered hydrology is the second overall greatest concern in the watershed, and the greatest concern in the lower watershed, hydrologic monitoring should take place in the watershed. In addition to the hydrologic study that is recommended as a part of this plan, an ongoing hydrologic study should monitor the watershed for trends of increasing flood frequency, stream widening/downcutting, and low dry weather flows. Volunteers from the watershed should be utilized where possible to promote education and stewardship while producing cost-effective usable data to help evaluate/reevaluate the plan strategies.