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South Branch Flint River Watershed Management Plan

Table of Contents

Introduction
- **What is a Watershed?**
- **The Need for Management of the South Branch Headwaters Area**
- **Watershed Plan Structure and Purpose**

Watershed Description
- **Geography**
- **Geology and Soils**
- **Land use**
- **Hydrology**

Water Quality Summary
- **Designated Use Attainment**

Implementation Strategy
- **Critical Areas**
- **Implementation Goals**
- **Public involvement and education**
- **BMPS**

Evaluation Plan

Appendix 1. Local Land Use Assessment
Appendix 2. Local Policy Review
Appendix 3. Hydrology Assessment and Impervious Surface Analysis
Appendix 4. Wetland Functionality Assessment
Appendix 5. Water Quality Assessments
- **Road Stream Crossing**
- **Fisheries Studies**
- **Invertebrates Studies**
- **Habitat Studies**
- **Point Source Discharges**

Appendix 6. Public Education Plan
Appendix 7. Pollution Loading Calculations
Appendix 8, Relevant Water Quality Standards

Introduction

WHAT IS A WATERSHED

A watershed is any area of land that drains to a common point. That common point may be a lake, the outlet of a river, or any point within a river system. Throughout this Watershed Management Plan, the terms basin, sub-basin, watershed, sub-watershed, and catchments are used to describe the drainages of the river.

The largest watershed management unit is the basin. A basin drains to a major receiving water, such as a large river, estuary or lake. Within each basin are a group of sub-basins, that are a mosaic of many diverse land uses, including forest, agriculture, range and urban areas. Sub-basins are composed of a group of watersheds, which, in turn, are composed of a group of sub-watersheds. Within sub-watersheds are catchments, which are the smallest units in a watershed, defined as the area that drains an individual development site to its first intersection with a stream (Figure 2.2 and Table 2.1) (Center for Watershed Protection).

Table 1 Description of the Various Watershed Management Units

Watershed Management Unit	Typical Area (square miles)	Influence of Impervious Cover	Sample Management Measures
Catchment	0.05 to 0.50	Very strong	Best Management Practices (BMP) and site design
Sub-watershed	1 to 10	Strong	Stream Classification and management
Watershed	10 to 100	Moderate	Watershed-based zoning
Subbasin	100 to 1,000	Weak	Basin planning
Basin	1,000 to 10,000	Very weak	Basin planning

(CWP, 1998)

In Michigan's Flint River system, the South Branch Watershed drains into the larger Flint River Sub-basin that ultimately drains into the Saginaw River Basin. The Saginaw River ultimately terminates at the Saginaw Bay and Lake Huron The South Branch Watershed begins in Oxford Township in northern Oakland County and flows north through Metamora, Dryden and Lapeer Townships. The headwaters of the South Branch of the Flint River also conveys water carried by streams that drain portions of Addison Township in Oakland County and Attica Township in Lapeer County.

Figure 1: Location of South Branch Flint River Watershed

The Need for Management of the South Branch Headwaters Area

It is commonly accepted among water quality professionals working in the Flint River Watershed that the South Branch Watershed (SBW) is potentially the "healthiest" sub-watershed within the sub-basin because of its hydrologic stability, in-stream habitat and biologic diversity. The health of the watershed and its location in rapidly developing southeast Michigan, places the watershed at great risk of degradation. Recent research has identified the Flint River South Branch as one of the most threatened watersheds in the state based upon projected land use changes and existing water quality (Whylie 06). The threat of rapid water quality reduction from urban expansion has led stakeholders to look for tools to preserve and maintain the community's high quality water resources. In order to achieve this, the University of Michigan-Flint's Center for Applied Environmental Research in partnership with the Flint River Watershed Coalition received funding from the MDEQ Non-Point Source Pollution Program (NPS) to develop a watershed management plan (WMP) in cooperation with the communities in the watershed.

Watershed Plan Structure and Purpose

This watershed plan is intended to be used by a wide variety of stakeholders and it is structured so that the main body of the plan is user-friendly and easily understandable. Throughout the watershed plan are "Key Findings" that are of particular importance to the successful management and protection of the watershed. Scientific explanations, methods and assessments have been placed in a series of appendices for those individuals who would like more specific information about the planning process and its scientific basis.

The purpose of the South Branch Watershed Management Plan is to catalog the current conditions impacting the water quality and to identify actions that can be taken to resolve existing problems and prevent future degradation of water resources. It is built around the concept of designated uses, as the primary criteria for water quality, according to Michigan's Department of Environmental Quality, is whether the water body meets certain designated uses. The Water Resources Commission Act (P.A. 451 of 1994, Part 31, Chapter 1) requires all waters of the State of Michigan to be of the quality to meet eight designated uses (2000). According to this legislation all surface waters of the state of Michigan are designated for and shall be protected for all of the following uses:

1. Agriculture
2. Industrial water supply
3. Public water supply at the point of intake
4. Navigation
5. Warmwater fishery (Some waterbodies are also protected as a coldwater fishery)
6. Other indigenous aquatic life and wildlife
7. Partial body contact recreation
8. Total body contact recreation between May 1 and October 1

In addition to identifying pollution concerns the plan also provides recommendations on how to use Best Management Practices (BMPs) to restore and protect the water quality in the watershed. A BMP is a land management practice that landowners and municipalities

implement to control sources or causes of pollution. There are three types of BMPs that treat, prevent or reduce water pollution. These include:

- Structural BMPs: "brick and mortar" practices that require construction activities to install, such as storm water basins, grade stabilization structures and rock rip-rap
- Vegetative BMPs: that use plants including grasses, trees, and shrubs to stabilize eroding areas
- Managerial BMPs: that involve changing the operating procedures

In addition to BMPs implemented at specific sites, management practices can also be implemented across political boundaries, such as the case with local land use and construction ordinances. The foundation for implementation of multi-jurisdictional management in this watershed is the Greenlinks program. Greenlinks is a planning and technical assistance program based on the concepts of green infrastructure that works to build the capacity of communities and conservation organizations. The Greenlinks program has worked with the planning team to identify Potential Conservation Areas (PCA) in the watershed. These PCAs are valuable to the health of animal and plant communities as well as water quality conditions. Similar PCAs also have been developed by Oakland County covering that portion of the South Branch watershed. Unlike any other watershed plan in the Flint River watershed, this one superimposes PCAs over parts of the watershed where designated uses are threatened as well as parts where designated uses are already impaired. This provides a watershed-wide framework municipalities can use to select the proper preservation or remediation BMPs and policies for individual sub-watersheds. The Lapeer and Oakland PCAs also bring the SBW Management Plan into a regional preservation effort that can help it tie into other watershed management plans, green space preservation, and master planning. Specific recommendation the integration of the GLS GReenLinks green infrastructure plan are identified in Appendix 2 as well as in the implementation work plan.

Watershed Description

Understanding of the physical characteristics of a watershed is important in order to identify priority pollutants, source areas, and specific causes of pollution affecting it. The following section of the watershed management plan is intended to provide information about the historic, current and future physical condition of the South Branch Flint River Watershed. In order to characterize the physical condition of the South Branch, CAER and its partners engaged in several activities including literature reviews of previous research, geographic information systems analysis, physical inventory activities and a public input process. A summary of these findings are presented in this section of the plan along with information about their relevance to future management activities. Detailed information about topics can be found in the various appendices that accompany this plan. Specific implementation activities based upon these findings are presented in the implementation work plan section.

Geography

The South Branch Watershed (SBW) begins in Oxford Township in northern Oakland County and flows north through Metamora, Dryden and Lapeer Townships. The stream also conveys water carried by streams that drain portions of Addison Township in Oakland County and Attica Township in Lapeer County. (Figure X) The Flint River South Branch Headwaters is composed of nine sub-watersheds. These include:

- Mirror Creek
- Hunters Creek
- Flint River Main Branch
- Pine Creek
- Pine Creek Headwaters
- South Branch Headwaters
- Whigville Creek
- Unnamed Creek
- Whigville Lake Watershed

The watershed also contains numerous small lakes and ponds. The number and types lakes and ponds are identified in Appendix 3.

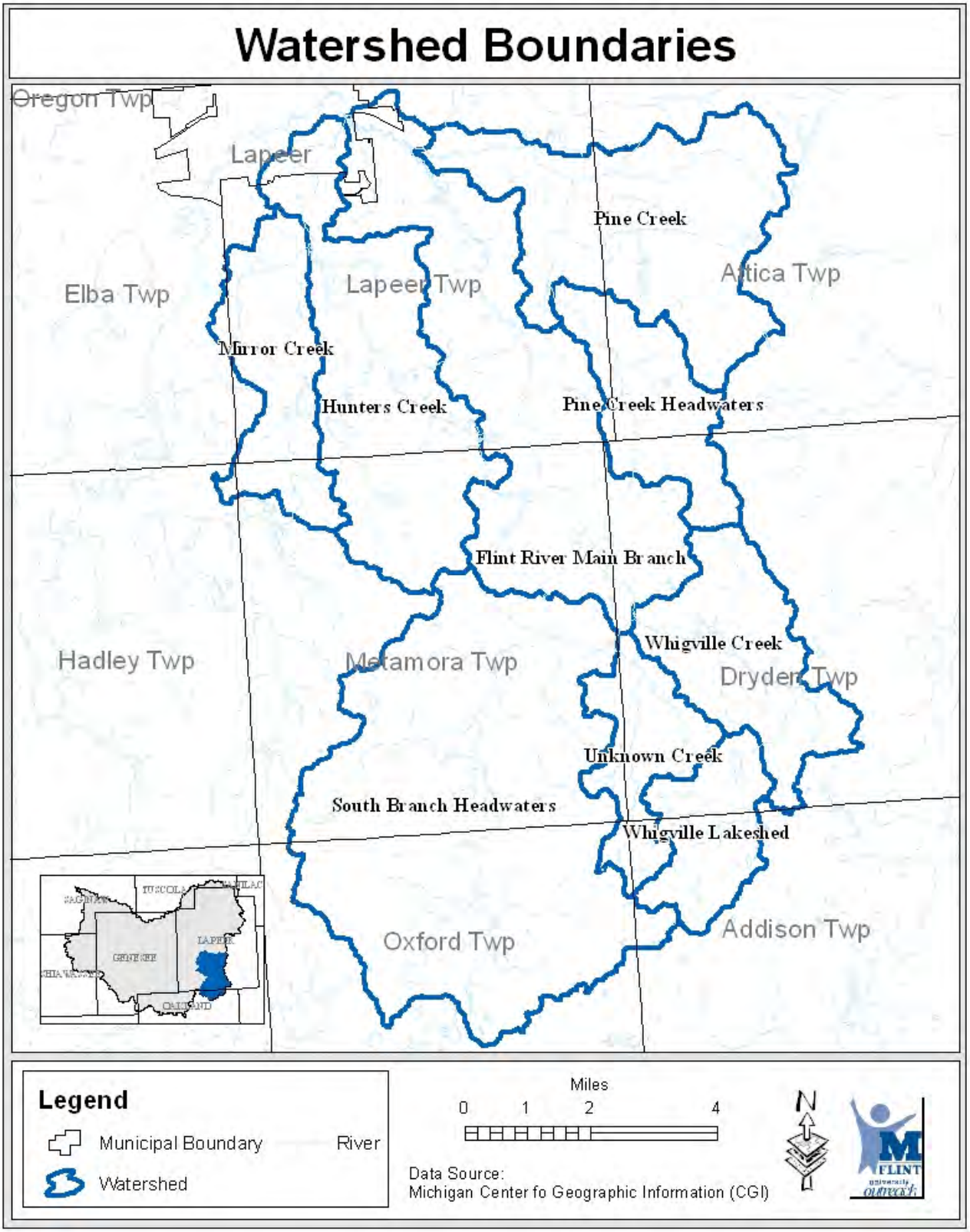


Figure 2. Sub-watersheds of the South Branch

Geology and Soils

The geology and soils of the South Branch Watershed are important to consider in this watershed management plan because it affects: (1) hydrology (2) temperature regime and (3) the feasibility of certain Best Management Practice (BMP) installations. Joe Leonardi (2001) summarized the importance of the geology and soils relationship to hydrology and water temperature of the Flint River when he wrote that:

> *Soil texture and particle size determines soil permeability to water. For example, water will percolate at a higher rate through coarse textured sand and gravel than it will through fine textured clay and silt. Permeable soils, if associated with topographic relief (usually moraines), can have high ground water elevation resulting in ground water inflow to a stream. Streams with high ground water inflow are typically cooler and have more stable flow regimes. Less permeable soils, high in clay content, produce greater surface water runoff resulting in unstable stream flow.*

The geology and soils of a watershed also influence the ability of stakeholders to successfully implement certain BMPs. The types and location of soils often determine what managerial, structural or vegetative activities are feasible. For example, specific geologic landforms and soils contain highly permeable soils that are more suitable for the installation of BMPs that function to increase infiltration. Likewise some soils types are susceptible to extensive erosion if managed incorrectly and need to be planned for with particular strategies in mind.

In this section of the watershed plan, information about the general soils and geologic nature of the watershed is presented along with key points to be considered in managing soils to protect water quality. This review does not provide the site-specific information required for the installation of some specific BMPs. The information provided here is intended to provide individuals who are implementing recommendations of the watershed management plan with a basis of information from which to begin a site-specific investigation prior to the installation of BMPs.

Geology and soils of the South Branch Watershed

The geology and soils of the South Branch Watershed are dominated by the remnants of glacial activity that took place between 10,000 and 13,000 years ago. Review of the geology and soils of the South Branch watershed identified several key points that need to be considered in the management of the watershed. These are related to the geology and soils impacts upon the hydrology of the watershed, the presence of significant amounts of highly and potentially highly erodable soil and the location of soils with moderate to severe limitations for septic system installations.

Infiltration capacity
The geology and soils of the South Branch Watershed play a large role in the hydrology of the watershed. The upstream portion of the watershed contains a large number of high infiltration soils. These soils are directly responsible for infiltrating precipitation and feeding the upper reaches of the watershed with groundwater inflow that function to moderate flows and maintain a cool water temperature regime.

- Key Point: Protection of these areas is extremely important to maintain existing high water quality. This area of the watershed provides the largest opportunity to affect the temperature regimes by implementing BMPs to increase infiltration and protect existing land uses. See Implementation section for specific BMPs.

Highly Erodable Lands

The United States Department of Agriculture Natural Resource Conservation Service maintains a data set identifying soils that are highly erodable or potentially highly erodable. The erodablity of soils is based upon two primary factors consisting of the physical properties of the soil and the slope of the soil. When these soils are disturbed by agricultural or construction activities they pose a potential threat to water quality from erosion and sedimentation. Several of the watersheds within the South Branch Watershed contain significant percentages of highly and potentially highly erodable soils. The Whigville Lake Watershed (28%), Unnamed Creek (27%) and South Branch Headwaters (15%) watersheds are most threatened by highly erodable lands. The relationship of these soils to land use is a key factor to consider in their management and protection. Both the Whigville Lake and Unnamed Creek Watersheds contain significant percentages of agricultural land with Whigville Lake at 28%, Unnamed Creek at 35% and South Branch Headwaters at 38%.

- Key Point: the Unnamed Watershed, Whigville Lake Watershed and South Branch Headwaters contain significant amounts of highly and potentially highly erodable soils. The combination of these highly erodable soils and moderate amounts of agricultural land uses result in a threat to water quality. Managerial, Vegetative and Education activities should take place to reduce these threats. Specific BMPs are identified in the Implementation section of the watershed plan.

Septic Limitations
Soils are a key factor in the proper functioning of onsite septic systems. Onsite septic systems installed in areas with poor soils are prone to problems and failures that can result in increased nutrient and bacteria loading to local waters.

- Key Point: The South Branch Watershed contains large areas identified as moderately to severely limited with regards to septic system installation and function. This combined with the lack of sanitary sewers in almost the entire watershed poses a potential threat to water quality. Communities in the watershed should work to adopt ordinances that require time of sale septic inspections. Communities also may want to use the septic suitability map provided in

Appendix 8 as a tool for future land use planning. A public education campaign would be useful to increase landowner awareness on the importance of properly maintaining their septic system. Specific ordinances and education activities are identified in the implementation section of the watershed plan and in Appendix 1.

Land Cover, Growth Trends and Population Density

By definition a watershed is the area of land that drains to a particular water body. As such, land use has a tremendous impact upon water quality. Because of the importance of linkages between land use and water quality, the planning team felt it important to examine the historic, current and future potential land use makeup of the Flint River South Branch Watershed. (Appendix 1).

Our observations revealed that the South Branch watershed has managed to avoid many of the negative water quality impacts that have been associated with rapid urban expansion in the southeast Michigan region. The largely rural area has maintained relatively stable land uses over the past decade but continues to face threats from urban expansion. (Michigan Land Transformation Model) The existing land covers, however have had some impacts on the water quality. Our observations revealed the most significant impacts are from agricultural land uses in the lower portion of the watershed. Based upon our experience we assert the largest future threat to the watershed is urban expansion from the southern portions of the watershed and along the M-24 corridor (see Figure 2-4 and 2-5). The following section of the watershed plan summarizes the major land use issues that are impacting the watershed. Specifics about the methods used to analyze and develop conclusions are included in Appendix 1. Specific BMPs to address these threats are included in the watershed implementation work plan.

Figure 3: M-24 road expansion

Figure 4: M-24 stream crossing

Agricultural Land Cover

- Agricultural land dominates the sub-watersheds of the SBW. This land use makes up approximately 50% of the land area within the watershed. The Pine Creek sub-watershed contains the highest percentage of agricultural land use at 57%. This is followed by Mirror Creek (49%), Flint River Main Branch (48%), Pine Creek Headwaters (37%), South Branch Headwaters (37%), Unnamed (35%), Whigville Creek (31%) and Whigville Lake (28%) respectively. The high percentage of agricultural landuses in the Pine Creek and Mirror Creek Watersheds also are coupled with the two lowest percentages of forested land uses in the watershed. Pine Creek's forest lands account for approximately 20% of the subwaterehed, and Mirror Creek's forested land is 22%.

- Key Point:
  The combination of high percentages of agricultural lands and reduced forest lands in the Pine Creek and Mirror Creek Watersheds are negatively impacting water quality. The land use combined with the drainage and ditching practices in the area appear to be increasing sediment delivery and hydrologic perturbations resulting in reduced water quality in these portions of the watershed. Figure 2-6 exemplifies these conditions. Specific recommendations for mitigating these impacts are presented in the implementation portion of the watershed plan including education, buffer strips and reforestation activities.

Figure 5: Pine Creek flowing through agricultural land (note lack of buffer on left bank)

Urban Land Uses
Urban land uses within the SBW land use has remained relatively stable from 1995 to 2000 with little to no significant increases in urban land use. The highest percentage of urban land uses are located within the Hunters Creek (6%), South Branch Headwaters (5%) and Mirror Creek (4%). These relatively higher percentages are associated with the Oxford urban center and the M-24 corridor.

- Key Point:
  Continued increases in urban land use poses a significant threat to future water quality within the SBW and are a major focus of the BMPs and education activities of this plans implementation section.

Riparian Corridor
The total amount of a particular land use impacts water quality in a watershed. Similarly, the location of that land use class will influence its impact on the health of the watershed. Research has shown that riparian lands, areas directly adjacent to the creek, are important in regulating flow, trapping sediment and providing critical habitat. These riparian areas often extend beyond the boundaries of the floodplain and act as a transition between aquatic and terrestrial environments (Forman and Wilson, 1995).

As part of the land use analysis of the South Branch Watershed, the planning team analyzed the land use within a 150 ft buffer from the center of a river or stream. The results of that analysis are located in Appendix 1. The analysis points to Pine Creek having the most significantly impacted riparian corridor with 53% of the riparian corridor in agricultural land covers. This is almost double that of Mirror Creek, which has 29%.

- Key Point:

The riparian corridor of Pine Creek and Mirror Creek and to a lesser extent Hunter's Creek are negatively impacting water quality through the introduction of agricultural sediments and increased solar radiation. Significant effort should be placed in management of the riparian corridor in order to restore the impacted and threatened cold water fishery and protect other designated uses in the Pine Creek Watershed. In addition efforts should be taken in the remainder of the watershed to protect the existing riparian corridors.

Hydrology

General

To understand the hydrology of the South Branch Watershed one needs to know how water moves through the drainage system. Reviewing information about the volume and rate at which water travels through the system before, during and after rain events can help us understand how the hydrology of the South Branch Watershed affects water quality. Appendix 3 contains specific information about the methods used to assess the hydrology of the South Branch Watershed

Hydrology of the South Branch Watershed

The hydrology of the South Branch Watershed appears to be relatively stable. The low percentages of urban land uses and historic stable land use has protected the watersheds hydrology from significant degradation The watershed is most hydrologically stable in the headwater reaches including the South Branch Headwaters, Unnamed, Whigville Creek, Pine Creek Headwaters and Flint River Main Branch. These areas hydrology are regulated by significant groundwater inflow. The high ground water inflow is a direct result of the high percentage of permeable soils (hydrologic soil groups A and B) and the undulating landscape of this region of the watershed. The lower section of the watershed including Mirror Creek, Hunters Creek and Pine Creek exhibit less stable hydrology due to significant draining and ditching practices and higher percentages of agricultural land.

- Key Point:
  The stable hydrology of the upper reaches of the South Branch Watershed should be a priority for preservation. Preserving this hydrology can be done through the combination of private land preservation, natural feature setback and increases in the use of storm water management techniques that encourage infiltration. Communities may want to adopt local ordinances that require construction sites to not increase offsite runoff beyond pre-development states.

- Key Point:
  The hydrology of the Pine Creek Watershed and Mirror Creek are impacting and/or threatening designated uses. Efforts should be made to mitigate historic alterations to the hydrology. This can be achieved through a combination of BMPs that include wetland restoration, alternative drain and ditch design, and improvements in riparian corridor management.

Wetland Functionality Assessment

A functional wetland assessment was developed to serve as a watershed level analysis of wetland function in the South Branch Watershed. Previous assessments of wetlands in the South Branch Watershed (SBW) relied on simple calculation of area gained and lost over time. This assessment seeks a detailed understanding of the functional changes in the wetland communities of the SBW from 1800 to 1998. Watershed scale assessments of wetland functions rely on geospatial data and geographic information systems (GIS). The analysis was based on landscape and watershed-level functional wetland assessment methods developed by the United States Fish and Wildlife Service (USFWS) in the Northeastern US (Tiner, et al) . These methods involved enhancing the National Wetland Inventory (NWI) by adding descriptors for landscape position, land-form, and waterbody type (LLWW) and then applying correlations between wetland characteristics and functions (Tiner, Assessing cumulative Loss of Wetland Functions in the Nanticoke River Watershed Using Enhanced National Wetlands Inventory Data, 2005). Wetlands of potential significance were identified for five different functions: surface water detention, streamflow maintenance, nutrient transformation, sediment and other particulate reduction, and shoreline stabilization. Wetland data from 1800 and 1998 were compared to quantify the functional changes in the SBW wetland community. Below are the key findings from the study. Specific methods, maps, data tables can be found in Appendix 4.

- Key Point:

According to the 1800 wetlands data, 1,350 wetlands occupied 20% of the FRSBW. By 1998, the total land area occupied by wetlands in the FRSBW had decreased to 16% . The number of wetlands increased to 2,151. From 1800 to 1998, there was a total wetland area loss of 17% in the FRSBW. This loss was conservative when compared to more urbanized watersheds.

- Key Point:

Losses in the total area of wetlands performing all five functions ranged from 22 to 36% decreases. Wet-lands performing sediment and other particulate reduction exhibited the greatest decrease at 36% while the other four functions ranged between 22 and 24% losses in total area.

- Key Point:

The evaluation of functional units showed that potential functional capacity of the SBW had been reduced for all five wetland functions. The capacity for stream flow maintenance and shore-line stabilization had been impacted the most with reductions of 29 and 24% respectively. The watershed capacity to reduce sediment and other particulates had been reduced by 14%. Less substantial reductions in the wetland community's capacity to transform nutrients and detain surface water were seen at 9 and 3% respectively. There were no increases in functional capacity.

- Key Point:

From 1800 to 1998, there was a 14% decrease in sediment reduction capacity, 24% decrease in shoreline stabilization, and a 29% decrease in stream flow maintenance capacity. Future wetland restoration and conservation efforts may target wetlands with high capacity to reduce sediment, stabilize shorelines and stream flow.

Water Quality Summary

Water quality standards for water and sediment chemistry, biological integrity, and physical habitat are generally being met however, some drains and tributaries have been identified impaired. (Leonardi 2001) Biological integrity and physical habitat of lower Pine Creek has been compromised due to ditching resulting in the loss of a brook trout fishery, a reduction of intolerant macroinvertebrates, increased water temperatures, and physical habitat loss. Elevated bacteria levels and nutrient loading from suspected failing septic systems, sewage lagoon discharge, and other non-point sources are a concern in unidentified drains located in Metamora, and Lapeer townships in Lapeer County (MDEQ 2000).

Wigvhille Creek, Whigville Lake, Pine Creek Headwaters and South Branch Headwaters maintains good biological integrity with high fish and macroinvertebrate diversity. Water and sediment chemistry values fall within the range considered acceptable for the Southern Michigan Northern Indiana Till Plain Ecoregion (Leonardi 2001). Stream flow is stable with moderate groundwater inflow. Pine Creek Headwaters was found to be meeting Water Quality Standards and designated uses. No fish or wildlife contaminant information is available for any of the sub-watersheds.

Sub-Watershed	Impaired Uses	Threatened Uses
Mirror Creek	**None**	**Warm Water Fish, Aquatic Life, Partial Body Contact**
Hunters Creek	**None**	**Warm Water Fish, Aquatic Life, Partial Body Contact**
Flint River Main	**Cold Water Fish**	**Full Body Contact**
Pine Creek	**None**	**Warm Water Fish, Aquatic Life**
Pine Creek Headwaters	**None**	**Cold Water Fish**
South Branch Headwaters	**Cold Water Fish**	**None**
Whigiville Creek	**None**	**None**
Whigville Lake	**None**	**None**
Unnamed Creek	**None**	**None**

Figure 9. Designated Use Attainment and Threats by Sub-watersehd

Critical Areas and Designated Uses

Green = Preservation Critical Area

Yellow = Transitional Areas

Red = Restoration critical Areas

		Mirror Creek	Hunters Creek	Flint River Main Branch	Pine Creek	Pine Creek Headwaters	S. Branch Headwaters	Whigville Creek	Unnamed Creek	Whigville Lake Watershed
Agricultural, Industrial Water Supply, Public Water, Navigation	**Status**	Met or NA	Met or NA	Met or NA	Met or NA	Met or NA	Met or NA	Met or NA	Met or NA	Met or NA
	Pollutant Impairing/ Threatening Status									
Warm Water Fish	**Status**	Impaired	Threatened	Met	Threatened	Met	Met	Threatened	Threatened	Met
	Pollutant Impairing/ Threatening Status	Sediment	Sediment		Sediment, Hydrologic Modification			Sediment	Sediment	
Cold Water Fish	**Status**	N/A	N/A	N/a	Impaired	Threatened	Impaired	NA	NA	N/A
	Pollutant Impairing/ Threatening Status				Sediment, Thermal, Habitat Loss	Sediment, Thermal, Habitat Loss	Sediment, Thermal, Habitat Loss			
Other Aquatic Life	**Status**	Threatened	Threatened	Met	Threatened	Met	Met	Met	Met	Met
	Pollutant Impairing/ Threatening Status	Sediment	Sediment		Sediment, Thermal, Habitat Loss					
Partial Body Contact	**Status**	Threatened	Threatened	Met	Met	Met	Met	Met	Met	Met
	Pollutant Impairing/ Threatening Status									
Full Body Contact	**Status**	N/A	Threatened	Threatened	N/A	N/A	Threatened	Met	N/A	N/A
	Pollutant Impairing/ Threatening Status		Bacteria, Storm water	Bacteria			Bacteria			

Current pollutant input and future threat prioritization. This prioritization is intended to incorporate key findings identified in the plan and its appendices to identify critical restoration areas and preservation areas. Low rankings indicate poor indicators of water quality or significant threats. High ranks indicate good water quality indicators and/or lack of threats

Quality Natural Areas	Low = 1	Med = 2	Med = 2	Low = 1	High = 3	High =3	High=3	Med = 2	High = 3
Quality of Hydrology Hydrology High = stable hydrology	Low = 1	Med = 2	High = 3	Low = 1	High = 3	High = 3	High = 3	High = 3	High = 3
Quality of Corridor	Med = 2	High = 3	Med = 2	Low = 1	High = 3	High = 3	High = 3	High = 3	High = 3
Lack of Urban Pollutants	High = 2	High = 3	High = 3	High = 3	High = 3	High = 3	High = 3	High = 3	High = 3
Lack or Development Pressure	Low = 1	Med = 2	High = 3	High = 3	High = 3	Low = 1	Med = 2	Med = 2	High = 3
Lack of Current Agricultural Threats	Low = 1	Med = 2	Med = 2	Low = 1	High = 3	Medium = 2	Med = 2	Med = 2	Med = 2
Lack of Septic Threats	Low = 1	High = 3	High = 3	Med = 2	High = 3	Low = 1	Med = 2	Low = 1	Low = 1
Lack of Wetland Loss	Low = 1	Med = 2	Med = 2	Low = 1	Low =1	High = 3	High = 3	High = 3	High = 3
	10	19	20	11	22	19	21	19	21

Implementation Strategy

Identification of Critical Areas

A critical area is a section of the watershed that contributes or has the potential to contribute a majority of the pollutants that impact water quality. Identifying critical areas reduces the geographic scope of watershed planning and implementation activities. In the South Branch Watershed we have identified two types of critical areas including preservation critical areas and restoration critical areas. Preservation critical areas consist of areas within the watershed that have positive impacts on water quality or have the potential to reduce water quality if management inappropriately. Preservation Critical areas are larger and more widespread in the South Branch Watershed and require a range of proactive policies and education activities to protect them. Preservation of these critical areas should be the major focus of both short and long term implementation activities. Restoration critical areas consist of areas within the watershed that are currently contributing a majority of the pollutants that are impairing or threatening designated uses. These areas are not extensive in the South Branch Watershed but are considered to be a moderate priority for short-term implementation activities.

Preservation Critical Areas

The lack of a large amount of restoration critical areas is not unexpected based upon the high water quality of the South Branch sub-watershed and the land use make up within the area. The lack of restoration needs in the watershed does not however indicate that watershed management activities are unnecessary. Recent research has indicated that the Flint River South Branch watershed is one of the most highly threatened watersheds in Michigan (Wyllie 06). Therefore, in addition to identifying critical areas contributing a majority of the pollutants affecting the water quality of the South Branch, the planning team felt it important to identify areas that if managed inappropriately would significantly reduce water quality. These include both areas that provide benefits to water quality such as high infiltration-rate soils and areas that have the potential to impact water quality such as highly erodable soils and soils that have significant limitations for septic system installations.

Pine Creek Headwaters

Our investigation revealed that the headwaters of Pine Creek contain high water quality. In spite of being a designated drain, this watershed maintains cold water conditions and contains a self-sustaining Brook Trout population. This high water quality appears to result from a combination of high groundwater inflow and land use within the watershed and it's riparian corridor. . Protection and enhancement of this watershed can be achieved by implementing several vegetative and managerial BMPs. Specific BMPs and education measures to address these pollutants and threats are identified in the Implementation Work Plan.

Special soil areas

In addition to specific watersheds that are identified as critical areas there are distinct regions of the watershed that are considered critical areas because of their physical properties and relationship to water quality. These consist of areas that have highly erodable soils, soils with high infiltration rates and soils that are moderately to severely limited with regards to septic system function. These areas are identified in figures 6-8 and Specific BMPs and education measures to address these areas are identified in the Implementation Work Plan.

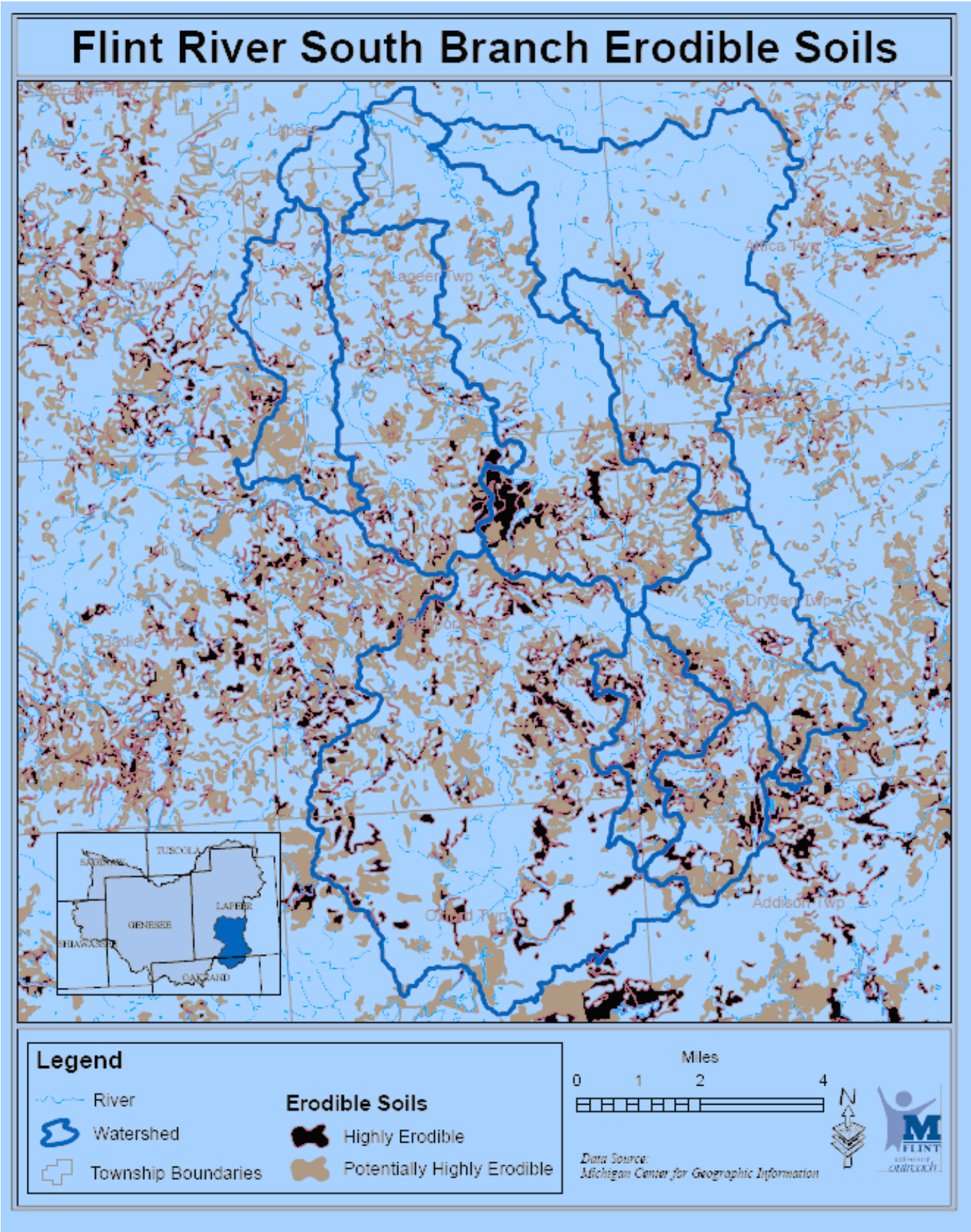


Figure 6. Highly and Potentially Highly Erodable Soils

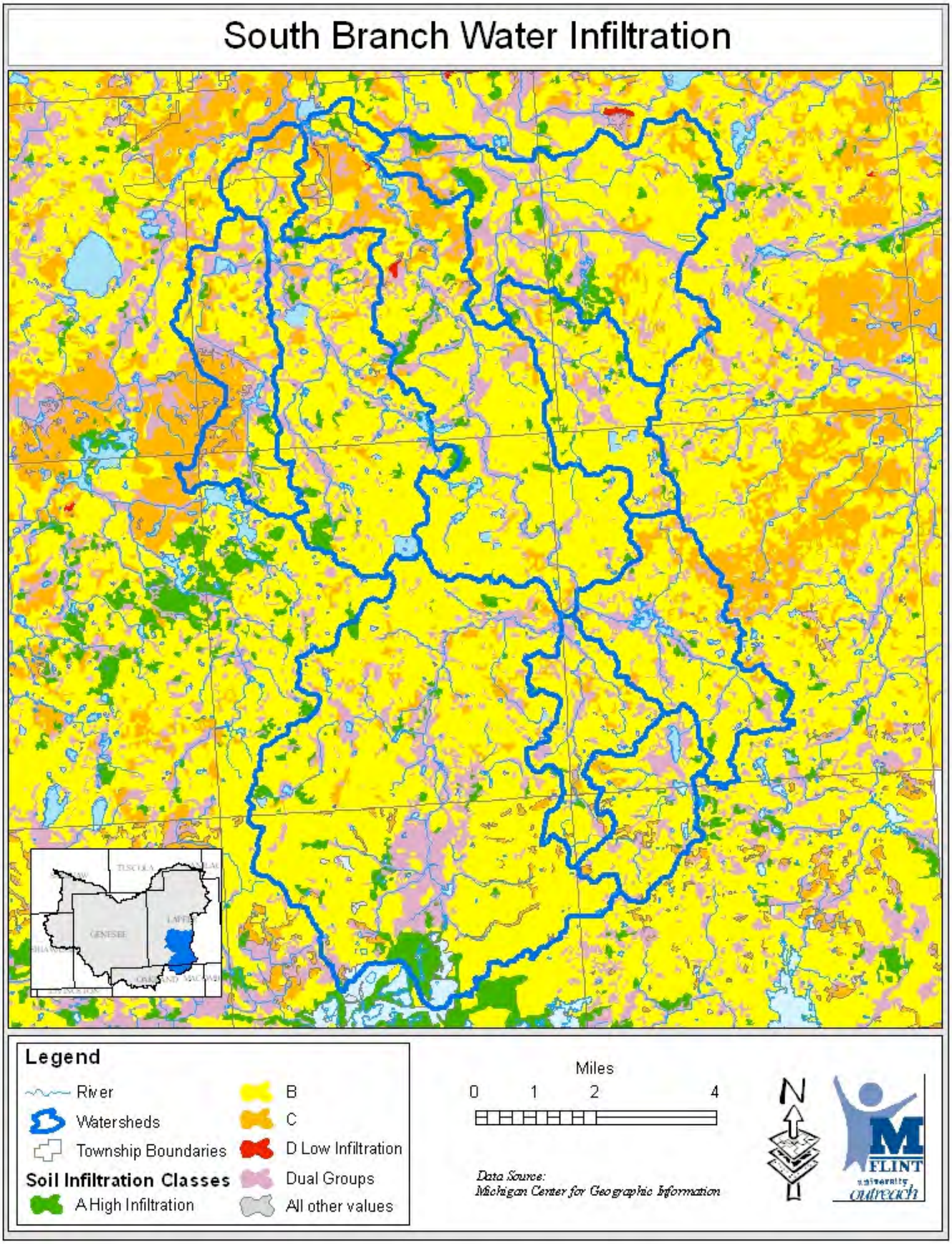


Figure 7. Water Infiltration (Hydrologic Soil Groups)

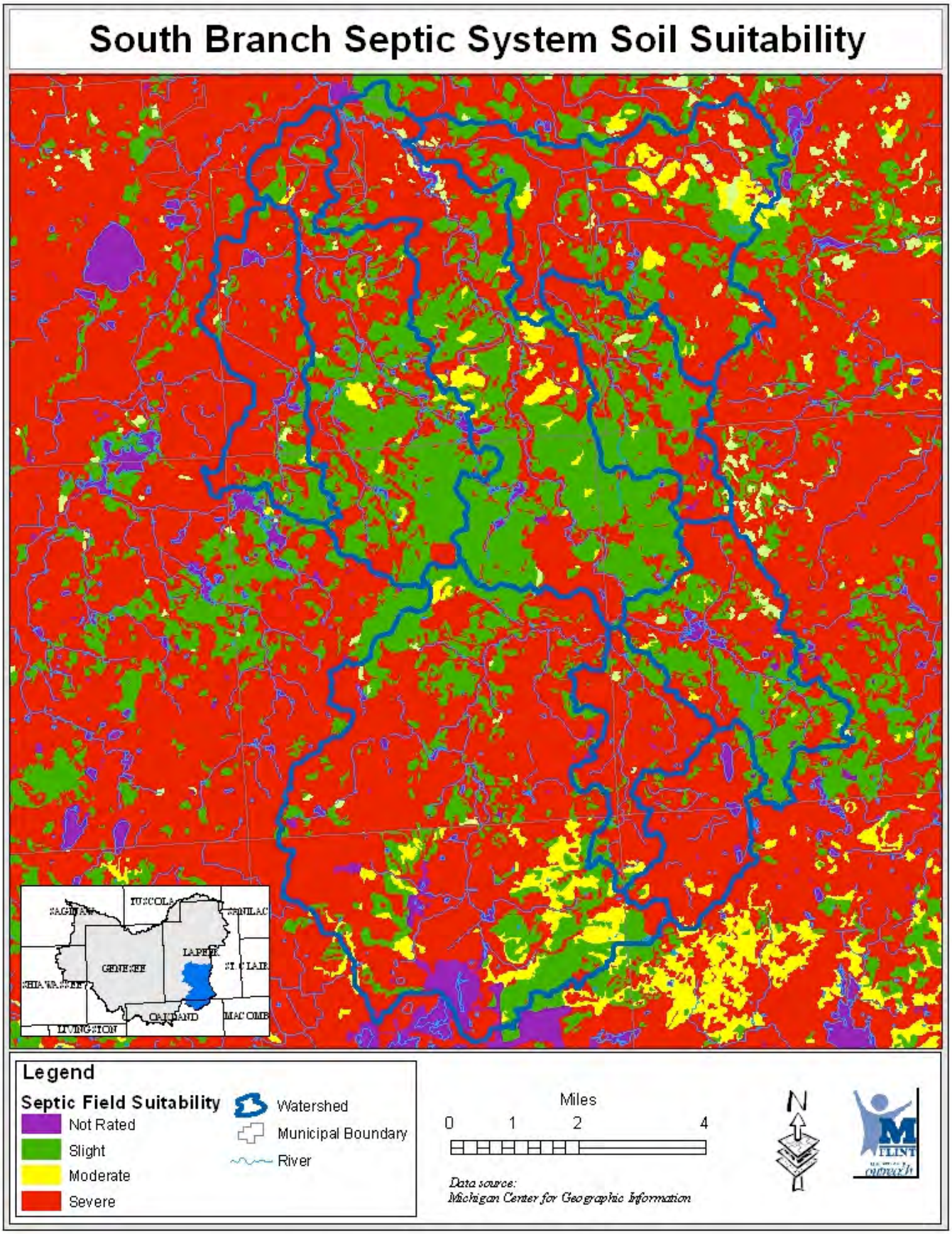


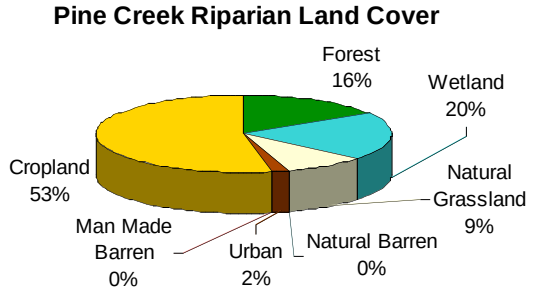
Figure 8. Septic Suitability Limitations

Restoration Critical Areas

Pine Creek, Mirror Creek and Hunters Creek Riparian Corridors

A review of the physical condition, water quality information, and observations made in the physical inventory process point to several restoration critical areas including the Pine Creek, Mirror Drain and Lower Hunters Creek riparian corridors. Our review has identified these corridors are the source areas for a majority of the pollutants that are currently impacting water quality within the watershed. The current condition of these corridors is responsible for introducing excess sediment and thermal inputs into these sub-watersheds and their receiving waters. These corridors are also suspected to be responsible for introduction E.coli, Nutrients and pesticides to the sub-watersheds.

The riparian corridor of the Pine Creek watershed is the highest priority for restoration. Pine Creek's riparian corridor has been significantly altered by human activity. Most notable is the percent of agricultural cropland within the 300 ft buffer used to examine the watersheds riparian corridors. This riparian corridor is also suspected to contain several gully erosion sites that are typical in the area. Pollution loading calculations were also conducted for these restoration activities. Restoration activities focused on the riparian corridor in Pine Creek will function to increase the possibility of restoring a previously destroyed cold water fishery and protect other designated uses.



The Mirror Creek and Hunters Creek riparian corridors are the second priority restoration critical area within the watershed. These sub-watersheds also have significant inputs of sediment and nutrients from agricultural activities within the 300ft buffer and isolated stream bank erosion sites. They are considered second priority to the Pine Creek corridor because they don't possess the opportunity for cold water fishery restoration. Specific location for restoration activities and pollution loading calculations are included in appendix 7.

Beyond the riparian corridors of the Pine, Mirror and Hunters Creek Watershed most restoration activities are scattered throughout the watershed at isolated locations. These locations consist of storm water runoff from commercial development along the M-24 and wetland destruction that has taken place since human settlement throughout the watershed. The extent and nature of this wetland loss is discussed in appendix 4.

Specific BMPs and education measures to address both the first and second priority Critical Areas are presented in the Implementation Work Plan.

Implementation of the watershed plan in intended to restore impaired designated uses and protect those that are threatened. A successful implementation plan will involve the development of goals, objectives to meet those goals and the tasks to complete objectives. Using a framework that identifies goals, objectives and tasks ensures that there is a direct linkage between the numerous tasks outlined in the implementation work plan and achieving the goals established to impact designated use attainment.

The implementation goals for the South Branch Watershed Plan include:

1. Reduce the impact of priority pollutants in restoration critical areas to restore impaired designated uses.
   a. Increase the use of govt. programs, private land conservation and education programs to encourage and implement buffer strips and improved riparian corridor management
   b. Mitigate all suspected gully erosion sites
   c. Mitigate known and suspected road surface runoff locations
   d. Improve the management of urban and agricultural runoff to reduce sediment introduction to Critical Area stream segments
   e. Improve the management of “drains” to support designated uses

2. Sufficiently protect/manage conservation critical areas that pose potential threats to designated uses if unmanaged/mismanaged
   a. Assist communities to plan for and implement policies that improve storm water management in high infiltration areas of the watershed
   b. Assist communities to plan for and improve policies that address soils posing moderate to severe septic system limitations
   c. Assist communities and individuals to appropriately manage soils that are considered highly erodable or potentially highly erodable
   d. Integrate private land conservation and progressive planning strategies into community planning activities

3. Promote and establish educational programs that support watershed planning goals, objectives and tasks, and increase stewardship.
   See Education Implementation Strategy Appendix 6 for details of education plan

See attached Excel file for Implementation Workplan, BMPs and Midterm Milestones

Public Involvement and Education Plan
Public Engagement

Public participation is a vital part of the watershed implementation process. Continuous public input and dialogue is needed to ensure the watershed plan is up to date and representative of all needs in the watershed. Throughout the watershed planning process CAER worked to gather public participation. CAER contracted with the Flint River Watershed Coalition (FRWC) to conduct the public input portion of the South Branch Watershed Management Plan. The public input program was conducted in three stages:

Stage 1 – Grass Roots Outreach

CAER and FRWC staff made several early visits to the FRWC's Lapeer Committee to explain the watershed planning process. Through these meetings the planning process was explained to residents, county parks staff, conservation district staff, local educators and members of the business community. Initial water quality concerns and opportunities for the watershed planning process were identified. Simple education materials highlighting the South Branch Project were prepared by the committee. This material was distributed at local events and festivals in an effort to spread the word and elicit feedback about the condition of the river from local citizens.

Stage 2 – Governmental Outreach

FRWC and CAER staff set up a series of meetings with local township boards, planning commissions, city planners, and other elected officials, to explain the watershed planning process. Through these visits, the team established a dialog with local community leaders and determine potential areas of concern and provide valuable information on local planning efforts. Over the course of the project, all planning agencies in the watershed were contacted and visited.

Stage 3 – Community Visioning Meetings

To gain a better understanding of the short and long range goals of the South Branch Community, a public visioning session was held in July 2007. The result of this meeting was the establishment of both five year and twenty five year planning goals for the South Branch communities. Additionally, the group looked at potential obstacles to those goals that could be addressed through appropriate planning.

Statements made in the visioning session were grouped into categories and correspond with those in the policy review (Appendix 2) and desired uses (Implementation Section).

Stage 4- Plan findings presentation and implementation assistance
The final state of the public input process will take place during the implementation of the watershed plan. FRWC and CAER staff will be working to begin the implemention process by conducting a number of visits to local planning boards and township officers.

These series of presentation will take place to present the findings of the watershed plan and work with communities to take those first steps towards implementation portions of the plan.

An effective community education plan is important to implementing the watershed plan. A successful education plan is important because reducing the pollutants affecting water quality in South Branch Flint River will require increases in knowledge by the community and voluntary behavior changes by residents and decision makers. A successful education plan must recognize the learning process and current stakeholder knowledge.

The learning process involves four basic steps: experiencing/awareness phase, building knowledge, processing of information, and application of knowledge (NVPDC, 1996). This education plan will be structured around theses processes by providing:

- Public education to increase **Experiences / Awareness** of issues that stakeholders are familiar with
- **Building knowledge** base of stakeholders
- Allowing stakeholders to **Process Information** through community dialogue and interactive learning
- Encourage stakeholders to **Apply** their knowledge

Specific tasks have been assembled in Appendix 6 based upon topic area and audiences in order to avoid a "one size fits all approach". In appendix 6 we have also identified education tasks, partners and estimated costs for implementing the programs**.**

Evaluation Plan

Program Process and Goals

The primary goal of the South Branch Flint River Watershed Planning Project was to develop a watershed plan that when implemented could protect and restore the designated uses of South Branch Watershed. A comprehensive watershed management process involves working though a number of phases that ultimately leads to water quality protection. Watershed management can be generally divided into three phases including watershed planning, plan implementation, and effectiveness assessment (evaluation). Figure 10 illustrates the relationship between the three phases of watershed management.

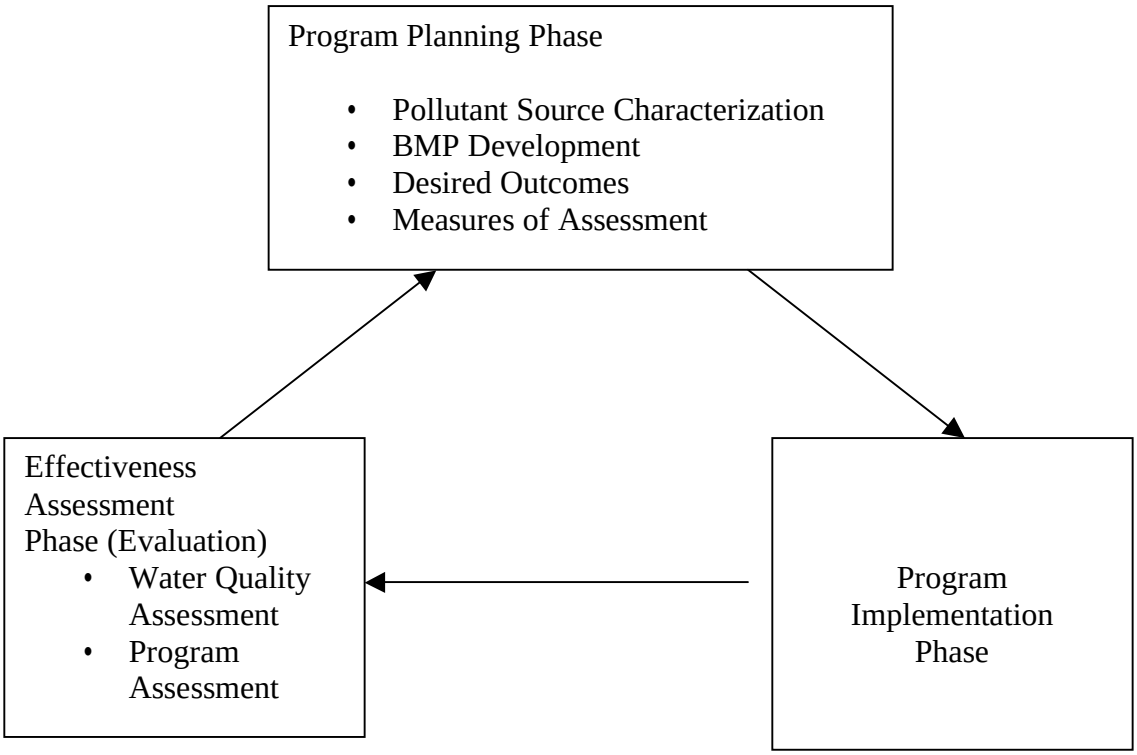


Figure 10. Watershed Management Cycle

Currently the South Branch Flint River Watershed Planning team has completed the steps associated with the program planning phase of the watershed management process including:

1. The identification of pollutants, source areas and causes of non-point source pollution in the watershed
2. The identification of Best Management Practices (BMPs) that need to be implemented to protect water quality
3. The identification of specific desired outcomes related to water quality
4. The identification of evaluation tools

With the South Branch Flint River Planning process complete the next step in watershed management involves implementing the watershed plan. As the program implementation is started activities will need to begin that provide information to evaluate the watershed plan.

Similar to the way that achieving objectives can lead to goal achievement, answering several questions will assist us in evaluating the effectiveness of the SBWMP. These questions are directly related to what are described as levels of success in the watershed management process. These include:

- Is the watershed plan in compliance with EPA requirements of watershed plans?
- Are changes in knowledge taking place because of the watershed plan?
- Are behavioral changes taking place as a result of the watershed plan?
- Are the reductions in the amount of pollution delivered to the stream because of the watershed plan?
- Are changes in the water quality of the South Branch Flint River being achieved because of the watershed plan?

Because watersheds are extremely dynamic systems that are influenced by nearly everything that happens in them, controlling all variables in a watershed plan is likely impossible. Similarly, measuring all outcomes of the plan is improbable. Instead what is intended by watershed management is that continual steps are made towards protecting water quality in a number of ways. These “levels of success” are intended to build upon one another in a hierarchy with the highest level resulting in water quality protection. Figure 11 is a graphic representation of the relationship between the six levels of success within watershed planning. The plan evaluation is set up to measure changes in these six levels/questions using a variety of tools and methods.

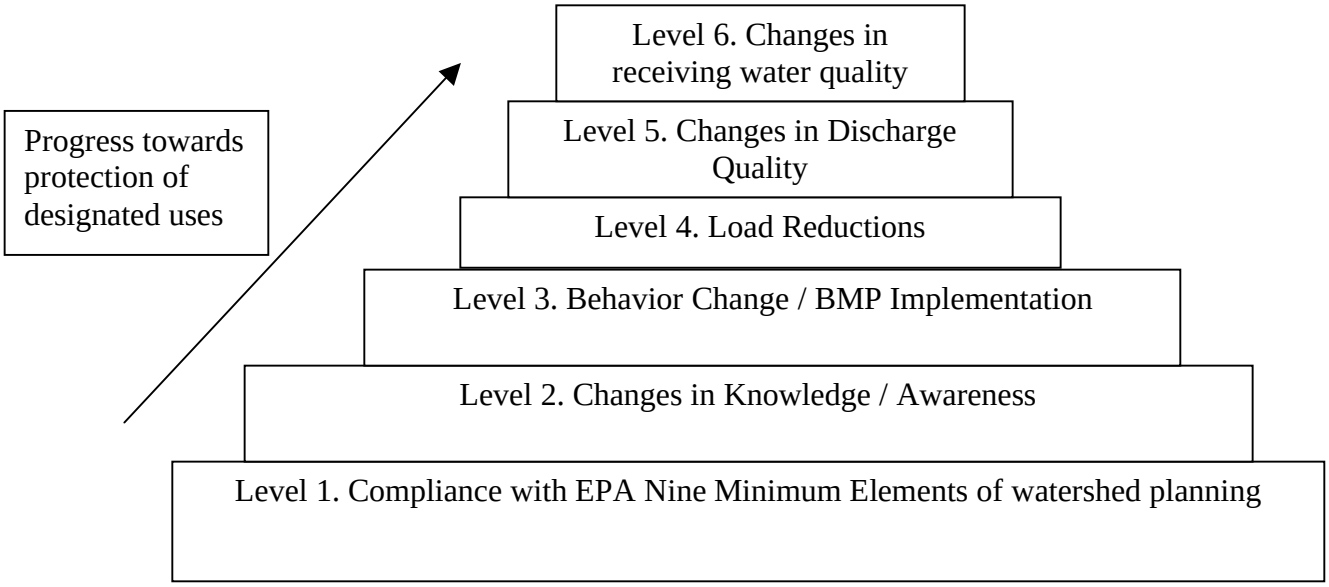


Figure 11: Levels of success necessary to protect the designated uses of the South Branch Flint River Watershed

easures of success are critical to assessing of the effectiveness of the South Branch Flint River Watershed planning effort. Identification of quantifiable measures provides measurability and accountability throughout the six levels of the program. Because of the hierarchical nature of the protection of water resources standards, data collection and analysis will be developed for each of the levels of success necessary to protect the water quality of the watershed. In the next section standards, measures and data gathering methods will be developed and detailed for each level of success.

Level 1: Compliance with EPA nine minimum elements of watershed planning
Evaluation Tool: Review of watershed plan for needed revisions should EPA requirements change.

Compliance with the EPAs minimum standards to watershed planning is a requirement of all watershed plans funded using federal dollars. This is achieved by including several key elements in all watershed plans.

Level 2: Changes in Knowledge / Awareness
Evaluation Tool: Surveys before and during implementation, increased involvement in local watershed organization and plan implementation.

Measures and data collection for this level of success can take place in two ways including a social survey and pre- and post-testing targeted individuals involved in education activities. Measures of knowledge change should be conducted on individuals who are specific targets of education efforts (elected officials, drain office, farmers, etc).

Data collection methods with these target individuals will primarily include pre- and post-tests at conferences or workshops focused on specific water quality issues in the South Branch Flint River Watershed.

Involvement in local watershed groups may also increase as a result of outreach conducted during plan implementation. This may be tracked by the Flint River Watershed Coalition and other local implementation partners.

Level 3: Behavior changes / BMP Implementation
Evaluation Tool: Tracking of BMP adoption and implementation with and without funding incentives.

The intended outcome of this level of success is a change in behaviors as a result of changes in knowledge. Behavior change should be monitored through action change (Levels 5 and 6), e.g. water quality is improving. Improved water quality is a result of changing behaviors. Therefore, activities performed must be documented to demonstrate successful implementation.

This portion of the evaluation will focus on identifying and tracking individuals who are known to be involved in the planning process and instrumental in implementing BMPs. Data about the implementation of BMP can be gathered simply through tracking the number of BMPs installed as a result of the plan's implementation. Data gathering should be done by project implementers with specific individuals as behavior changes and BMP installations are identified. An example of this may include documenting behavior changes of a local planning commission with regards to a particular policy after an educational seminar (managerial BMP) or by mapping the location of structural and vegetative BMPs. Standards for evaluating the success of these efforts are based on the specific measurable objectives outlined in the plan including the number of sites identified for BMPS or the number of policy changes recommended.

Level 4: Reduction in pollutant loadings to the South Branch Flint River
Evaluation Tool: Reduction of pollutant loading estimates due to reduced pollutant sources and causes.

A pollutant loading is a quantifiable amount of pollution that is being deposited in a river. Pollutant loads are based on an amount of pollutant that enters a stream in a given unit of time. An example could include a statement such as 500 pounds of nitrogen enter the stream per day from a specific site. Pollutant loads can be calculated based on the ability of an installed BMP to reduce the targeted pollutant. Loadings are best used at specific sites where detailed data about the reduction of pollutants can be gathered. Pollutant load reductions should be calculated for each installed BMP. Standards for pollutant loads are generally calculated on a cost-effectiveness basis. These are expressed in terms of the dollars spent to reduce a particular unit of pollution. MDEQ has specific standards that are established for BMPs and pollutants. These standards should be tied to the specific measurable milestones identified in the implementation work plan.

Level 5 and 6: Changes in water quality
Evaluation Tool: Benthic monitoring, habitat surveys, thermal monitoring

The evaluation of achievements in Levels 5 and 6 include activities that directly measure the water quality of the South Branch Flint River. The monitoring of water quality in these systems is an extremely complex task that involves gathering data from a number of sources. Periodic assessments of the water quality of the South Branch Flint River are conducted as part of several federal and state water quality monitoring programs. Combining data gathered under these programs, with periodic water quality assessments conducted as part of the watershed planning, will provide the best picture of existing water quality in the watersheds.

Benthic Monitoring – consistent and improved quality of biannual monitoring of two sites along the South Branch by the Flint River Watershed Coalition(FRWC) and continued monitoring of sites by the MDNR every 5 years will serve to evaluate changes in water quality aquatic life.

Habitat Surveys – conducted as part of benthic monitoring, expand habitat surveys to focus on natural areas identified in the Greenlinks Vision. Potential surveyors are the FRWC, students from the University of Michigan – Flint, Mott Community College, and public schools.

Thermal monitoring – is of special importance in the South Branch due to cold water fish species existing in portions of Pine Creek. Routine monitoring of temperature regimes will allow watershed managers to prescribe appropriate BMPs for cold water fish species protection and to evaluate changes in the riparian corridor.

Institutional integration

A key to successful implementation of a watershed is the use of the document by a wide variety of watershed stakeholders. It is the goal of the SBWMP to have the plan play an active role in decision making by a number of organizations and local government partners. Figure 12 includes a list of those partners, how they may use the document and how we intended to monitor its use.

User	Use	Measure
Drain Office	Guide drain maintenance practices and schedules	Measured reduction in drainage costs and linear drains cleaned
Conservation District	Guide annual resource assessment, strategic plan, and work plan	Review annual documents for reference and annual reports for activities directly related to plan implementation
Flint River Watershed Coalition	Guide strategic planning document, integration into public education work , used by committees including policy and watershed plan committee	Review strategic plan, review annual report, regular meeting notes of committee work
NRCS	Guide implementation of Farm bill programs in critical areas	Identification in annual business plan, monitoring of annual status reviews of contracts in priority areas
Local governments	Guide local master plans, parks and recreation plans, zoning and construction ordinances	Period review of planning document for citation, identification of planning decisions made using the document
Local Green Infrastructure planning partnerships	Integration into green infrastructure vision	Increase use in publication and focus in education programming

Figure 12 User, use and measure of institutional use of watershed plan.

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