

MILLECOQUINS RIVER WATERSHED MANAGEMENT PLAN



SUPERIOR WATERSHED PARTNERSHIP

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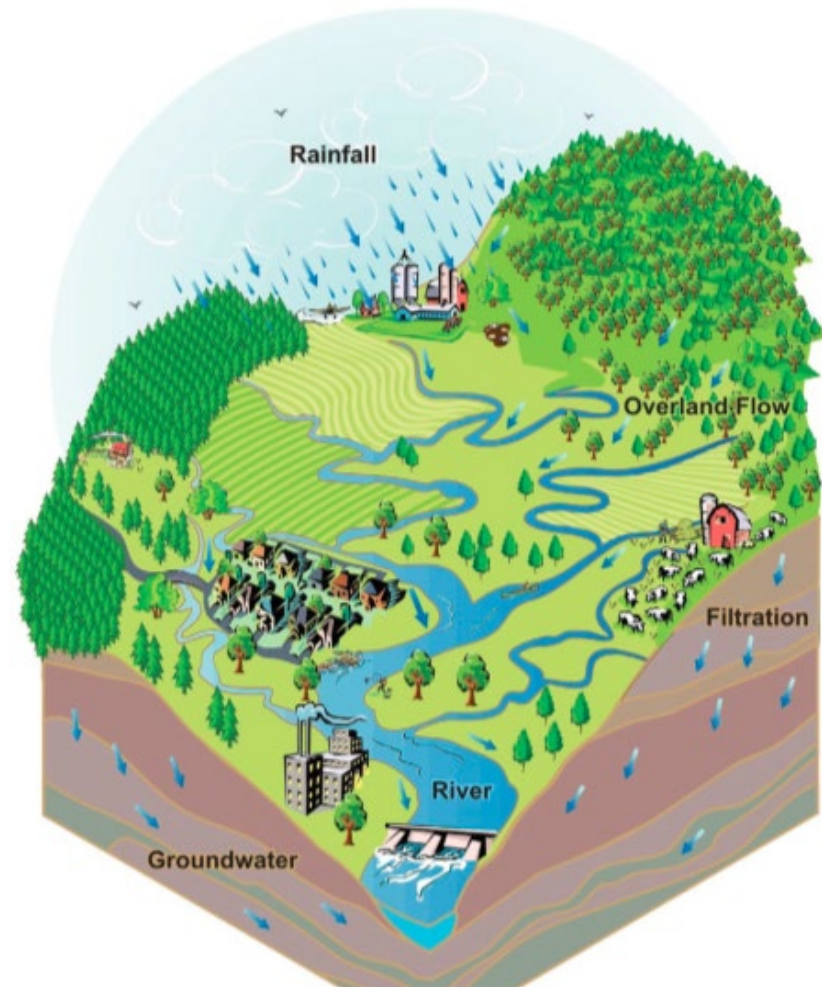
1.0 INTRODUCTION

1.1 Millecoquins River Watershed Setting

People live, work, and recreate in areas of land known as “Watersheds.” A watershed is best described as an area of land where surface water drains to a common location such as a stream, river, or lake. The source of groundwater recharge to streams, rivers, and lakes is also considered part of a watershed. Despite the simple definition for a watershed, they are complex systems with interaction between natural elements such as climate, surface water, groundwater, vegetation, and wildlife as well as human interactions. Agriculture, mineral exploration, timber harvesting and urban development produce polluted stormwater runoff, increase impervious surfaces thereby altering stormwater flows, and degrade or fragment natural areas. Other common names given to watersheds, depending on size, include basins, sub-basins, subwatersheds, and Subwatershed Management Units (SMUs).

The following sections summarize the natural character and condition of the Millecoquins River Watershed based on the results of past and recent inventories of natural features. Included are general descriptions of the location, climate, geology, topography and soils, hydrology and significant natural features.

The Millecoquins River Watershed is located in the Brevoort-Millecoquins Watershed (USGS HUC: 04060107) in Michigan’s Upper Peninsula (Lake Michigan Watershed). Most of the watershed is in Mackinac County with a small portion of the Northern section extending into Luce County. The watershed is named for the Millecoquins River which, along with all other flow sources in the watershed, enters Lake Millecoquins before entering the Lower Millecoquins river outlet channel to Lake Michigan through a series



Hypothetical watershed setting (Source: USEPA)

of sand dune ridges. In total, the Millecoquins River Watershed drains a little over 101 square miles (approximately 65,000 acres) and includes 3 sub-watersheds: Lower Millecoquins River (USGS HUC: 040601070204, 35.5 square miles); Furlong Creek (USGS HUC: 040601070203, 35.5 square miles); and Jacko Creek-Upper Millecoquins River (USGS HUC: 040601070202, 30.8 square miles). Municipalities found in the watershed include portions of the City of Newberry near the headwaters, nearly the entirety of Garfield Township, Engadine, and Naubinway on the Coast of Lake Michigan.

According to EGLE's Water Quality and Pollution Control in Michigan 2024 Sections 303(d), 305(b), and 314 Integrated Report (EGLE, 2022), the Millecoquins River Watershed is facing a mix of pressures that affect its ability to support the use designations of some streams. Hagler Creek, Lower Millecoquins River, North Branch of Cold Creek, O'Niel Creek, South Branch of Gold Creek, Upper Millecoquins River, Maloney Creek, South Branch of Three Mile Creek, Three Mile Creek, Jocko Creek, and Milk Creek were all found to be in good condition for Agriculture, Industrial Water Supply, Navigation, and Indigenous Aquatic Life and Wildlife uses. However, East Branch Furlong Creek, West Branch Furlong Creek, Furlong Creek, and Doe Creek are impacted by mercury linked to atmospheric deposition, impairing their use for Fish Consumption and Indigenous Aquatic Life and Wildlife. Lake Millecoquins is also considered impaired due to the discovery of mercury in fish tissue. In addition, recent/ongoing water quality monitoring by the Superior Watershed Partnership has documented e-coli bacteria in portions of the watershed that exceed State of Michigan Water Quality Standards.

1.2 Project Scope & Purpose

The Superior Watershed Partnership and Land Conservancy is an award-winning Great Lakes nonprofit organization that has set

national records for pollution prevention and implements innovative, science-based programs that achieves documented, measurable results. SWP, in partnership with the Michigan Department of Environment, Great Lakes, and Energy (EGLE) and other key stakeholders, worked to undergo a watershed planning effort and produce a comprehensive "Watershed-Based Plan" for the Millecoquins River Watershed that meets requirements as defined by the United States Environmental Protection Agency (USEPA).

The watershed planning process is a collaborative effort involving voluntary stakeholders with the primary goal to restore impaired waters and protect unimpaired waters by developing and implementing a Watershed-Based Plan designed to achieve water quality standards/criteria. In practice, the plan will support water quality by protecting green infrastructure, creating protection policies, implementing ecological restoration, and educating the public. Another important outcome is to improve the quality of life for people in the watershed for current and future generations.

1.3 USEPA Watershed-Based Plan Requirements

In March 2008, the United States Environmental Protection Agency (USEPA) released watershed protection guidance entitled "Non-point Source Program and Grant Guidelines for States and Territories." The document was created to ensure that Section 319 funded projects make progress towards restoring waters impaired by non-point source pollution. Applied Ecological Services, Inc. consulted USEPA's "Handbook for Developing Watershed Plans to Restore and Protect Our Waters" (USEPA 2008) to create this watershed plan. Having a Watershed-Based Plan will allow Millecoquins River Watershed stakeholders to access 319 Grant funding and other funding for watershed improvement projects recommended in this plan. Under

USEPA guidance, “Nine Elements” are required in order for a plan to be considered a Watershed-Based Plan. 

1.4 Using the Watershed-Based Plan

The information provided in this Watershed-Based Plan is prepared so that it can be easily used as a tool by any stakeholder including elected officials, federal/state/county/municipal staff, and the general public to identify and take actions related to watershed issues and opportunities. The pages below summarize what the user can expect to find in each major “Section” of the Watershed-Based Plan.

Section 2.0: Watershed Resource Inventory

An inventory of the characteristics, problems, and opportunities in the Millecoquins River Watershed is examined in Section 2.0. Resulting analysis of the inventory data can help develop a Management Measures Action Plan. Inventory results help identify sources and causes of watershed impairment as required under USEPA *Element A*.

Section 3.0: Water Quality Assessment & Pollutant Loading Analysis

This section includes a detailed summary of physical, chemical, and biological data available for the Millecoquins River Watershed. Water quality data combined with pollutant loading data provides information that sets the stage for developing pollutant reduction targets and identifying “Critical Areas.”

Section 4.0: Causes & Sources of Impairment & Reduction Targets

This section of the plan includes a list of causes and sources of watershed impairment as identified in Section 2.0 (Watershed Resource Inventory) and by watershed stakeholders that affect Michigan Department of Environment, Great Lakes, and Energy (EGLE) “Designated Uses” for water quality and other watershed

- ❖ *Element A:* Identification of the causes and sources or groups of similar sources of pollution that will need to be controlled to achieve the pollutant load reductions estimated in the watershed-based plan;
- ❖ *Element B:* Estimate of the pollutant load reductions expected following implementation of the management measures described under Element C below;
- ❖ *Element C:* Description of the BMPs (non-point source management measures) that are expected to be implemented to achieve the load reductions estimated under Element B above and an identification of the critical areas in which those measures will be needed to implement;
- ❖ *Element D:* 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 the plan;
- ❖ *Element E:* Public information/education component that will be implemented to enhance public understanding of the project and encourage early and continued participation in selecting, designing, and implementing/maintaining non-point source management measures that will be implemented;
- ❖ *Element F:* Schedule for implementing the activities and non-point source management measures of the plan; identified in this plan that is reasonably expeditious;
- ❖ *Element G:* Description of interim, measurable milestones for determining whether non-point source management measures or other control actions are being implemented;
- ❖ *Element H:* Set of environmental or administrative 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;
- ❖ *Element I:* Monitoring component to evaluate the effectiveness of the implementation efforts over time.

features. As required by USEPA, Section 4.0 also addresses *Element A* including an identification of the “Critical Areas.”

Section 5.0: Watershed Plan Goals & Objectives

This section of the plan contains the goals/objectives of the Watershed Management Plan. Implementation strategies to support these goals are categorized by non-point source reduction, habitat restoration, and climate adaptation implementation strategies. The goals and implementation strategies focus on increased outreach and education to landowners, demonstration of BMP implementation, continued monitoring including opportunities for the public to get involved and sharing measurements of progress to encourage increased stewardship by watershed stakeholders and landowners.

Section 6.0: Management Measures Action Plan

A “Management Measures Action Plan” is included in Section 6.0. The Action Plan is divided into a Programmatic Action Plan and a Site-Specific Action Plan. Programmatic recommendations are described in paragraph format; site specific recommendations are presented in table format with references to entities that would provide consulting, permitting, or other technical services needed to implement specific measures. The site-specific tables also outline project priority, pollutant reduction efficiency, implementation schedule, sources of technical and financial assistance, and cost estimates. This section also contains a watershed-wide summary table of specific information for all recommended site-specific management measures combined including “Units,” “Cost,” and “Estimated Pollutant Load Reduction” as well as pollutant load reduction targets and estimate of pollutant load reductions following implementation of recommended Critical Area Management Measures identified in Section 4.0. This section addresses all or a portion of USEPA *Elements B, C, & D*.

Section 7.0: Information & Education Plan

This section is designed to address USEPA *Element E* by providing an Information/Education component to enhance public understanding and to encourage early and continued participation in selecting, designing, and implementing recommendations provided in the Watershed-Based Plan. This is accomplished by providing a matrix that outlines each recommended education action, target audience, package or vehicle for implementing the action, who will lead the effort, what the expected outcomes or behavior change will be, and estimated costs to implement.

Section 8.0: Measuring Plan Progress & Success

A list of key stakeholders and discussion about forming a Watershed Implementation Committee that forms partnerships to implement watershed improvement projects is included in Section 8.0. Section 8.0 includes two monitoring components; 1) a “Water Quality Monitoring Plan” that includes specific locations and methods where future sampling should occur and a set of water quality “Criteria” that can be used to determine whether pollutant load reduction targets are being achieved over time and 2) “Report Cards” for each plan goal used to measure milestones and to determine if Management Measures are being implemented on schedule, how effective they are at achieving plan goals, and need for adaptive management if milestones are not being met. Section 8.0 addresses USEPA *Elements F, G, H, and I*.

1.5 Prior Studies & Projects

Past Surveys

The Millecoquins River Watershed has been surveyed by the Michigan Department of Natural Resources three times since 1990. These efforts involved the collection of water samples throughout the watershed as well as macroinvertebrate assessment. In addition,

several nonpoint source implementation projects that included cattle exclusion, fencing, stream crossing upgrades, and erosion prevention projects were implemented within the Doe Creek and Furlong Creek watersheds in the early 1990s. During 2003 and 2005, the Millecoquins Lake Association commissioned 2 aquatic plant surveys for Lake Millecoquins. Starry stonewort (*Nitellopsis obtusa*), an invasive aquatic plant, was first discovered in Lake Millecoquins during an additional plant survey in August 2007.

Millecoquins River Watershed MiCorps Volunteer Stream Monitoring Program

During 2009, MiCorps funding provided the equipment and technical resources to establish 6 water quality monitoring sites in the Millecoquins River Watershed located in Mackinac County, Michigan. With assistance from the SWP, project volunteers monitored these sites during the spring and fall of 2009 and 2010, and the spring of 2011. On-site training sessions were held before each monitoring event for returning and new volunteers. Outdoor macroinvertebrate training/identification sessions were held after each monitoring event during the first year of monitoring. For the remainder of the project, identification sessions were held indoors at the Hiawatha Sportsman's Club (HSC) Community Center. Following each sampling event, an informal debriefing session was held between SWP staff and project volunteers. These discussions resulted in improved understanding of project goals, increased efficiency in sampling methods, and improved performance of project volunteers. A report summarizing project results was presented at meetings of the HSC Fish and Wildlife Committee each year.

HSC Watershed Planning

The Hiawatha Sportsman's Club, a property association holding and managing over 35,000 acres of land, has been working with the SWP

to produce a watershed management plan for the Millecoquins River Watershed since 2020. SWP technical staff monitored the physical, chemical, and biological elements of the watershed by collecting *E. coli* surface water samples, collecting water quality characteristic data using a YSI, conducting an aquatic plant inventory of Lake Millecoquins, and inventorying stream crossings. SWP staff advised the HSC Watershed Committee with data collected and provided annual reports. In 2023, SWP and the HSC Foundation Inc. also collaborated to apply for the EGLE Watershed Council Grant to fund the creation of the Millecoquins River Watershed Management Plan, provide water quality community outreach and education, and implement pilot nonpoint source pollution reduction project(s) with willing stakeholders.

2.0 WATERSHED RESOURCE INVENTORY

2.1 Geology, History & Climate

The Millecoquins Watershed lies within the sedimentary Michigan Basin, which covers the entire Lower Peninsula and the Eastern half of the Upper Peninsula. These rocks are covered to various depths by material deposited during the last Ice Age. The Michigan Basin consisted largely of shales, limestones, and sandstones deposited on the bottom of ancient seas that covered Michigan on and off for millions of years. The basin is estimated to be about 14,000 ft thick, and its rocks rest on the top of a very old Precambrian surface. The preglacial topography was much disturbed by the power of vast migrating ice sheets as they eroded and leveled certain areas and deposited materials in other sections of the state (PROJECT GEO MSU). Three quarters of the bedrock surface in Mackinac County is composed of limestone and dolomite of the Niagara Series. The Niagara Series includes Engadine Dolomite, Manistique Dolomite, and the Burnt Bluff Formation. Portions of Mackinac County fall along the Niagara Escarpment, a unique Silurian formation extending from Wisconsin to New York and forming Niagara Falls.

Mackinac County's climate ranges from warm and humid continental in the summer season to cold and snowy subarctic in the winter. Seasonal high temperatures range as high as the mid-80s Fahrenheit while seasonal lows can be sub-zero. The county's proximity to the Great Lakes, especially the straits of Mackinac, create unique weather conditions with wide fluctuations. Precipitation is frequent year-round with snow beginning in late October and continuing until April.

The variable effects of climate change are altering Northern Michigan forests and other ecosystems and can be attributed to changes in

important cultural, economic, and environmental factors. In Michigan, the four heaviest rain events per year contain 35% more water than they did 50 years ago (US EPA 2016). These heavy rains lead to increased sedimentation, nitrates, phosphates, E. coli, and other pollutants entering waterways leading to beach closings and algae blooms. In addition, northern forest compositions are changing. In particular, the Upper Peninsula of Michigan may see declining paper birch, quaking aspen, balsam fir, and black spruce populations and increasing populations of oak, hickory, and pine trees (US EPA 2016). Furthermore, the central and eastern regions of the Upper Peninsula are projected to experience more extreme temperature changes than other parts of Michigan (GLISA 2014).

The Climate Change Response Framework conducted a series of vulnerability assessments for the Northwoods region supported by 27 science and management experts from across the area, aka the "Northwoods Framework." The experts agreed that current and anticipated climatic changes suggest the following main points for the Laurentian Mixed Forest Province of the eastern Upper Peninsula and northern Lower Peninsula of Michigan found: 1). Increased precipitation 2). Increased daily maximum temperatures, particularly in winter 3). Potential increase in mean annual temperature of 2.2 to 8.1 °F for the region 4). The most vulnerable forest communities in the assessment area include upland spruce, fir, jack pine, lowland conifers, and red pine-white pine forest communities (Handler et al. 2014).

Projected climate trends anticipated for the next 100 years were determined using downscaled global climate model data. The suggested management implications in the Northwoods Framework report include (summarized);

- 1) Following state/federal guidance and developing wildlife action plans to protect and support wildlife, and specifically rare, threatened, and endangered species;
- 2) Adapt fire and fuel policies specific to land use in particular regions to address ecosystem and human health concerns exacerbated by drought conditions;
- 3) Replace water infrastructure such as culverts, bridges, and shoreline roads following 100-year flood plans. Use hydrologic modeling where possible to identify high runoff zones;
- 4) Prioritize the preservation of stream margins, as reduced shading could cause the effects of warming temperatures to compound with severe consequences for fish populations and other aquatic life;
- 5) Adapt Forest harvest and management practices for anticipated changes in tree species diversity related to heat-stress and tolerance levels;
- 6) Manage forests for non-timber products such as food, medicine, and craft. In addition, protect cultural, archeological and historical resources;
- 7) Adapt forest harvest and management practices for shorter seasons of frozen ground and reduced harvest windows;
- 8) Manage forests using strategies for increasing carbon storage with enhanced regeneration, competition control, fertilization, and superior stock;

- 9) Plan for increased infrastructure maintenance on trails, campsites, structures and hazard tree removal in wilderness areas due to increased storm events;
- 10) Plan to adapt to challenges and increased infrastructure maintenance at cultural heritage sites;
- 11) Plan to shift tourist and local recreational focus from winter-sports to warmer-weather activities;
- 12) Plan, adapt, and inform the public about regional increases in human diseases and vectors of transmission; and
- 13) Plan, adapt to challenges and plant a variety of highly tolerant species at urban and community forest sites (Handler et al. 2014).

2.2 Topography, Watershed Boundary, & Subwatershed Management Units

From its headwater springs just south of Newberry to where the Lower Millecoquins River empties into Lake Michigan, the Millecoquins watershed shows very little topographic relief. Its highest elevation is approximately 238 feet above sea level, while its lowest falls around 179 feet above sea level. This puts the Millecoquins watershed only 109 feet above Lake Michigan even at its highest (Figure 1). Locations with the highest-grade change include the watershed's headwaters in Lake Superior State Forest, along County Road M-117, and around Lake Millecoquins.

Subwatershed Management Units (SMUs)

The Center for Watershed Protection (CWP) is a leading watershed planning agency and has defined watershed and subwatershed sizes appropriate to meet watershed planning goals. In 1998, the CWP released the "Rapid Watershed Planning Handbook" (CWP 1998) as a guide to be used by watershed planners when addressing issues

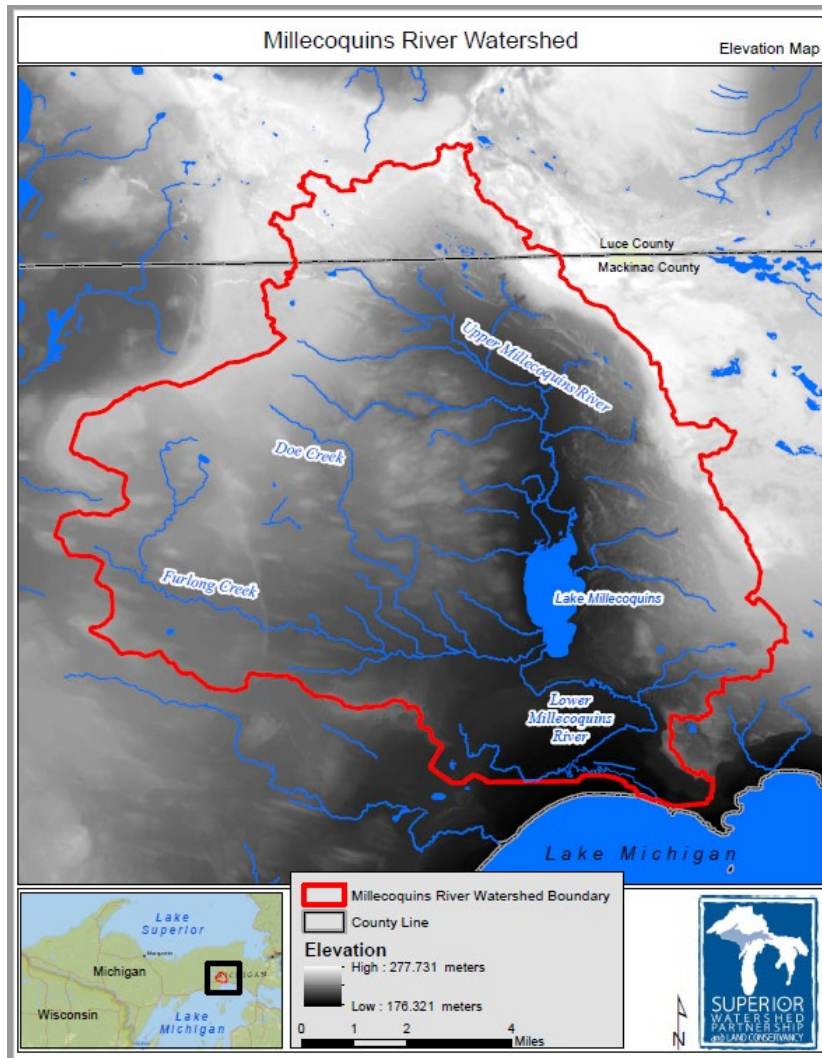


Figure 1. Watershed Elevation Map

within urbanizing watersheds. Broad assessments of conditions such as soils, wetlands, and water quality are generally evaluated at the watershed level and provide some information about overall conditions. The Millecoquins watershed is approximately 101 square miles in area; therefore, this plan allows for a detailed look at watershed characteristics, problem areas, and management opportunities in its subwatersheds as well as from a broader view. However, an even more detailed look at smaller drainage areas must be completed to find site specific problem areas or “Critical Areas” that require immediate attention.

A watershed can be divided into subwatersheds called Subwatershed Management Units (SMUs) to address issues at a smaller scale. The Millecoquins watershed includes 3 sub-watersheds: the Jocko Creek-Upper Millecoquins River (USGS HUC: 040601070202, 30.8 square miles); Furlong Creek (USGS HUC: 040601070203, 35.5 square miles); the Lower Millecoquins River (USGS HUC 040601070204, 35.5 square miles); and over 150 miles of river (Figure 2). Information obtained at the SMU scale allows for detailed analysis and better recommendations for site specific Best Management Practices (BMPs). Delineation into SMUs also allows for better identification of areas contributing to water quality problems as summarized in Section 4.0.

Hydrology

The Millecoquins watershed includes 3 sub-watersheds and over 150 miles of river. There are compensating dams on the Upper (DNR) and Lower (Mackinac County) Millecoquins Rivers that control Millecoquins Lake levels and the Hiawatha Sportsman’s Club operates two small control structures on Jocko and Cold Creeks. There are six small lakes in the watershed connected to Lake Millecoquins’ various tributaries.

The Millecoquins River is divided into an upper section above Lake Millecoquins and a lower section that empties into Lake Michigan. The upper river originates from springs and lakes south of Newberry. Lake Millecoquins is also fed by wetland drainage from Furlong Creek. All flow from the upper watershed enters Lake Millecoquins, which is a shallow lake with a surface area of a little over 10,000 acres and a maximum depth of 12 feet. The lower Millecoquins outlet channel takes drainage through a series of sand dune ridges before emptying into Lake Michigan. A large wetland system surrounds the lower river as well.

Lake Millecoquins is well known as a Northern Pike, Bass, and Perch fishery. In the upper watershed, Jocko Pond and Cold Creek Pond, fed by Jocko Creek and Cold Creek respectively, are both stocked by the Hiawatha Sportsman's Club with Rainbow and Brook trout. The Upper Millecoquins is a cold water fishery with a strong Brook and Rainbow Trout population. Three mile creek is slightly warmer, making it a good habitat for Brown Trout. Pike, Bass, and Trout live throughout the Lower Millecoquins River.

While the MDEQ's 2009 Biological Survey found that the Millecoquins River was largely successful in the supporting "other indigenous aquatic life" component of the river's designated use, the Millecoquins watershed is also home to several nonindigenous aquatic species. These include the Common Carp, an exotic fish species. The Millecoquins watershed is also affected by Sea Lamprey intrusion; lamprey are more common in the Lower Millecoquins River where they venture inland from Lake Michigan during their breeding season. Starry Stonewort, a Eurasian algae variety, was identified in the watershed during a survey in the early 2000s. However, ensuing aquatic vegetation assessments have found no evidence of its presence, meaning the earlier identification was likely erroneous.

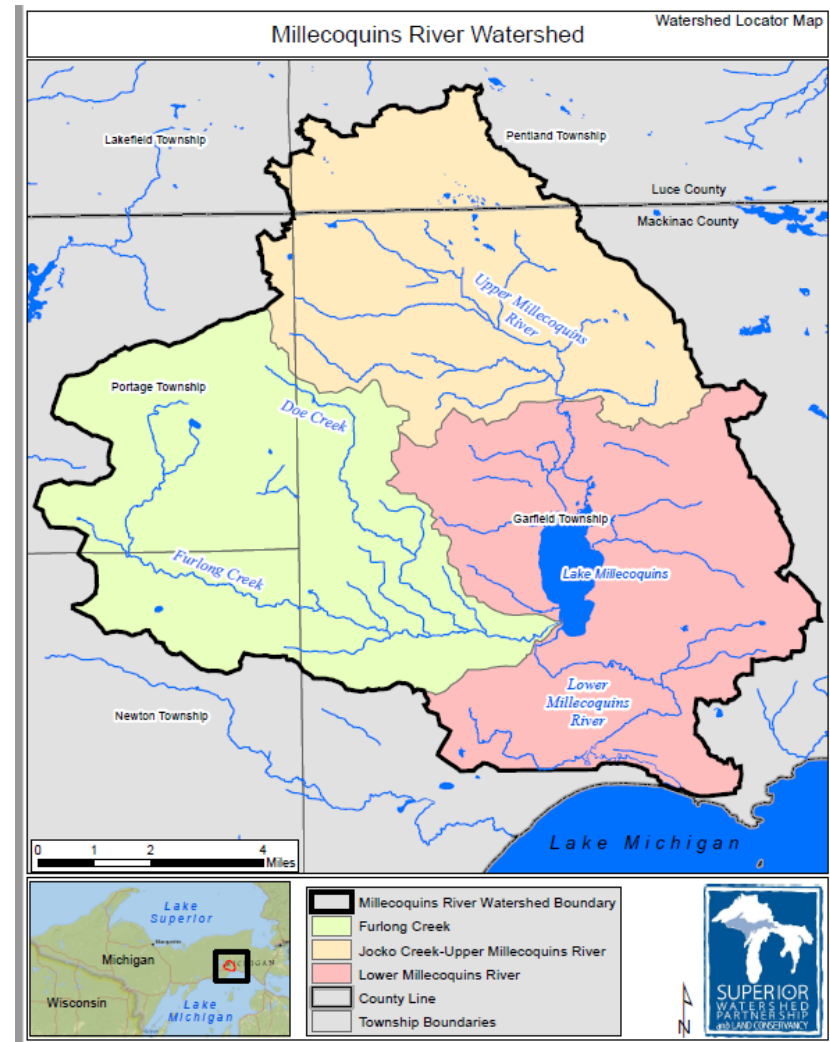


Figure 2. Watershed Map showing Subwatershed Management Units (SMU's)

Wetlands/Waterbodies

Freshwater wetlands provide cool water sources to streams, shade, flood storage, wildlife habitat, and water quality protection. The U.S. Fish and Wildlife Service National Wetland Inventory (NWI) indicate wetland and water body types within the Millecoquins River watershed (USFWS 1980). According to the NWI, wetlands cover 20,161 acres or 31% the total watershed land area. The most prevalent wetland type is forested/shrub, covering 19,084 acres. Emergent wetlands comprise over 487 acres of the watershed. Other waterbodies including freshwater ponds (183 acres), inland lakes including Millecoquins Lake (1,119 acres), and rivers (175 acres) (Figure 3).

Wetland/Waterbody Type	Acres
Freshwater Emergent Wetland	487
Freshwater Forested/Shrub Wetland	19,674
Freshwater Pond	183
Lake	1,119
Riverine	175
Total Wetland/Waters	21,638
Total Watershed Area	65,084

Figure 3. National Wetland Inventory Mapped Wetlands

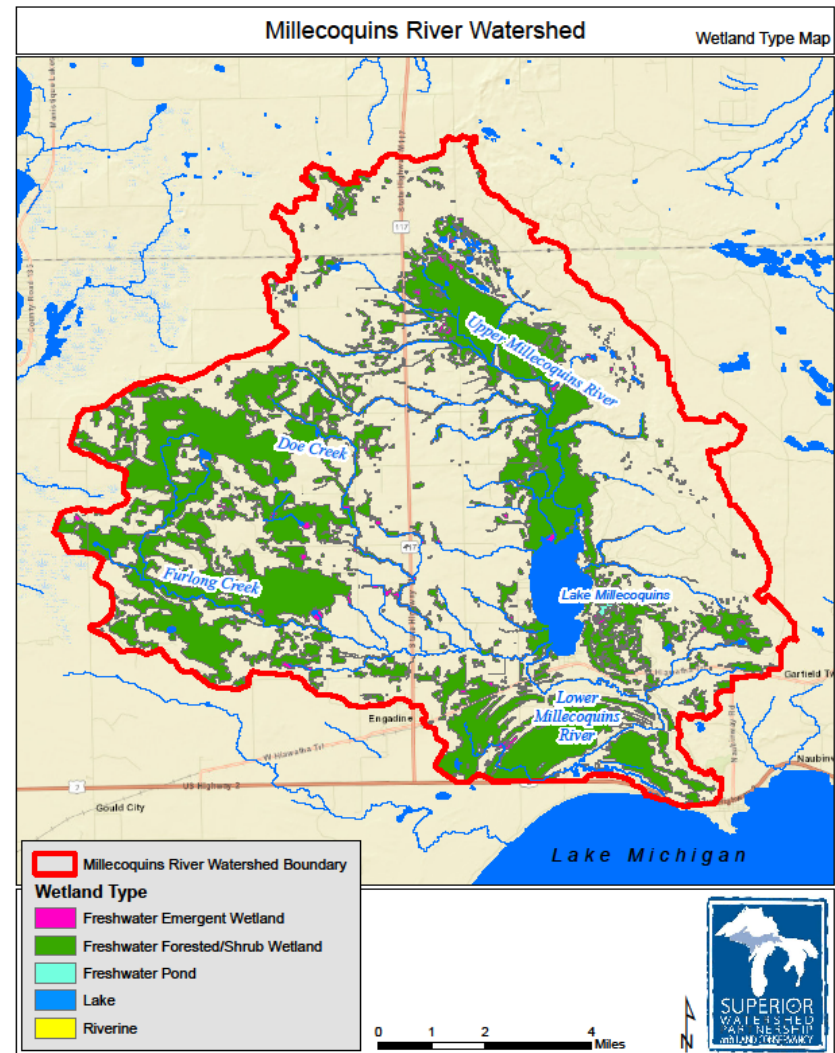


Figure 4. Watershed Wetlands Map

2.3 Hydric Soils, Soil Erodibility, & Hydrologic Soil Groups

Soils

The U.S. Department of Agriculture Natural Resources Conservation Service Soil Survey Geographic (SSURGO) database for Luce County (USDA 2003), Michigan indicates the presence of 63 soil types within the boundary of the Millecoquins River Watershed. These soil types range from well drained sandy soils to poorly drained muck.

Soil survey information can be used to adjust land uses to the limitations and potentials of natural resources and the environment. In preparing a soil survey, soil scientists collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. This information can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties (USDA 2003).

Interpretive ratings are used to identify the limitations that affect specific uses and to indicate the severity of those limitations. Rating classes are expressed in terms that indicate the extent to which the soils are limited by all of the soil features that affect a specified use or in terms that indicate the suitability of the soils for the use. Terms for the limitation classes include: not limited, somewhat limited, and very limited; or slight, moderate and severe. The suitability ratings are expressed as well suited, moderately suited, poorly suited, and unsuited or as good, fair, and poor (USDA 2003). Soil erosion potential is based on the probability that damage will occur where soils are exposed as a result of management activities. This attribute is directly connected with slope and other attributes of the soil type. The ratings slight, moderate, and severe indicate the degree at which



Figure 5. Watershed Soils Map

erosion-control measures should be taken with the severe rating requiring the most precautions (USDA 1997).

Hydric soils are soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part. Under natural conditions, these soils are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic (wetland) vegetation (USDA 2003). Figure 6 shows percentage of map units that meet the criteria for hydric soils in the watershed from the [NRCS Web Soil Survey](#). The thematic map is color coded based on the composition of hydric components. The five color classes are separated as 100 percent hydric components (red), 66 to 99 percent hydric components (orange), 33 to 65 percent hydric components (yellow), 1 to 32 percent hydric components (dark green), and less than one percent hydric components (light green).

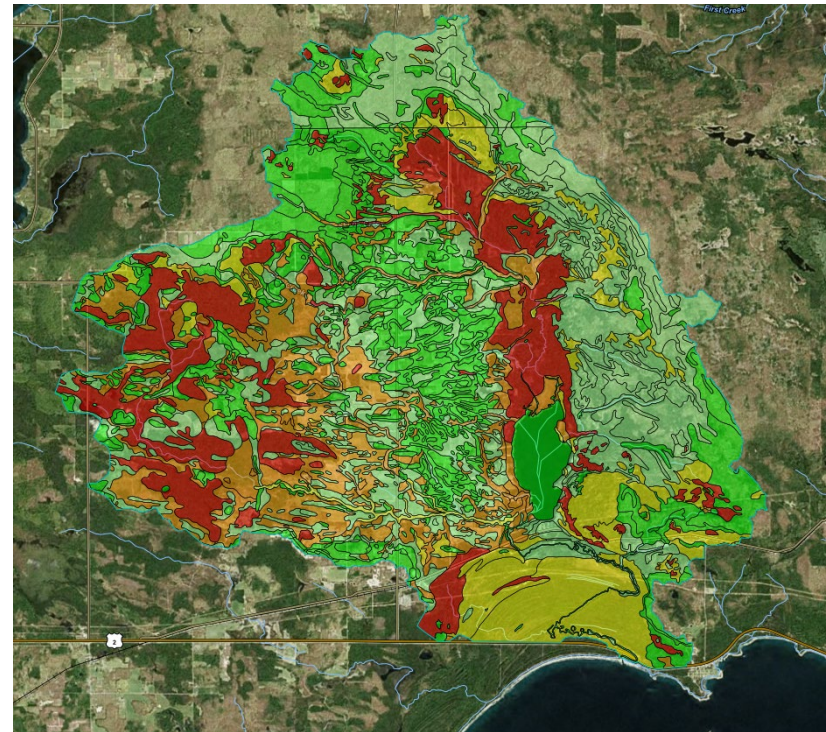


Figure 6. Hydric Soil Class Ratings from the NRCS Web Soil Survey



Figure 7. Local Jurisdiction Map

2.4 Jurisdictional Roles and Protections

The majority of the Millecoquins Watershed falls within Garfield Township in Mackinac County (87,680 acres) with portions of the headwaters located in Pentland Township in Luce County (68,480 acres), one of only 24 of the 83 Michigan counties that have county-wide zoning ordinances (Figure 7).

Water Quality Protection

At the federal level, the Clean Water Act (CWA) is the strongest tool in protecting water resources. Within the state of Michigan, the authority to administer the provisions of the CWA has been delegated to the Michigan Department of Environment, Great Lakes, and Energy (EGLE). Section 402 of the CWA establishes the National Pollution Discharge Elimination System (NPDES), while Section 319 Nonpoint Source Management Program was created in order to further support state and local nonpoint pollutant source efforts not addressed by NPDES permits. Section 319 permits states to receive grant money towards activities such as technical assistance, financial assistance, education, training, technology transfer, demonstration projects, and monitoring to assess the success of nonpoint pollutant source implementation projects. Section 303 of the CWA requires states to catalogue impaired waters, prioritize them, and calculate Total Maximum Daily Loads (TMDLs) of pollutants a waterbody can receive and still safely meet the water quality standards.

The Safe Drinking Water Act also plays a role in protecting surface and groundwater resources. In Michigan, the Wellhead Protection Program includes both mandatory and voluntary initiatives aimed at protecting groundwater resources. As such, the Michigan Department of Environment, Great Lakes, and Energy (EGLE) oversees protection of around 10,000 non-community and 1,400 community water supplies. In 1985, the Michigan Legislature created the Office of the

Great Lakes under the Great Lakes Protection Act, which is now part of the Michigan Department of Environment, Great Lakes and Energy (EGLE). The Office houses the Areas of Concern Program, Coastal Management Program, and the Great Lakes Coordination Program with a mission of collaborating with groups locally and federally to protect and restore the Great Lakes. In 2016 Michigan released the Michigan Water Strategy, a 30-year vision for the protection, restoration, and sustainable management of Michigan's water resources (MDNR 2016).

Additionally, Michigan is part of three interstate compact agreements that also have jurisdiction over Lake Michigan. The first is the Great Lakes Basin Compact which established the Great Lakes Commission and gave it the authority to research and make recommendations regarding water use and development in the Great Lakes. The Council of Great Lakes Governors established the Great Lake Protection Fund to finance projects used to protect and restore the Great Lakes. Finally, the Great Lakes Charter, signed by the Council of Great Lakes Governors, regulates water transfers out of the Great Lakes Drainage basin in excess of 100,000 gallons per day.

The Michigan Coastal Management Program was established under the Federal Coastal Zone Management Act in 1978. It serves to protect Michigan's coastline by supporting healthy and productive coastal ecosystems and sustainable coastal communities.

Planning, Policy & Regulation

Planning, policy, and regulation are the foundation of watershed protection, because the process sets the minimum standards for development that occurs or is proposed to occur in the vicinity of water resources. It is hoped that recommendations from this watershed plan would be referenced in future comprehensive plans and implemented

in ordinances. In many cases, municipal codes also lay the foundation for the types of trees that can be removed from sites as well as what types of plant communities and species that can be replanted. County storm water ordinances are the primary preventative measure that can be used to standardize for the respective county the requirements that proposed developments must meet. Monitoring and enforcement of implemented municipal codes and county regulations falls in the hands of local municipalities or County agencies. It is up to these enforcing bodies to communicate effectively and discuss often the problems with how ordinance language is interpreted and amendments that may help clarify certain regulations.

Planning/zoning guidance provides another level of watershed and natural resource protection. Most planning and zoning guidance is in the form of local floodplain or zoning ordinances that regulate onsite land use practices to ensure adequate floodplain, wetland, stream, lake, pond, conservancy soil, and other natural resource protection. Zoning ordinances and overlay districts in particular define what type of development is allowed and where it can be located relative to natural resources. Other examples of planning/zoning forms of resource protection include riparian and wetland buffers, impervious area reduction, open space/greenway dedication, conservation easements and conservation and/or low-density development. To improve the impact of planning/zoning guidance on water resource protection, there needs to be improved coordination and communication between county and local government. Watershed development regulations should be made very clear to local enforcement officers; local planners and zoning boards should consider revisions to local ordinances that address watershed, subwatershed, and/or site-specific natural resource issues. For example, communities with less impervious development now should revise their zoning ordinances sooner rather than later in order to

adequately prevent the types of development that contribute to flooding, degrade wildlife habitat, and reduce water quality.

2.5 Existing Policies & Ordinance Review

The EGLE Water Resources Division (WRD) administers several aspects of the National Resources and Environmental Protection Act, Public Act 451 of 1994, as amended (Act 451), that regulate activities that are on, within, or involve significant land and water interface features including, floodways, streams, inland lakes, and wetlands. Act 451 lays out a permitting process for any landowner seeking to utilize, manipulate, or otherwise alter these features.

In 2013, the Mackinac County Planning Commission partnered with the Eastern U.P. Regional Planning & Development Commission to update the 2007 county master plan, laying the framework for future land decisions. The Plan identifies the County's vision for "coordinated, adjusted, and harmonious development of the county." The goals outlined in the Plan include the conservation and wise use of the Great Lakes and other natural features, the encouragement of tourism for economic development, and increased collaboration between all levels of government in the county.

Garfield Township, which contains the majority of the Millecoquins Watershed, has several zoning ordinances dealing with water protection. Firstly, section 4.07 states that any land use with more than five thousand (5,000) square feet of impermeable surface shall retain all storm water drainage resulting from runoff on-site by diverting the runoff to a storm water detention or retention pond or into an approved public storm sewer or drainage system. Secondly, with respect the heavy agricultural and animal husbandry presence in the township, Section 4.21 establishes that a one hundred (100) foot wide area of vegetative cover, exclusive of pasture area, shall be maintained

between any corral, unvegetated exercise area, manure pile, manure application area, and any surface water or well, in order to minimize runoff, prevent erosion, and promote quick nitrogen absorption. Setback requirements increase with grade until five percent, at which point aforementioned land uses are prohibited. A map showing the general zoning types in Garfield Township is provided in Figure 8.

Protection of natural resources during future growth is important for the future health of a watershed. To assess how future growth might further impact the watershed, an assessment of local municipal ordinances is recommended to determine how development is regulated in each municipality. In this way, potential improvements to local ordinances can be identified. As a future measure, it is recommended that municipal governments compare their local ordinances against model policies outlined by the Center for Watershed Protection (CWP) in a publication entitled "*Better Site Design: A Handbook for Changing Development Rules in Your Community*" (CWP 1998).

CWP's recommended ordinance review process involves assessments of three general categories including "Residential Streets & Parking Lots", "Lot Development" and "Conservation of Natural Areas". Various questions with point totals are examined under each category. The maximum score is 100. CWP also provides general rules based on scores. Scores between 60 and 80 suggest that it may be advisable to reform local development ordinances. Scores less than 60 generally mean that local ordinances are not environmentally friendly and serious reform may be needed. This assessment is meant to be a tool to local communities to help guide development of future ordinances.

Garfield Township is making good steps in preventing damage to natural resources by implementing zoning measures like the

agricultural buffer and runoff ordinances mentioned above. However, it is highly recommended that the CWP review process be implemented to identify areas for improvement. In addition, more attention to stream bank erosion and current ordinance enforcement is warranted.

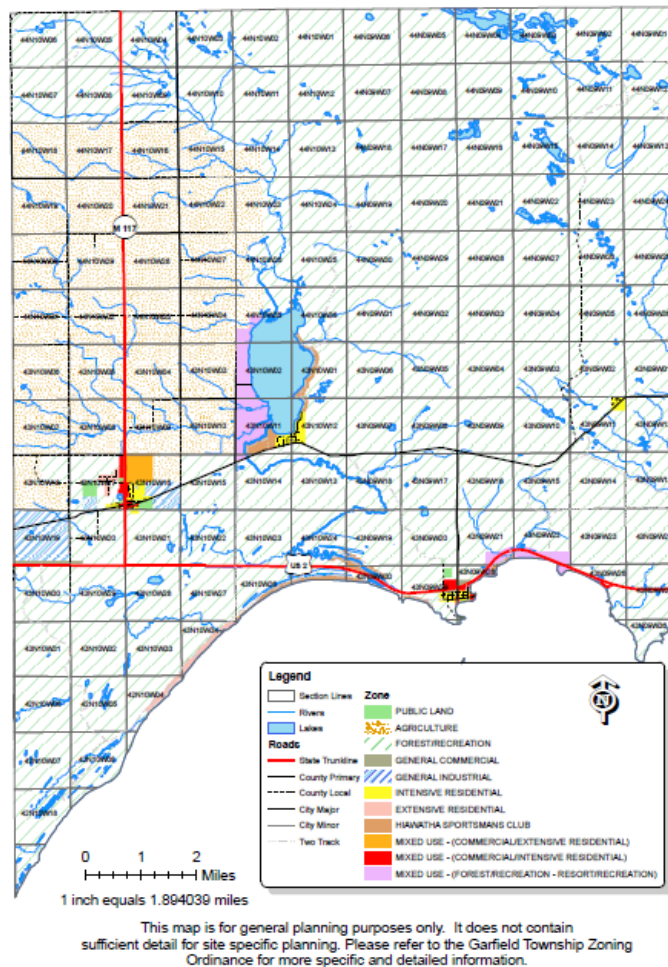


Figure 8. Garfield Township Map #7 General Zoning Map (Mackinac County Master Plan)

2.6 Demographics

Mackinac County is a decidedly rural area, making demographic data difficult to come by. In such areas, the presence of a regional planning body provides a window into demographic trends. Since 2020, the Eastern Upper Peninsula Regional Planning & Development Commission (EUPRPDC) has provided annually updated Comprehensive Economic Development Strategy (CEDS) documents containing demographic information to support a locally-based, regionally-driven economic development planning process.

According to data from the American Community Survey 2021 5-Year Estimates as shown in the most recent CEDS, the Eastern Upper Peninsula is home to 53,435 people. The EUP's population is projected to continue to decline at a rate of .7% between 2021 and 2026. This decline is likely related to an increasing mean population age. As of 2022, the Eastern Upper Peninsula has a labor force of 24,782 with an estimated 19,210 jobs available. Most people are employed by the government or in the accommodation and food services, retail trade, health care, and social services industries.

Census data for Mackinac County provides further insight into the Millecoquins Watershed's human geography. The county has a specific population of 10,941 people. As indicated in the CEDS, the census shows that a third of the population is over 65. 73.9 percent of the population identifying White, 16.2% identifying as Native American, and 3.5% identifying as African American.

Mackinac County is also home to one of the Upper Peninsula's Amish communities. The Amish are an ethnoreligious group connected to European Anabaptist fellowships including the Mennonites. They adhere to a range of communal rules or principles including the rejection of most modern technology, including labor saving devices

and entertainment, pacifism, and communal self-sufficiency. The Mackinac County Amish community began in 2008 and is located within the Millecoquins watershed. The majority of Garfield Township's residents belong to the Amish community. Community members practice pastoral agriculture focused on cattle and sheep rearing, work as carpenters and roofers, and sell artisan goods (Nolt, 2016). Amish farms are clustered around the western side of Lake Millecoquins, interspersed with larger non-Amish farms utilizing modern practices.

Landownership

The history of the Millecoquins watershed and surrounding area is closely associated with logging. Logging companies came to the area in the late nineteenth century to cut huge stands of virgin white pine. Settlements sprang up along the railroad lines used to move lumber out of the U.P. after harvesting. The Minnesota-St. Paul-Sault Ste. Marie Railway, in particular, ran along the Lake Michigan's northern coastline in Mackinac County, leading to the establishment of settlements including Rexton, Naubinway, Curtis, Hessel, Epoufette, and Engadine (Mackinac County Factbook). Today, the largest landholders in Mackinac County are the state and federal governments, which hold over half of all land in the form of state forests; the Lake Superior State Forest and Hiawatha National Forest combine for 53% of all land area in Mackinac County. The Hiawatha Sportsman's Club is also a major landholder in Mackinac County, owning 35,000 acres, over 5% of all lands. This private preserve hosts members for recreation activities including fishing, hunting, boating, and golf. Club lands make up 30.5% (19,827 acres) of the Millecoquins watershed. Over half of Club property falls within the Millecoquins watershed, recognized by club members as roughly the Club lands west of Finn Farm Road, A Trail and Naubinway Road.

As described above, the Lower Millecoquins watershed is largely split between privately owned residences, agricultural land, and state or federal forests to the west and Hiawatha Sportsman's' club lands to the east. The upper watershed also follows this general ownership pattern with smaller, individual landholdings on the western side and the Club lands making up the eastern section. The upper most section falls within Luce County's border. Privately owned residences become more common closer to Newberry, while state and federal forest otherwise dominate.

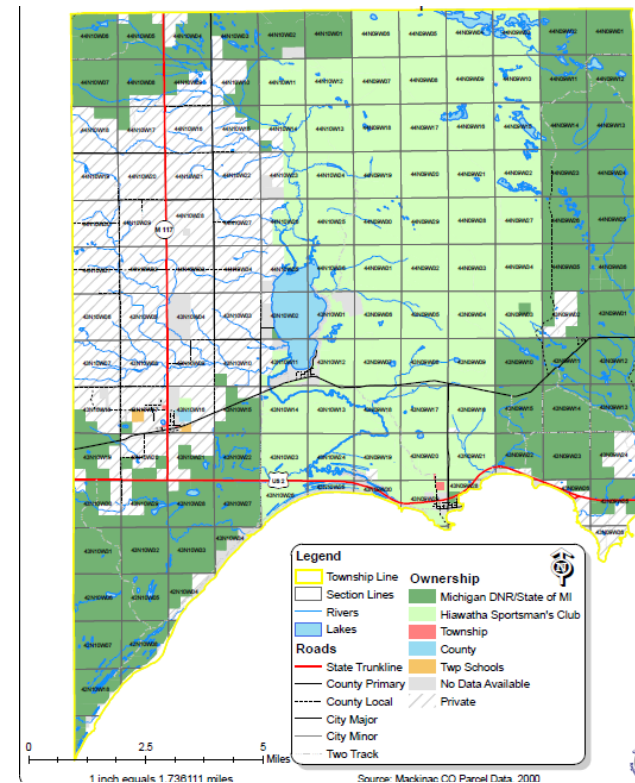


Figure 9. Garfield Township Map #3 Major Landowners Map
(Mackinac County Master Plan)

2.7 Transportation Network

Roads

A limited network of roads traverses the Millecoquins watershed. However, different sections of the watershed experience different levels of intensity. State highway M-117 is a major road that carries traffic south from Newberry to US-2 on the Lake Michigan shoreline. M-117 bisects the upper watershed's eastern agricultural area, providing access to a grid of paved and dirt roads that serve farmers and families living in the area. In the lower section, Hiawatha Trail Road connects Engadine with Millecoquins, a small settlement on the southern edge of Lake Millecoquins, before continuing into HSC lands. Further south, US-2 crosses the Lower Millecoquins River just before it empties into Lake Michigan. This interstate is a major travel corridor connecting Wisconsin, the Upper Peninsula, and the Lower Peninsula via the Mackinac Bridge as part of Michigan's state trunk line highway system. In contrast to these more intensely trafficked areas, HSC lands have minimal road pressure and are open to HSC members who travel two-tracks in vehicles and ORVs.

Roads can have a significant impact on the landscape because they often destroy and fragment habitat (including wetlands), contribute sediment to streams, block passage for fish, and provide pathways for other threats including increased recreation or development pressures and invasions of non-native invasive plants. Crossing structures that are misaligned, undersized, and/or perched can impact stream flow and movement of fish and aquatic organisms. Many of the crossings are situated at the lowest elevation point of the road that they service and function as a focal point to funnel sediment into the river. Some crossings consist of old or improvised materials or have no crossing structure at all, with vehicle traffic driving directly through the stream. During 2021, the SWP Great Lakes Climate Corps (GLCC) inventoried 61 road-stream crossings in the Millecoquins River

Watershed (Figure 10). Data was collected according to the DNR's Great Lakes Road Stream Crossing Inventory Instructions and was uploaded to the Michigan DNR Stream Crossing Viewer database. By clicking on a point, the viewer can see detailed measurements and observations collected by the SWP field technicians and view photos of the site. The inventory data, which is summarized in Appendix A, was used to prioritize replacement of culverts/crossings that are undersized, damaged and/or impeding stream flow and fish passage. Specific prioritization was given to crossings which caused excessive sedimentation and posed concerns for nonpoint source pollution. The prioritized crossings are summarized in Appendix B, including their current conditions and recommended BMPs.



Figure 10. Road/stream crossing inventory map.

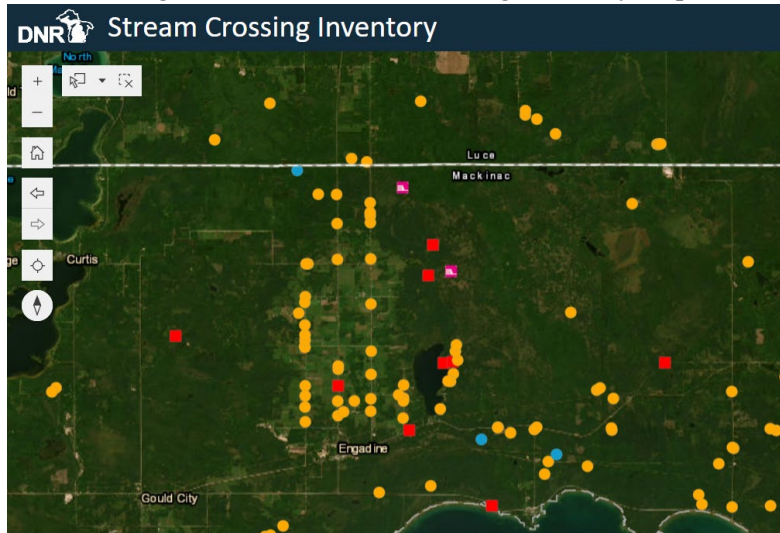


Photo: Michigan DNR Stream Crossing Viewer ([Source](#))



Photo: GLCC field technicians assessing erosion at an unregulated stream ford

Railroads

The Canadian National Railway Company manages an international freight line that follows US-2 closely through the Upper Peninsula. At Engadine, the railroad turns north, following Hiawatha Trail Road through Millecoquins just south of Lake Millecoquins. The line bisects the Lower Millecoquins River alongside Hiawatha Trail Road as well.

Airports

The only airfield in the watershed belongs to the Hiawatha Sportsman's Club and is restricted to club member use. It is a small facility with an under 3,000-foot landing strip.

The closest public airport is the Luce County Airport in Newberry, approximately ten miles away from the Millecoquins watershed's northern lobe.

Harbors

There are no major harbors within the boundaries of the watershed. The closest is the Naubinway Marina, which is less than a mile south from the watershed's southeastern edge.

Trails and Bike Paths

There are little to no publicly accessible hiking or bike path style recreation areas in the watershed. However, the Hiawatha Sportsman's Club maintains an extensive network of private recreation areas that include paths and trails.

2.8 Existing & Future Land Use / Land Cover

Land cover in the watershed is dominated by forested (woody) wetlands (41.4%) and deciduous forest (18.4%), followed by hay/pasture (11.7%) and evergreen forest (9.7%). Anecdotally,

agricultural land owners in the watershed have been approached to lease land for solar energy. Millecoquins Lake (1,062 acres) is the largest lake in the watershed and is a popular destination for recreation. During the summer months, this is also a popular spot for anglers, with the lake having a high population of northern pike, walleye, smallmouth bass, largemouth bass, panfish, minnow species, other fishes and aquatic life. The table in Figure 11 includes a summary of the landcover types in the watershed.

Landcover	acres	percent
Open Water	1,179	1.8
Developed, Open Space	1,337	2.1
Developed, Low Intensity	787	1.2
Developed, Medium Intensity	164	0.3
Developed, High Intensity	26	0.0
Barren Land	108	0.2
Deciduous Forest	11,967	18.4
Evergreen Forest	6,300	9.7
Mixed Forest	4,525	7.0
Shrub/Scrub	1,159	1.8
Herbaceous	1,231	1.9
Hay/Pasture	7637	11.7
Cultivated Crops	602	0.9
Woody Wetlands	26,963	41.4
Emergent Herbaceous Wetlands	1,107	1.7
Total	65,092	

Figure 11. Landcover Types in the Millecoquins River Watershed

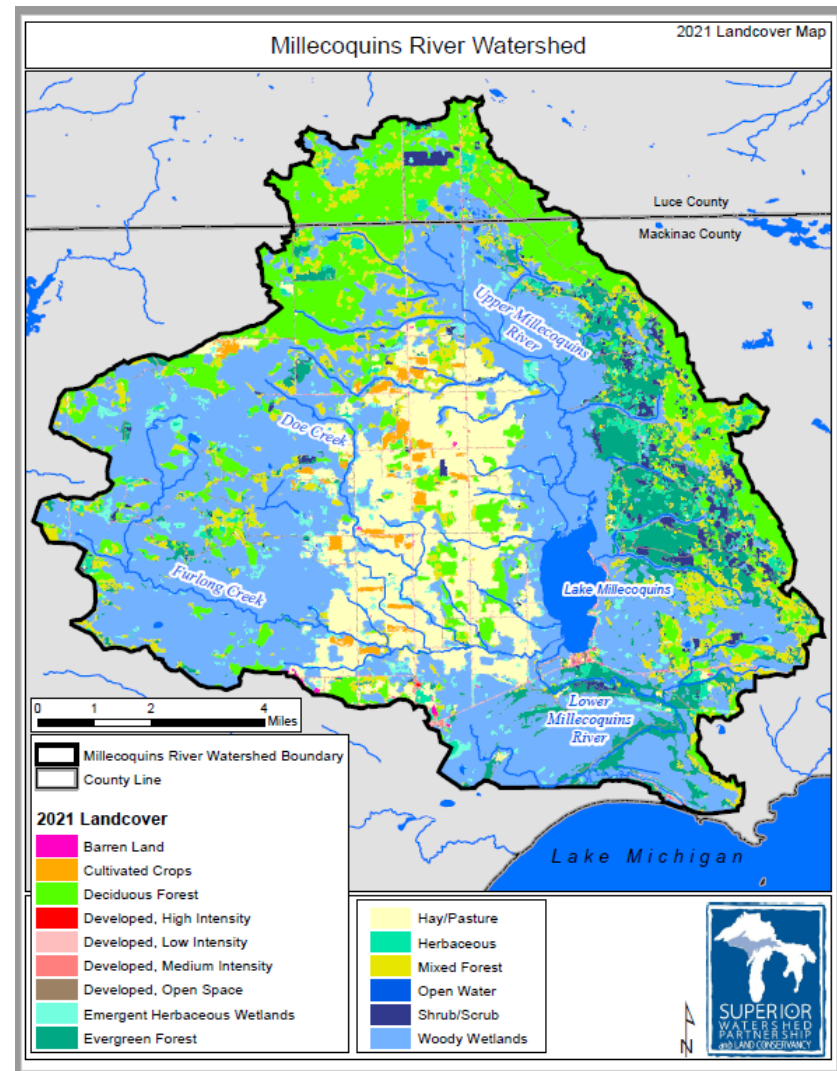


Figure 12. Land Use Land Cover Map

2.9 Important Natural Areas

The Michigan Department of Natural Resources defines natural areas as: “Areas that have retained the best example of Michigan’s native landscapes, ecosystems, natural communities or scenic qualities”. Features used to identify natural areas include: size, uniqueness, pristine nature, aesthetic or scenic qualities, and outstanding opportunities for solitude or a primitive and unconfined type of recreation. To be legally dedicated, natural areas must also contain ecological, geological or other features of scientific, scenic or natural history value. Many areas also have populations of endangered and threatened species.”

While the Millecoquins watershed does not hold any natural areas as designated by the DNR, over 40,000 acres of property have at least some levels of protection from development. These include the Iron Belle Trail (5 miles of trail and buffer through the lower watershed), the St. Ignace Lake Plain State Forest Compartments (approximately 3,000 acres in the upper watershed and approximately 2,000 in the lower watershed), and portions of the Hiawatha Sportsman’s Club lands (35,000).

Given the intensive agricultural presence in the Millecoquins watershed, the more remote portions of the Hiawatha Sportsman’s Club lands have the highest potential for high quality habitat. Specifically, the wetland system along the Lower Millecoquins River between Lake Millecoquins and Lake Michigan are robust and largely unaffected by roadways and trails.

2.10 Significant Natural Resources

Logging and forestry have been a prevalent land use in the Millecoquins watershed since the 19th century logging boom due to thick hardwood forests and proximity to Lake Michigan’s harbors and

coastal railroads for shipping. Harvesting has continued in State Forests as well as a small section of privately owned commercial forest. With the implementation of best management practices, timber harvesting has become more sustainable in recent years. However, over-harvesting in the dune systems along Lake Michigan and the Millecoquins River’s upper and lower sections can cause destabilization, changes in hydrology, flow patterns, water infiltration, and evapotranspiration.

In addition to commercial forestry, private landowners as well as the State are able to lease the mineral harvesting and exploration rights to their land. In the context defined by EGLE, “mineral” and therefore “mineral rights” pertains to: fossil fuels (oil, natural gas, and coal), metals and metal-bearing ores, nonmetallic minerals and mineable rock products (limestone, gypsum, building stone, and salt), and may also include sand and gravel, peat, and marl. Mineral rights, similar to property rights, may be sold, transferred, or leased. They are distinct from “surface rights” and one can transfer “mineral rights” while maintaining “surface rights.” The owner of a parcels “mineral rights” may develop that parcel’s mineral deposits or, alternatively, may lease the rights to a mineral development company. In this process, the land owner is generally paid a “bonus” when signing the lease along with royalties from any minerals extracted from the parcel.

This is applied to State-held public lands through the leasing nomination and bidding process. Interested parties have the opportunity to nominate state-owned parcels for leasing mineral rights, and the leases are then auctioned. Interested parties may also apply for a direct lease. The State receives the revenue for these leases and has generated over \$255 million in the last seven years which goes into the Michigan State Parks Endowment Fund and the Game and Fish Protection Trust Fund.

Whether the leased land is State or private owned, it is subject to regulation by the EGLE, as leasing itself is not authorization to harvest minerals. The information on what land is leased and how as well as upcoming lease nominations is publicly available on the Michigan DNR “Managing Your Resources-Minerals” page. At the time of writing, there are currently no lands nominated for mineral leasing in the Millecoquins watershed area.

2.11 Environmentally Sensitive Areas

The main land use activities within the Millecoquins watershed are forest management conducted by the State of Michigan, the Hiawatha Sportsman’s Club, and other small private landowners, agriculture by various private landowners and businesses, and recreation. While a large portion of the watershed is undeveloped, there is further potential for agricultural intensification and residential development, especially impactful along the rivers and tributaries interspersing the agricultural areas and the upper watershed. Environmentally sensitive areas that have the potential to be impacted by potential land use changes include:

- Forested, shrub and emergent wetlands that filter runoff and aid in flood storage capacity and groundwater recharge.
- Riparian areas and flood plains that when intact, provide flood storage capacity, shade and woody debris for rivers/streams.
- Inland lakes, ponds and tributaries that support fish and other aquatic life including DNR priority fish species.
- Habitat for threatened & endangered species that have been impacted due to habitat loss and invasive species.

2.12 Groundwater Aquifers, Contamination Potential, & Water Supply

The primary source of drinking water for residents in the Millecoquins River Watershed is groundwater. Groundwater and surface water are closely linked, and any contamination of one has the potential to significantly impact the other. Stormwater runoff from lawns, roofs, roads, parking lots and agricultural lands often carry bacteria, nutrients, pesticides and other pollutants that can impact water quality and be harmful to human health. In the Millecoquins River Watershed, virtually all of this stormwater ends up in Millecoquins Lake, the Lower Millecoquins River and Lake Michigan either through natural drainage or through the stormwater drains along the roadside. As a result, Millecoquins Lake has experienced impacts from E. coli bacteria and excessive vegetation growth in recent years (E. coli results are summarized in Appendix C and aquatic plant survey results are in Appendix D).

TC Energy’s natural gas and Enbridge’s line 5 oil pipelines pass west to east through the southern portion of the watershed crossing the Lower Millecoquins River. Future spills from these pipelines pose a threat to human health and environmental contamination. The Enbridge line 5 pipeline has two recorded spills in the Millecoquins watershed. In 1972 line 5 experienced a weld failure resulting in a 100 barrel (4,200 gallons) oil spill. Again in 1990, line 5 spilled 15 barrels (630 gallons) as the result of a pinhole leak. The soil from that leak, less than 1 mile from the Lower Millecoquins River, was excavated and hauled to a landfill.

3.0 WATER QUALITY ASSESSMENT AND POLLUTANT LOADING ANALYSIS

3.1 Point & Nonpoint Source Water Quality Pollutants

Water quality can be adversely affected by both point and nonpoint source pollutants. Point sources are identified as any discharge that comes from a pipe or permitted outfall, such as municipal and industrial discharges. Nonpoint source designation accounts for diffuse contamination, which can create cumulative negative effects in a watershed. The Michigan National Pollution Discharge Elimination System (NPDES) program and Industrial Pretreatment Program regulated point source contaminants. However, nonpoint sources are more difficult to track and manage because tracking them back to their origins is difficult. Nonpoint source pollutants can include, but are not limited to, illicit discharges into waterways, excess nutrients (such as nitrogen and phosphorus) entering the watershed via fertilizer or animal manure bearing runoff, and excess sediment from construction sites or streambank destabilization.

3.2 Water Quality Report, Designated Uses, & Impairments

The Federal Clean Water Act requires Michigan and all other states to submit to the United States Environmental Protection Agency (USEPA) a biannual report of the quality of the state's surface and groundwater resources and an updated Section 303 (d) list. The Water Quality and Pollution Control in Michigan 2024 Sections 303(d), 305(b), and 314 Integrated Report was compiled by the Michigan Department of Environment, Great Lakes and Energy (EGLE) and is the most recent of these reports to be finalized. This report must also describe how Michigan assessed water quality and whether assessed waters meet or do not meet water quality standards specific to each "Designated Use" of a stream or lake as defined in the State of Michigan's Part 4 Rules of the Water Resources Protection Act (Act

451, Part 31). When a waterbody is determined through biological and/or physical chemical sampling to be impaired, EGLE must list potential causes and sources for impairment in the 303 (d) impaired waters list (EGLE 2024).

Michigan's Water Quality Standards require that all designated uses of surface waters be protected, and those designated uses include: agriculture, navigation, industrial water supply, public water supply at the point of water intake, warmwater or cold-water fish, other indigenous aquatic life and wildlife, fish consumption, partial body contact recreation, and total body contact recreation from May 1 to October 31 (EGLE 2024). Each designated use is associated with particular water quality criteria and set the standards a waterbody must meet in order to protect the intended use. These standards and designated uses are designed to 1) protect the public's health and welfare, 2) to enhance and maintain the quality of water and 3) to protect the state's natural resources. The first step in establishing goals for this watershed planning project was to evaluate the current condition of water quality in the watershed. The primary criterion for water quality is whether the waterbody meets designated uses.

Atmospheric deposition of mercury and other heavy metals into water bodies have been observed across the globe. According to EGLE's Water Quality and Pollution Control in Michigan 2024 Sections 303(d), 305(b), and 314 Integrated Report (EGLE, 2024), 7 streams in the Millecoquins River Watershed fulfill all their assessed designated uses (Figure 13). Furlong, Doe, and the Upper West and East Branches of Furlong Creek are listed as impaired. These three waterbodies were described as impacted by mercury in the water column, impairing fish consumption and indigenous aquatic wildlife designated uses.

SWP's field work (appendix C) suggests that portions of the Millecoquins River Watershed are impaired for partial and total body contact due to E. coli presence. Part 4 of the State of Michigan's Water Quality Standards (R 323.1062 Microorganisms. Rule 62.) describe microbial impairments as follows:

“(1) All waters of the state protected for total body contact recreation shall not contain more than 130 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 2 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. (2) All surface waters of the state protected for partial body contact recreation shall not contain more than a minimum of 1,000 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.”

EGLE will propose to list the following waterbodies for designated use impairments in the 2026 Integrated Report (Figure 13). Proposed listings are subject to change due to public comment and USEPA approval.

Assessment_Unit_ID (AUID)	Partial Body Contact Use Attainment	Total Body Contact Use Attainment
MI040601070203-01 Doe Creek	NS	NS
MI040601070203-02 Furlong Creek	NS	NS
MI040601070203-03 East/West Branch Furlong Creek	FS	NS
MI040601070203-04 Lower Portion of Furlong Creek	FS	FS
MI040601070203-05 Doe Creek upstream of Pleasant Ave, southernmost crossing	FS	NS
MI040601070203-06 Doe Creek upstream of Pleasant Ave, northernmost crossing	FS	FS

FS= Fully Supporting. NS= Not Supporting

Figure 13. Proposed Designated Use Listings for 2026

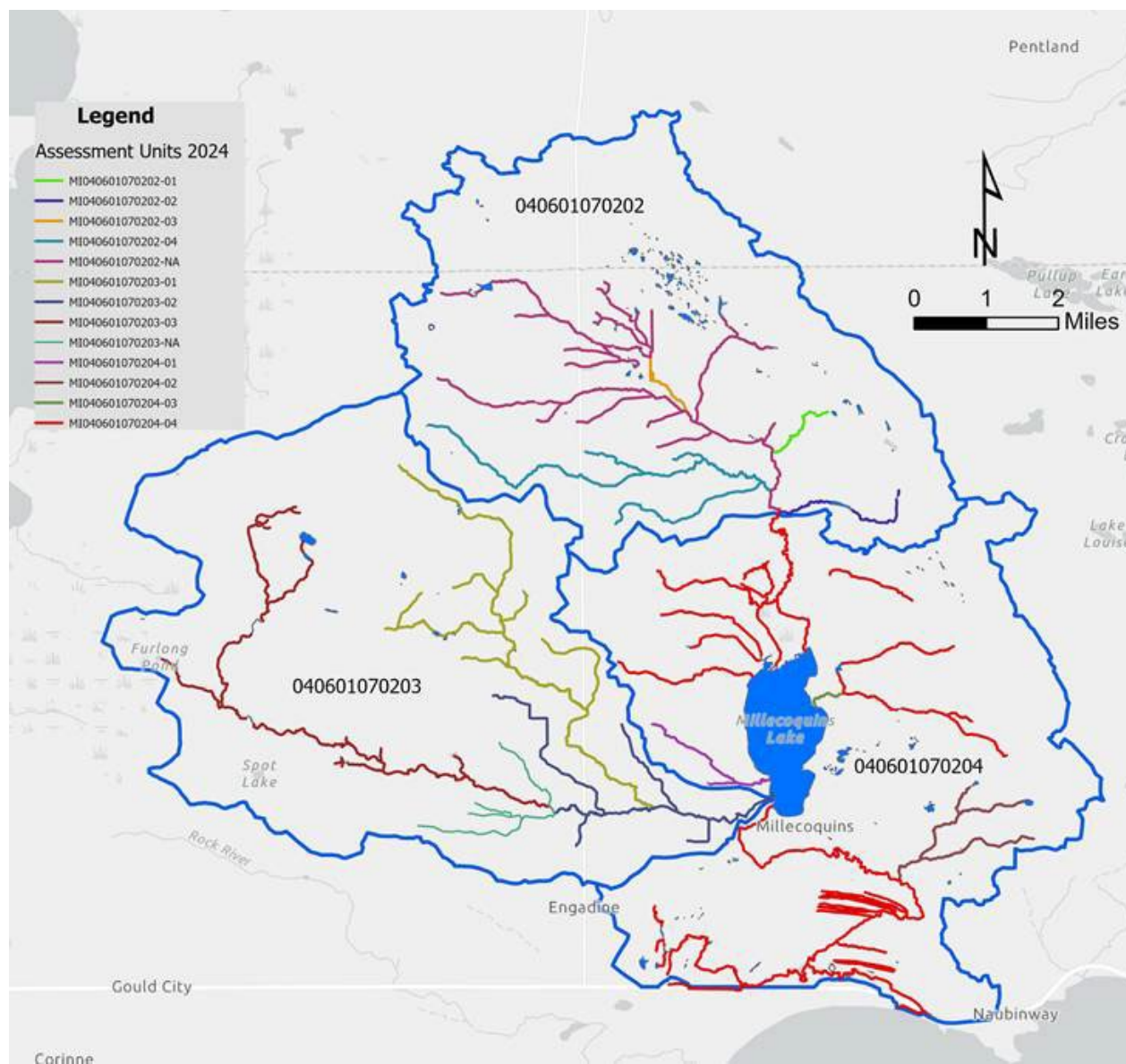


Figure 14. AUID map.

AIUD/Waterbody	Designated Uses								
	Agriculture	Cold Water Fishery	Fish Consumption	Industrial Water Supply	Navigation	Other Indigenous Aquatic Life and Wildlife	Partial body Contact	Total Body Contact	Warm Water Fishery
McAlpine Creek 040601070202-NA	X	X	X	X	X	X	X	X	X
040601070202-03	FS	X	X	FS	FS	FS	X	X	X
Milk Creek 040601070202-01	FS	X	X	FS	FS	FS	X	X	X
Maloney Creek 040601070202-04	FS	X	X	FS	FS	FS	X	X	X
Jocko Creek 040601070202-02	FS	X	X	FS	FS	FS	X	X	X
Upper/Lower Millecoquins 040601070204-04	FS	X	X	FS	FS	FS	X	X	X
Unnamed Creek 040601070204-01	FS	X	X	FS	FS	X	X	X	X
Furlong Creek 040601070203-02	FS	X	NS	FS	FS	NS	X	X	FS
Doe Creek 040601070203-01	FS	X	NS	FS	FS	NS	X	X	X
040601070203-NA	X	X	X	X	X	X	X	X	X
East/West Branch Furlong Creek 040601070203-03	FS	X	NS	FS	FS	NS	X	X	FS
Three Mile Creek 040601070204-02	FS	X	X	FS	FS	FS	X	X	X

X= Does not apply. FS= Fully supporting. NS= Not supporting

3.3 Water Quality Assessment

While much of the Millecoquins watershed is remote, sections have experienced impacts from historic and recent land uses such as logging, agriculture (cattle), and increasing development and recreational uses. Harmful algal blooms and other changes have been observed and documented by local landowners who have raised concerns about potential impacts on water biochemistry which support fish and macroinvertebrate populations. Due to these concerns from local stakeholders and a history of state investment in best practices and infrastructure in the area, the SWP undertook a multi-method water quality assessment project from 2020 to 2023.

During the Spring of 2009, the SWP coordinated a stream monitoring event to assess cold water fishery health at six key habitat locations in the watershed. Volunteers from the Hiawatha Sportsman's Club and a MiCorps Volunteers Stream Monitoring Team, as well as SWP staff, conducted stream habitat assessments and macroinvertebrate community assessments. For the habitat assessment, physical appearance was recorded throughout a 300-foot reach, recording only observations which were seen. The recorded physical characteristics of the stream included width, depth, velocity, water color, temp, water body type, stream flow, and substrate. For the macroinvertebrate community assessment, macroinvertebrates were collected, identified to the order level, and listed as rare or common based on abundance. Macroinvertebrates were sampled for approximately 30 minutes per 300-foot station, collected from all available habitats within the station. The results of the 2009 stream monitoring are summarized in Appendix E. This data provides a baseline for future habitat restoration efforts.

Water chemistry monitoring took place at 10 sites twice between 2020 and 2022. SWP field technicians used a YSI water quality meter to monitor seven key water chemistry characteristics, suspending the probe close to the riverbed midstream for several minutes at each site and recording readings. Measured parameters were water temperature, specific conductivity, conductivity, dissolved oxygen as percentage of sample, dissolved oxygen in milligrams, water pH, and oxidation reduction potential. This water quality data is included in Appendix C.

To account for concerns about potentially dangerous bacteria blooms, staff collected surface water samples, which were tested for *E. coli* bacteria levels. All samples were collected following best practices protocol including sterile container use supplied by the analysis lab, glove use, avoiding the surface water microlayer, and limiting sediment. Samples were preserved in iced coolers before being delivered to the LMAS lab for analysis. During the first year, only three sites were sampled. The results indicated that a more expansive study was required, warranting the addition of four more sites in 2021. In 2022, sampling took place exclusively at two key Hiawatha Sportsman's Club locations. Finally, for the 2023 sampling season, staff expanded the HSC sites to four, including 2 sites on Lake Millecoquins itself, as well as 18 sites selected through consultation with EGLE's Water Resources Division based on proximity to potential water quality impact sites.

Finally, from 2020 to 2023, SWP field technicians inventoried 61 road-stream crossings within the HSC and Millecoquins watershed to identify structural concerns including crushed, plugged, or undersized culverts using the [Great Lakes Stream Crossing Inventory](#) protocol. Dozens of detailed measurements were collected to identify concerns related to fish passage including perched, scoured, or unnatural substrate culverts. Photos were taken of each culvert's inlet and outlet,

creek's upstream and downstream, and road in both directions. Data from the inventory was entered into the DNR Stream Crossing Inventory and findings are summarized in Appendix A. Results indicated that 56 of the 61 assessed crossings were found to be generating erosion in the watershed. Six of the crossings were found to be creating ponding as well (at the time of the assessment, these six streams were at bankfull or just under bankfull). These phenomena negatively impact water quality; sediments entering the watershed destabilize hydrology necessary for healthy fish habitat while also carrying excess nutrients, causing algal blooms. Similarly, pooling caused by road-stream crossings increases water temperature, providing tepid, still water for algal development.

3.4 Septic Impact

While properly installed and maintained septic systems do not negatively impact water quality, system failures can lead to nutrient and pathogen leakage into groundwater.

These pollutants can threaten human, animal, and vegetation health in a watershed through drinking water well infiltration, seepage into surface water, and the fueling of *E. coli* blooms. Septic systems are common in rural communities like those in the Millecoquins watershed; cumulative impacts of failing systems and other insufficient human waste management practices can greatly damage designated uses. The EPA cautions that freshwater systems, like the Millecoquins watershed, are especially sensitive to high phosphorous (P) leakage from damaged septic systems.

The EPA's PLET software provides modelled information on septic systems and their water quality impact by subwatershed in the Millecoquins. There are 143 systems in the Upper Millecoquins, 165 in the Furlong, and 250 in the Lower Millecoquins subwatersheds

respectively. These systems have a general, modelled failure rate of 1.14%. The PLET also estimates the following average pollutant concentration data for all 558 septic systems in the watershed:

Pollutant	Average Concentration
N	60 mg/L (range of 20 to 100)
P	23.5 mg/L (range of 18 to 29)
BOD	245 mg/L (range of 200 to 290)
Average Septic Overcharge Rate	70 gal/day/person (range of 45 to 100)

Figure 15. Average PLET Estimate of Pollutant Concentrations across the Millecoquins River Watershed Septic Systems

A factor in septic safety or failure is soil suitability. Further analysis is required to determine whether or not septic failure is playing a significant role in the water quality issues identified in this plan. Given the high *E. coli* impact in the Millecoquins River Watershed, the SWP strongly suggests additional work in this area. Section 6.2 details specific tasks and BMPs recommended by SWP to address septic system and *E. coli* issues.

3.5 Desired Uses

Given the watershed pressures identified through this pollutant assessment, this plan identifies the following desired uses for the Millecoquins River Watershed:

Support water quality by reducing agricultural and pastoral watershed impacts while also supporting the protection of prime farmland.
Protect critical habitat for native aquatic/terrestrial species through BMP implementation.

Encourage the safe passage of fish and other aquatic organisms through the watershed and preserve aquatic habitat connectivity.
Support recreational use along lakes, rivers and streams while reducing potential impacts to water quality and designated uses.
Improve resilience to more frequent and intense storms, invasive species infestations, and other impacts as a result of climate change.

Figure 16. Millecoquins River Watershed Desired Uses

Achieving these desired uses sustainably while also restoring impaired designated uses will require a coordinated effort to implement key BMPs throughout the watershed. Specifically, the above desired uses align directly with the restoration and protection of fish consumption, native aquatic habitat, and both partial and total body contact.

4.0 CAUSES/SOURCES OF IMPAIREMENTS & REDUCTION TARGETS

4.1 Causes & Sources of Impairment

There are a number of pollutants in the Millecoquins watershed that adversely affect designated and desired uses or have the potential to do so (Figure 17). The sources and causes of these pollutants were ascertained through scientific research reports, water quality monitoring data, road/stream crossing inventory data, field observations, land use analysis, and personal contact with watershed residents and experts.

Pollutants	Sources	Threatened Designated Uses
Excess Nutrients	Intensive fertilizer use, agricultural waste, sewage and septic systems, stormwater runoff, forest management practices	Partial Body Contact Recreation, Total Body Contact Recreation, Indigenous Aquatic Life and Wildlife (algal blooms), Fish Consumption (bioaccumulation of toxins)
E. coli	Agricultural waste, animal waste, sewage and septic systems	Partial Body Contact Recreation, Total Body Contact Recreation
Sediment	Road stream crossings, forest management practices, recreational activities, development, stormwater runoff, agriculture, uncontrolled livestock access	Indigenous Aquatic Life and Wildlife, Navigation

Figure 17. Potential non-point source pollution and sources and threatened uses

Heavy Metals (mercury and others)	Atmospheric deposition, stormwater runoff	Indigenous Aquatic Life and Wildlife, Fish Consumption
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Escherichia coli (*E. coli*) is a type of bacteria (single cell organism) that is used by the State of Michigan as a water quality indicator. When *E. coli* is found in surface waters, it means that there has been fecal contamination. While *E. coli* itself may be harmful to human health, other disease-causing organisms might also be present. Once these pathogens are in a stream or lake, they can infect humans through ingestion or skin contact, resulting in diseases such as gastroenteritis (diarrhea), giardia, hepatitis, or cholera.

Common and potential sources of *E. coli* contamination vary by where you are in the landscape. For example, urban areas would be expected to have a different set of sources than a rural farm-type setting where there are livestock and people rely on septic systems. All animals (livestock, pets and wildlife) and human sewage are possible sources under certain circumstances.

In the Millecoquins watershed, the SWP's field work confirms that *E. coli* presence in the watershed is directly linked to this latter, agricultural set of pressures. In particular, sampling indicates long-term, high *E. coli* levels in the Doe and Furlong subwatersheds in the western section of the Millecoquins. Both creeks are tributaries of Lake Millecoquins, resulting in elevated *E. coli* levels in the Lake itself during certain weather events; large precipitation events in the summer appear to correlate with high *E. coli* numbers. *E. coli* presence in these water bodies affects the health of indigenous aquatic life and wildlife, partial and total body contact, and other designated uses. Excessive inputs of sediment also fill in stream channels, making them shallower and wider and more susceptible to changes in hydrologic flow, increases in water temperature, and occasionally problematic for

navigation. Figure 18 shows pollutant load estimates by land use type in the Millecoquins River Watershed. These estimates were calculated using the EPA's Pollutant Load Estimation Tool (PLET) and provide a baseline of current existing conditions. Forestland in the watershed appears to be relatively high in pollutants because of the large difference in acreage between forests and other types of land uses. The PLET calculates the watershed's forestland as encompassing over 32,000 acres, whereas the pastureland is calculated at 8,400 acres, cropland at 570 acres, and urban land at 1,400 acres. Results of the PLET are further detailed by subwatershed in Section 6.3.

Land Use Type	N Load (lb/yr)	P Load (lb/yr)	BOD Load (lb/yr)	Sediment Load (ton/yr)
Cropland	1,798	257	3,763	30
Pastureland	19,422	1,503	62,933	47
Feedlots	2,122	424	2,829	0
Forest	31,208	2,737	6,621	30
Urban	4,805	740	18,225	111
Septic	81	32	332	0
Totals	59,436	5,694	94,704	219

Figure 18. Pollutant load estimates by land use type.

4.2 Critical Areas, Management Measures & Estimated Impairment Reductions

Critical areas in the Millecoquins River Watershed are defined as the portions of the watershed that are most sensitive to environmental degradation and those areas having the most impact or potential to impact water quality and designated and desired uses. They include areas that may contribute the greatest number of pollutants to the watershed, either now or in the future, and where preservation and restoration efforts will have the most profound results. Critical areas

were identified by SWP employees through an analysis concerning protection potential, current and future land uses, pollutant loading, water quality and road stream crossing inventory results, and anticipated load reductions from particular Best Management Practices. The goal of this analysis was to target specific strategies to areas most in need of protection or restoration. The identified critical areas, along with the primary pollutant threats in these areas, are detailed in Figure 19. It should be noted that these critical areas are by no means the only areas in need of protection and restoration efforts; they are simply those with the highest priority. Without implementation of the strategies outlined under the Goals and Objectives section of this management plan, the future negative impacts in critical areas of the Millecoquins River Watershed will be significant and the mitigation very costly.

The **Jocko Creek/Upper Millecoquins River** subwatershed is approximately 19,677 acres in total and occupies the northernmost section of the larger Millecoquins River Watershed (Figure 2). The watershed is densely forested (16,361 acres) with pastureland as the second largest land use type by area (2,564 acres). The Millecoquins River's headwaters, a scattering of perennial lakes and ponds in a remote forested area, lie in Luce County, just South of Newberry, MI. This section of the watershed likely has the highest potential for high quality habitat. This same area is the least-developed area of the watershed. However, water quality issues do exist. The EPA PLET shows heavy BOD and N levels (summarized in Section 6.3), likely linked to intensive agricultural operations in the southeastern area around M-117 and Krause Road.

Furlong Creek is the smallest subwatershed at 1,046 acres. It covers the Millecoquins River Watershed's eastern area with all streams and rivers feeding into one of the Furlong's two branches or Doe Creek,

which in turn feeds into the Furlong. The subwatershed is largely used for agriculture/cropland (315 acres). Furlong and Doe Creeks have been the focus of several pollutant reduction initiatives due to elevated E. coli levels over the years. The PLET shows high BOD levels in the watershed (see Section 6.3), which are especially concerning given its small size. The SWP's field work confirms this conclusion; by far, most stream sampling sites which showed elevated E. coli levels in surface water were in the Furlong Watershed.

The **Lower Millecoquins** subwatershed is the largest of the three, occupying 23,807 acres. This section of the watershed is highly hydrologically dynamic, containing Lake Millecoquins, several large wetland systems, dune swale, and the Lower Millecoquins River, which empties into Lake Michigan. Forests make up 15,765 acres of the subwatershed with agricultural uses at approximately 6,000 acres. The Lower Millecoquins subwatershed has the highest pollutant loads in all parameters, with BOD reaching 58,770 lbs/year and N at 32,573 lbs/year (see Section 6.3). These numbers likely reflect the culmination of issues in the rest of the watershed; all streams in the Jock/Upper Millecoquins and Furlong Creek subwatersheds flow into the Lower Millecoquins watershed. In addition, the Lower Millecoquins' Northeastern lobe sees heavy agricultural use.

Location of Critical Area by Subwatershed	Primary Concern(s)
McAlpine Creek Subwatershed	
Road stream crossings along McAlpine Creek and Skunk Creek, intersecting County Rd 405	Sediment
Upper Millecoquins River Subwatershed	
Road stream crossings along Sandtown Rd intersecting Maloney Creek	Sediment

Agricultural areas around M-117 and Krause Rd which flow to Maloney Creek	Excess Nutrients, E. coli
Lower Millecoquins River Subwatershed	
Mouth of Lower Millecoquins River (downstream of rest of the watershed)	Excess Nutrients, E. coli
Agricultural areas along Krause Rd	Excess Nutrients, E. coli
Road stream crossings at North Branch and South Branch Cold Creek near Cold Creek Trail	Sediment
Doe Creek Subwatershed	
Agricultural areas along Doe Creek	Excess Nutrients, E. coli
Doe Creek	E. coli
Road stream crossings along Doe Creek	Sediment
Furlong Creek Subwatershed	
Agricultural areas along Furlong Creek	Excess Nutrients, E. coli
Mouth of Furlong Creek; Furlong Creek and headwaters	E. coli
Kisro/Blake's Creek	E. coli

Figure 19. Critical areas of the Millecoquins River Watershed by Subwatershed

4.3 Priority Pollutants & Sources

Given this section's analysis, the SWP recommends the following implementation priority framework. E. coli has become an increasingly pressing issue in the Millecoquins River Watershed with multiple stakeholders expressing concern. EGLE will likely add six of the watershed's streams to the 303(d) listing for designated use impairment in 2026. See Section 3.2 and Figure 14 for more details. The SWP's fieldwork confirms that E. coli is indeed a chronic issue, likely stemming from agricultural practices, including animal management and agricultural runoff use. Another key issue in the watershed is over-sedimentation, resulting from damaged or out of date road stream crossing infrastructure along remote tributaries.

Heavy metal deposition in the watershed is likely the result of rainfall entering the watershed through runoff; however, resilient infrastructure BMPs targeting other, higher priority pollutants will also help with runoff filtration in general. For this reason, managing heavy metals in the watershed are lowest priority. Further evaluation of reduction estimates and management goals by subwatershed are available in sections 6.3 and 6.4 respectively.

Pollutant	Priority
E. coli	1
Sediment	2
Nutrients, Pesticides/Herbicides	3
Heavy Metals	4

Sources	Priority
Agricultural waste (animal husbandry), septic systems	1
Road stream crossings, forest management practices, recreational activities, development, stormwater runoff, agriculture	2
Intensive fertilizer use, forest management practices, agricultural practices	3
Atmospheric deposition, stormwater runoff	4

Figure 20. Prioritized pollutants and their sources

5.0 WATERSHED PLAN GOALS & OBJECTIVES

5.1 Watershed Plan Goals & Objectives

The main goal of the Millecoquins River Watershed Management Plan is to promote and facilitate coordinated, collaborative action among stakeholders in order to protect and preserve water quality and the unique nature of the watershed. The watershed inventory and analysis identified and prioritized the causes and sources of pollution affecting or having the potential to affect water quality and designated and desired watershed uses. The following goals, objectives and management strategies provide guidance for implementation of actions that will reduce these affects and provide a basis for protection from further impacts.

Millecoquins River Watershed Goals:

➤ Non-Point Source Reduction Goals

1. Reduce E. coli levels in the watershed
2. Reduce streambank/shoreline erosion with a focus on resilient riparian corridors and road stream crossing management to reduce non-point source pollution impacts from land uses
3. Reduce negative impacts of fertilizers, herbicides, pesticides, and excess nutrients

4. Increase community awareness of watershed health issues and encourage inter-stakeholder collaboration (businesses, private, recreational, and other users)
5. Continue monitoring sources of impact identified in this plan in order to track BMP effectiveness

➤ Habitat Restoration Goals

6. Maintain aquatic ecosystem health and connectivity through the implementation of road stream crossing improvements and resilient infrastructure
7. Stop or at least slow the spread of non-native invasive species
8. Control populations of invasive species
9. Decrease or eliminate habitat alteration

➤ Climate Adaptation Goals

10. Invest in resilient infrastructure/flood risk mitigation
11. Implement adaptive plant and forestry management practices that stabilize slopes and enhance forest diversity and resiliency

5.2 Non-point Source Pollution Implementation Strategies

Non-point source pollution implementation strategies will focus on reducing sources of non-point source pollution. Figure 21 lists the goals and implementation strategies to address non-point source pollution.

Figure 21. Nonpoint source pollution goals and proposed implementation strategies for all Millecoquins River subwatersheds.

Goals	Implementation Strategy	Pollutants Addressed	Partners	Milestone Timeline
1. Reduce E. coli levels in the watershed	A. Deploy education and outreach focused on causes, impacts, and solutions associated with E. coli pollution. B. Utilize all available data sources to identify E. coli sources.	E-coli, sediment, nutrients	SWP, Private landowners, Townships, County Health Department, EGLE Water Resources	A, B Ongoing D, E 2025-2030

Goals	Implementation Strategy	Pollutants Addressed	Partners	Milestone Timeline
	C. Restrict livestock access to rivers and streams. D. Assess agricultural practices (feedlots, pasturing, and waste management) that may be causing algal blooms. E. Assess septic suitability and siting. F. Implement best management practices to limit E. coli concentrations in water.		Division, NRCS Farm Bill Programs	
2. Reduce streambank/shoreline erosion with a focus on resilient riparian corridors and road stream crossing management to reduce non-point source pollution impacts from land uses	A. Stabilize slopes using native plants and other best management practices. B. Replace damaged or undersized culverts with road stream crossing infrastructure designed to prioritize watershed health by reducing erosion and hydrologic flow alterations. C. Enhance/restore riparian corridors using native plants/trees and encourage no-mow zones along waterways. D. Restrict livestock access to rivers and streams.	Sediment, nutrients, E. coli	SWP, Private landowners, Townships, County Road Commission, NRCS Farm Bill Programs	C 2025-2030
3. Reduce negative impacts of fertilizers, herbicides, pesticides, and excess nutrients	A. Education and outreach of causes, impacts, and solutions as well as fitting resources to reduce pollutants. B. Employ best management practices that balance agricultural priorities with watershed health.	Pesticides, herbicides, excess nutrients	SWP, Private landowners, Townships, County Health Department, EGLE Water Resources Division, NRCS Farm Bill Programs	A, B 2025-2030
4. Increase community awareness of watershed health issues and encourage inter-stakeholder collaboration (businesses, private, recreational, and other users)	A. Throughout all outreach and education efforts, strive to involve stakeholders from all groups that utilize the watershed while emphasizing the distinct and connected roles their actions play in overall watershed health.	All	SWP, Businesses, Private Landowners, and Other Users	A Ongoing

Goals	Implementation Strategy	Pollutants Addressed	Partners	Milestone Timeline
5. Continue monitoring sources of impact identified in this plan in order to track BMP effectiveness	A. Track E. coli levels in surface water with continued sampling events at problematic sites identified in past field work. B. Track water chemistry changes through continued sampling C. Track sedimentation levels at problematic road stream crossings through continued periodic site evaluations	All	SWP, EGLE, Others	A, B, C Ongoing
6. Start Cooperative Lakes Monitoring Program	A. Recruit volunteers, partners, and interested citizens through local outreach efforts B. Establish water quality monitoring parameters, waterbody monitoring locations, and data collection and upload process C. Hold annual in-person and online trainings to educate volunteers in water quality monitoring and educate residents in best lake management practices D. Use collected data to assess for trends or changes in waterbody health	All	SWP, MSU Extension Chippewa Luce Mackinac Conservation District	A,B 2025-2030 C,D Ongoing

5.3 Habitat Restoration Implementation Strategies

Habitat restoration implementation strategies will focus on restoration and preservation of habitat in the watershed. Figure 22 lists the habitat restoration goals and proposed implementation strategies.

Figure 22. Habitat restoration goals and proposed implementation strategies.

Goals	Implementation Strategy	Pollutants Addressed	Partners	Milestone Timeline
6. Maintain aquatic ecosystem health and connectivity through the implementation of road stream crossing improvements and resilient infrastructure	A. Replace inadequate high-priority road stream crossings to protect stream health and aquatic habitat connectivity. B. Encourage the use of bottomless culverts and bridges to allow for aquatic organism passage and reduce habitat fragmentation at crossings. C. Reduce sedimentation by stabilizing slopes using resilient infrastructure, native plants, and other best management practices.	N/A	SWP, Private landowners, Townships, County Road Commission	A, B Ongoing
6. Stop or at least slow the spread of non-native invasive species	A. Conduct education and outreach. B. Encourage planting of native plants in gardens, landscaping and along shorelines. C. Conduct Clean Boats Clean Waters Trainings. D. Install boat washing station(s) within or near the watershed.	N/A	SWP, Private Landowners, CISMA's	A, B, C, D 2025-2030
7. Control populations of invasive species	A. Educate public on effects of invasive species, control and prevention methods, and identification of invasive species. B. Continue to map new and existing populations of invasive species. C. Control existing populations of invasive species. D. Research and implement, when possible, biological control methods rather than chemical control	N/A	SWP, Private Landowners, CISMA's	A, B, C, D 2025-2030

Goals	Implementation Strategy	Pollutants Addressed	Partners	Milestone Timeline
8. Decrease or eliminate habitat alteration	A. Map sites of major habitat degradation within watershed B. Perform habitat restoration projects at degraded sites C. Map rare and fragile habitats as well as habitats important to rare species D. Prioritize rare and fragile habitats for protection and restoration E. Restoring habitat, including restoration to agriculturally-impacted wetlands using Farm Bills programs. F. Protect unaltered land within the watershed (acquisition/conservation easements) G. Improve aquatic organism passage at road stream crossings	N/A	SWP, Private Landowners	A, B, C, D, E, F 2025-2030

5.4 Climate Adaptation Implementation Strategies

The impacts of climate change including more frequent and intense storms and flashier floods are a concern for the Millecoquins River watershed. Resilient infrastructure, flood risk mitigation, and climate adaptive plant and forestry measures are proposed strategies in Figure 23.

Figure 23. Climate adaptation goals and implementation strategies

Goals	Implementation Strategy	Pollutants Addressed	Partners	Milestone Timeline
9. Invest in resilient infrastructure/flood risk mitigation	A. Replace inadequate high priority road stream crossings; ensure they can sustain at least a 100-year flow event. B. Encourage the use of bottomless culverts and bridges to accommodate high-flow events and prevent diversion or overtopping.	N/A	SWP, Private landowners, Townships, County Road Commission	A, B Ongoing
10. Implement adaptive plant and forestry management practices that stabilize slopes and enhance forest diversity and resiliency	A. Utilize climate adaptive species to ensure plant community/forest health in a changing climate. B. Utilize technical resources and best practices developed by the Northern Institute of Applied Climate Science (NIACS).	N/A	SWP, Private landowners, Townships, County Road Commission	A, B 2025-2030

6.0 MANAGEMENT MEASURES ACTION PLAN

Earlier sections of this plan summarized the watershed's characteristics and identified causes and sources of watershed impairment. This section includes an "Action Plan" developed to provide stakeholders with recommended Best Management Practices (BMPs) to specifically address plan goals and strategies. The Action Plan is divided into two subsections:

- Programmatic Measures: watershed-wide management measures that can be applied across the watershed by various stakeholders.
- Site-Specific Measures: recommended BMPs that can be implemented at specific sites to improve surface and groundwater quality.

The recommended programmatic and site-specific management measures provide a solid foundation for protecting and improving watershed conditions but should be updated as projects are completed or other opportunities arise. Key implementation stakeholders are encouraged to organize partnerships and develop various funding arrangements to help delegate and implement the recommended actions. The key stakeholders in the watershed are listed in connection to each individual project and task.

6.1 Programmatic Measures

The goals and objectives of this watershed management plan will be implemented through a suite of management strategies or tasks. These tasks were developed based on the prioritization of watershed pollutants, sources, and causes, and critical areas of the watershed. A

ten-year timeline was used as the schedule for implementation. Tasks that should be done in the short term were given a completion timeline of 3 years. Tasks that have begun were also given a timeline of "ongoing". Estimated costs for implementation tasks do not include staff oversight or administrative costs. A summary of implementation tasks and milestones is provided in below.



Task 1: Implement outreach and communication action plan

Work with local administrators, EGLE, and other entities to implement the Information and Education Plan (Section 7) to increase awareness and engage watershed stakeholders around best management practices for key watershed uses:

- Bring together a work group of watershed representatives to lead outreach/education efforts.
- Invite landowners to workgroups hosted at community gathering places (township buildings and churches) to develop awareness of current issues, their causes, the plan to address them, and encourage participation in BMP implementation.
- Create opportunities for residents and the public to get involved in hands-on restoration and monitoring efforts.
- Monitor effectiveness of information and education actions including level of community awareness and willingness to participate in watershed preservation/restoration efforts.

Goals Accomplished: All

Designated Uses Addressed: Agriculture, Fish Consumption, Industrial Water Supply, Navigation, Other Aquatic Wildlife, Warm Water Fishery

Desired Uses Addressed: All

Estimated Cost: \$7,500/year

Timeline: Years 1-10/ongoing

Milestones:

- Create contact lists of focus groups and target audiences (Year 1/ongoing)
- Conduct a social survey of watershed stakeholders (Year 1)
- Develop and distribute informational & educational materials (Years 1-5)
- Conduct k-12 education aligned with State standards/curriculum (Years 1-10)
- Train and host volunteer monitoring events (Years 1-10)
- Invite/engage landowners and other stakeholders to participate in hands-on restoration demonstrations (Years 1-10)
- Evaluate outreach/education actions (Years 1-10)

Potential Partners/Technical Assistance: Garfield Township, EGLE NPS, Superior Watershed Partnership, and Chippewa Luce Mackinac Conservation District, private landowners, local schools, and community members, etc.

Measurements:

- Number of outreach actions completed, number of partners participating, number of public notices issued, number of new partnerships created

Task 2: Implement resilient infrastructure solutions, such as native vegetation plantings, soil stabilization, and natural processes to reduce non-point source pollution, restore habitat, and improve climate resiliency

Work with landowners to implement resilient infrastructure projects at prioritized sites to reduce pollutants, BOD and sediment being priority, while also illustrating options for stakeholders to build similar best management practices on their land.

- Work with landowners identified through fieldwork as living too close to or causing negative water quality impacts and develop a BMP implementation plan that meets their needs while also reducing pollutants. A few land management options are listed below:
 - Install buffer strips to prevent soil erosion, runoff, and pollution. These areas also provide habitat for native wildlife.
 - Eliminate livestock access to waterbodies. Livestock can increase erosion, introduce E. coli into the aquatic environment, and destroy natural habitat.
 - Evaluate septic systems and sewage lagoon. Repair any leaks or pipes entering waterways.
 - Direct drain pipes away from waterways and into rain gardens which filter any contaminants prior to release of water.
 - Learn to identify and properly control invasive species, plant only native plants and do not transport invasive species, including bait.
 - Clean boats and gear, especially when transporting from one waterbody to another, to prevent the spread of aquatic invasive species.
 - Limit the use of fertilizers, herbicides, and pesticides, especially near waterways.
 - Maintain boats to prevent leakages of oil, gasoline, and fluids
 - Protect land in future years by obtaining a conservation easement.

Goals Accomplished: All

Designated Uses Addressed: Agriculture, Fish Consumption, Other Aquatic Wildlife, Warm Water Fishery

Desired Uses Addressed: All

Estimated Cost: \$5,000-30,000/year for all measures, depending on scale of demonstration project

Timeline: Years 1-5/ongoing

Milestones:

- Agricultural BMPs will target animal exclusion from waterways, animal waste management, and fertilizer/pesticide run off reduction
- Sediment BMPs will target stream bank re-vegetation and faulty road stream crossing improvement
- Deploy the SWP's Great Lakes Climate Corp, and additional contractors, if necessary, to implement BMPs
- Document BMP pollutant reductions through monitoring and share with other landowners as demonstrations for best practice options

Potential Partners/Technical Assistance: EGLE NPS, Superior Watershed Partnership, local units of government and landowners, NRCS

Measurements:

- Number of BMPs implemented, number of landowners reached/participating, number of pollution load reductions achieved

Task 3: Work with local administrators to encourage the broad adoption of BMPs with particular focus on agriculture. Encourage the adoption of specific ordinances at the township level to enforce pollutant reduction and resilient infrastructure

Building from the information and education plan, the SWP and local administrators will push for landowners to adopt best management practices identified in this plan as they best fit landowners needs. In particular, agricultural operations identified during fieldwork as causing pollutant spread through animal husbandry and other practices are high priority actors for voluntary BMP adoption. Over time, the adoption of township-level ordinances enforcing the mitigation of pollution and adoption of low-impact high-result agricultural BMPs should be pursued.

- Post BMP demonstration, work with additional landowners to discuss BMP options and encourage voluntary adoption
- Distribute educational information on water quality protection and voluntary BMPs
- Work with community members and administrators to present potential options to improve water quality and habitat protection
- Identify/assist with funding opportunities for planning and implementation of improved water quality protection BMPs and public infrastructure improvements

Goals Accomplished: All

Designated Uses Addressed: Agriculture, Fish Consumption, Other Aquatic Wildlife, Warm Water Fishery

Desired Uses Addressed: All

Estimated Cost: \$15,000/year

Timeline: Years 1-5

Milestones:

- Continued outreach and education to landowners via direct contacts and mailings
- Deploy the SWP's Great Lakes Climate Corp, and additional contractors, if necessary, to implement BMPs
- Document BMP pollutant reductions through monitoring and share with other landowners as demonstrations for best practice options
- Host informational workshops for community members and local administrators regarding voluntary BMPs and model ordinances

Potential Partners/Technical Assistance: Local administrators, EGLE NPS, Superior Watershed Partnership, and community members

Measurements:

- Number of BMPs voluntarily implemented
- Number of landowners reached/participating
- Number of pollution load reductions achieved
- Number of policies/ordinances improved

Task 4: Continue monitoring sources of impact identified in this plan in order to track BMP effectiveness

With continued support from key stakeholders including the Hiawatha Sportsman's' Club, EGLE NPS, LMAS Lab, and Garfield Township, the SWP strongly suggests continued water quality monitoring to track BMP impact, ordinance compliance, and guard against future water quality issues. Given its experience in the watershed, the SWP is a strong partner for continued fieldwork.

- Establish a volunteer network or reinitiate SWP fieldwork agreements to continue monitoring
- Build from past fieldwork to identify pollutant hotspots and continue tracking their impact
- Monitor pollutants at and around sites where BMPs have been implemented to track their effectiveness
- Store monitoring results in a database available to administrators as well as a version for public use with non-geolocated data to protect landowner privacy

Goals Accomplished: NPS Reduction Goal 5 - Continue monitoring sources of impact identified in this plan in order to track BMP effectiveness

Designated Uses Addressed: Agriculture, Fish Consumption, Other Aquatic Wildlife, Warm Water Fishery

Desired Uses Addressed: All

Estimated Cost: \$7,500/year

Timeline: Years 1-10/ongoing

Milestones:

- Work with partners/key stakeholders to identify funding and personnel for continued monitoring
- Create volunteer opportunities - host volunteer workshops/trainings on monitoring protocols for data collection and hands-on events
- Share monitoring results to demonstrate success in reducing non-point source pollution and encourage continued implementation of voluntary BMPs by landowners

Potential Partners/Technical Assistance: EGLE NPS, Superior Watershed Partnership, LMAS Lab, and Garfield Township, community members, and other organizations

Measurements:

- Number of sites monitored for water quality
- Number of volunteers participating in monitoring events/workshops
- Number of pollution load reductions achieved

6.2 Site Specific Management Measures Action Plan

The SWP's field work, remote sensing research and data from past studies allowed this plan to identify areas in the Millecoquins Watershed that would likely benefit from the implementation of site-specific BMP's to reduce pollutant pressures in the watershed as well as address their sources and causes. Funding, planning and implementing these BMP's will be accomplished with urgency over the next decade (2025-2035). Road stream crossing BMP's will be prioritized for implementation based on available funding and the position of the crossings within the watershed. Also, due to the growing problem with sea lamprey in the Great Lakes and their connecting waterways, all work will coordinate with USFWS sea lamprey control.

Figure 21. Selected BMP's for implementation throughout the Millecoquins Watershed:

Priority	Watershed Goal(s) Addressed	Project	Site ID(s)*	Subwatershed	Potential Partners/ Technical Assistance	Cost	Possible Funding Sources	Timeline
High	Road Stream Crossing	Analyze road stream crossing data to identify high-priority crossing replacement/removal projects.	All RSC Sites	All	SWP	N/A	Existing Source	2025
High	Non-Point Source Pollution, Habitat Restoration, Climate Resilience, Road Stream Crossing	Host stakeholder meeting to receive feedback on WMP and open community dialogue on the WMP goals and objectives.	N/A	All	SWP, HSC, CLMCD	\$1,000	Existing Source	2025
High	Non-Point Source Pollution	Inventory, evaluate and map non-compliant and failing septic systems (OSDS): utilize LMAS District Health Department testing records.	TBD	TBD	LMAS, SWP	\$100,000	GLRI, Clean Water Act (CWA) Section 319	2027

Variable	Non-Point Source Pollution, Habitat Restoration, Climate Resilience, Road Stream Crossing	Contact all agricultural landowners (AGR sites) to provide O & E, technical assistance, and offer site assessments at all 51 AGR sites identified by EGLE's aerial imagery analysis to advance BMP implementation. Develop site-specific BMP implementation plans for high-priority AGR sites as identified in this plan in addition to those identified as high priority during site assessments.	All AGR Sites	All	CLMCD, SWP	Variable, ~\$1,500-\$4,000/site	NRCS Environmental Quality Incentives Program (EQIP), Clean Water Act (CWA) Section 319	2030
Medium	Non-Point Source Pollution, Habitat Restoration, Climate Resilience, Road Stream Crossing	Farm Eco-Economics campaign: Discuss the environmental and economic benefits of grazing cattle naturally on pasture instead of concentrated on feedlots. Discuss benefits of excluding animals from streams and wetlands.	N/A	All	CLMCD, NRCS	\$5,000	NRCS EQIP, CWA Section 319	2035
Medium	Road Stream Crossing	Develop engineering plans for all identified high-priority road stream crossing projects.	TBD	TBD	HSC, SWP	\$30,000/site	GLRI, CWA Section 319	2035
Medium	Non-Point Source Pollution	Address non-compliant and failing septic systems.	TBD	TBD	EGLE, LMAS Townships	Variable	Rural Development Loan Program	2035

* Agricultural sites were given representative site ID numbers to protect landowner privacy

Figure 22. Selected BMP's for implementation in the Doe Creek Sub-Watershed:

Priority	Watershed Goal(s) Addressed	Project	Site ID(s)*	Subwatershed	Potential Partners/ Technical Assistance	Cost	Possible Funding Sources	Timeline
High	Non-Point Source Pollution	Medium size operation. Animal waste storage lagoon and possible dry manure storage south of barn. Evaluate the three ponded areas. Two ponded areas are directly adjacent to the Doe Creek tributary. Evaluate the fencing and identify if there are any cattle access points. More site evaluation is needed on the ground. There are cattle access points on the north end of the main field. Several animal trails and looks like streambank erosion also. The 2016 aerial photo had a fence line along the stream. Evaluate if the animals are fenced into the stream corridor instead of outside the corridor.	AGR 17	Doe Creek	CLMCD, NRCS, SWP	TBD	NRCS Environmental Quality Incentives Program (EQIP), Clean Water Act (CWA) Section 319	2035
High	Non-Point Source Pollution	Small operation. Evaluate land ownership/leasing. Animals appear to have access to the south and north flow path flowing west to Doe Creek.	AGR 41	Doe Creek	CLMCD, NRCS, SWP	TBD	NRCS EQIP, CWA Section 319	2035
High	Non-Point Source Pollution	Medium operation. Evaluate the operation for manure storage and management. Also evaluate for storm water runoff paths to the Pleasant Ave ditch line and Doe Creek. The southern heavy use area does not have a buffer to the ditch line. Install exclosure fencing and implement stormwater and manure storage BMP's.	AGR 42	Doe Creek	CLMCD, NRCS, SWP	TBD	NRCS EQIP, CWA Section 319	2035

High	Road Stream Crossing, Non-Point Source Pollution	Evaluate road stream crossings along Doe Creek at Kovar Rd, Raski Rd, Pleasant Ave, and M-117, which all have high sediment erosion estimates. Crossings may need added rip-rap and bank armoring, as well as additional native/woody vegetation planted in the streambanks and approach ditches.	6341984018, 6342057017, 6341986358, 6342050581, 6341986926, Culvert 20, 6341989910	Doe Creek	SWP, CLMCD, NRCS	TBD	NRCS EQIP, EGLE Nonpoint Source (NPS) Grants, Great Lakes Fishery Trust (GLFT), USFWS National Fish Passage Program, DNR Fisheries Habitat Grant Program, GLRI, National Fish and Wildlife Foundation (NFWF) Sustain Our Great Lakes Program, Private Foundations	2035
High	Road Stream Crossing, Non-Point Source Pollution	The road stream crossing at Doe Creek and Mile Rd has a very high sediment erosion estimate (3.92 tons per year). The inlet and outlet banks lack armoring or rip-rap and the road fill depth is low (0.5 feet). To protect banks and minimize erosion, rip-rap should be added to the culvert's inlet and outlet banks, and well-compacted gravel should be added to the road surface to a depth of at least 2 feet. There is also woody debris plugging the structure's inlet and outlet, restricting flow on both sides. Regular maintenance at the crossing to remove brush would preserve proper streamflow and aquatic passability.	6341986804	Doe Creek	CLMCD, NRCS, SWP, County Road Commission	\$10,000-200,000	NRCS EQIP, EGLE Nonpoint Source (NPS) Grants, Great Lakes Fishery Trust (GLFT), USFWS National Fish Passage Program, DNR Fisheries Habitat Grant Program, GLRI, National Fish and Wildlife Foundation (NFWF) Sustain Our Great Lakes Program, Private Foundations	2035
Medium	Non-Point Source Pollution	Large operation. It appears that pastures are properly fenced but should be checked. Look at the area south of the barns and adjacent to the stream for possible concerns. Look at dry manure storage practices in the sacrifice lot west of the barn. This could be a low priority site after evaluation.	AGR 18	Doe Creek	CLMCD, NRCS, SWP	TBD	NRCS EQIP, CWA Section 319	2035

Medium	Non-Point Source Pollution	Small operation. Evaluate dry manure storage to the south of the barn with possible runoff to a N-S flowline going to the stream.	AGR 19	Doe Creek	CLMCD, NRCS, SWP	TBD	NRCS EQIP, CWA Section 319	2035
Medium	Non-Point Source Pollution	Medium operation. Dairy with no pasture. Three storage lagoons are very near the river and should be evaluated for proper design, lining, and construction. Evaluate overall dry and liquid manure management. Evaluate the pastures on the west side of Pleasant Road for fencing out the animals from the channel. Determine what farm uses these pastures. Check the operation for how the animals are sheltered and see if there are pasture areas to consider. Evaluate land ownership/leasing.	AGR 24	Doe Creek	CLMCD, NRCS, SWP	TBD	NRCS EQIP, CWA Section 319	2035
Medium	Non-Point Source Pollution	Large operation. See notes for AGR 26 for possible inclusion. Evaluate the stormwater flow, the wallow area on the west side of the barn, and the lagoon for direction of flows and potential discharges to surface water and ditches. Determine if it flows NW and west to the stream and if it is an adequate filter. Evaluate solid and liquid manure storage as well as manure management. Evaluate all pasture fields for exclusion fencing.	AGR 27	Doe Creek	CLMCD, NRCS, SWP	TBD	NRCS EQIP, CWA Section 319	2035

Medium	Road Stream Crossing, Habitat Restoration	The road stream crossing structure at Doe Creek and Pleasant Ave has upstream ponding and a scour pool. The crossing is also a barrier to aquatic passage at most flows. Substrate should be added to the interior of the culvert to allow fish passage and the culvert should be assessed for proper sizing to accomodate stream flow.	6341986358	Doe Creek	SWP, CLMCD, NRCS, County Road Commission	\$5,000-20,000	NRCS EQIP, EGLE Nonpoint Source (NPS) Grants, Great Lakes Fishery Trust (GLFT), USFWS National Fish Passage Program, DNR Fisheries Habitat Grant Program, GLRI, National Fish and Wildlife Foundation (NFWF) Sustain Our Great Lakes Program, Private Foundations	2035
Low	Non-Point Source Pollution	Small horse operation. It appears that the animals are fenced out of the stream. The site could use further evaluation to confirm there is no animal access to the stream. Address with fencing and alternative water source if needed.	AGR 5	Doe Creek	CLMCD, NRCS, SWP	TBD	NRCS EQIP, CWA Section 319	2035
Low	Non-Point Source Pollution	Small operation. Evaluate the runoff from the heavy use area and the flow path south to the stream channel.	AGR 10	Doe Creek	CLMCD, NRCS, SWP	TBD	NRCS EQIP, CWA Section 319	2035
Low	Non-Point Source Pollution	Small operation. Horse barn and feeding area somewhat near the stream.	AGR 16	Doe Creek	CLMCD, NRCS, SWP	TBD	NRCS EQIP, CWA Section 319	2035
Low	Non-Point Source Pollution	Small operation. Confirm that the fence line along the stream to the west is intact and animals do not have access.	AGR 23	Doe Creek	CLMCD, NRCS, SWP	TBD	NRCS EQIP, CWA Section 319	2035
Low	Non-Point Source Pollution	Small operation. Pasture land east of the road does not appear to have a buffer along the road ditch.	AGR 25	Doe Creek	CLMCD, NRCS, SWP	TBD	NRCS EQIP, CWA Section 319	2035
Low	Non-Point Source Pollution	Small operation. Evaluate if this location is working in cooperation with AGR 28 or another producer. Calf houses are close to the road with possible runoff to the road ditch. Evaluate for runoff potential to road ditch and Doe Creek.	AGR 39	Doe Creek	CLMCD, NRCS, SWP	TBD	NRCS EQIP, CWA Section 319	2035

Figure 23. Selected BMP's for implementation in the Furlong Creek Sub-Watershed:

Priority	Watershed Goal(s) Addressed	Project	Site ID(s)*	Subwatershed	Potential Partners/ Technical Assistance	Cost	Possible Funding Sources	Timeline
High	Non-Point Source Pollution	Medium operation. The cattle have access to the stream and are potentially kept in the stream corridor for long periods of time. Evaluate the manure storage pit to see if there is an overflow point causing a discharge. The runoff from the dry manure stacked on the south end of the barn needs evaluation. Barn roof runoff goes to dry manure and heavy use area and could be redirected. The wallow area east of the barn appears to have a discharge to the stream. Land application of manure on the 5/8/2016 Google Earth aerial was directly adjacent to the road. Manure management planning and implementation needed.	AGR 7	Furlong Creek	CLMCD, NRCS, SWP	TBD	NRCS Environmental Quality Incentives Program (EQIP), Clean Water Act (CWA) Section 319	2035
High	Non-Point Source Pollution	Small operation. Heavy use area and pasture runoff discharges to a ponded area in the NE corner of the pasture. The runoff discharges to a stream on the east side of the road. Evaluate the large pond to see if it is a pond or an on-site sewage lagoon. There appears to be a discharge channel flowing east. Implement BMP's for manure management.	AGR 12	Furlong Creek	CLMCD, NRCS, SWP	TBD	NRCS EQIP, CWA Section 319	2035

High	Non-Point Source Pollution	Medium operation. Evaluate the fields for fencing. There is a lot of channel distance through many acres of pasture. There appears to be cattle and vehicle crossings without culvert structures.	AGR 21	Furlong Creek	CLMCD, NRCS, SWP	TBD	NRCS EQIP, CWA Section 319	2035
Medium	Non-Point Source Pollution	Medium operation. Whole pasture has stream fencing to restrict cattle access. Assess the stream crossing west of the barn.	AGR 4	Furlong Creek	CLMCD, NRCS, SWP	TBD	NRCS EQIP, CWA Section 319	2035
Medium	Non-Point Source Pollution	Field assessment needed to determine if animals have access to the creek and a small tributary. Address with fencing and alternative water source if needed.	AGR 6	Furlong Creek	CLMCD, NRCS, SWP	TBD	NRCS EQIP, CWA Section 319	2035
Medium	Road Stream Crossing	Further evaluate road stream crossings along Furlong Creek. None are high-priority at this time, but some crossings may need added rip-rap or vegetation to stabilize banks. Some structures are majorly skewed, contributing to sediment erosion, and may need to be assessed for future replacement.	N/A	Furlong Creek	CLMCD, NRCS, SWP	TBD	NRCS EQIP, EGLE Nonpoint Source (NPS) Grants, Great Lakes Fishery Trust (GLFT), USFWS National Fish Passage Program, DNR Fisheries Habitat Grant Program, GLRI, National Fish and Wildlife Foundation (NFWF) Sustain Our Great Lakes Program, Private Foundations	2035
Low	Non-Point Source Pollution	Small operation. Potential pasture runoff to road ditch. Evaluate the runoff potential.	AGR 2	Furlong Creek	CLMCD, NRCS, SWP	TBD	NRCS EQIP, CWA Section 319	2035

Low	Non-Point Source Pollution	Small horse operation. Pasture fencing appears to be installed along the stream to the north and there is a small buffer in place. Needs field assessment.	AGR 3	Furlong Creek	CLMCD, NRCS, SWP	TBD	NRCS EQIP, CWA Section 319	2035
Low	Non-Point Source Pollution	Small operation. Evaluate the heavy use area runoff where the road ditch flows to the channel through the east field.	AGR 9	Furlong Creek	CLMCD, NRCS, SWP	TBD	NRCS EQIP, CWA Section 319	2035

Figure 24. Selected BMP's for implementation in the Lower Millecoquins River Sub-Watershed:

Priority	Watershed Goal(s) Addressed	Project	Site ID(s)*	Subwatershed	Potential Partners/ Technical Assistance	Cost	Possible Funding Sources	Timeline
High	Non-Point Source Pollution	Medium operation. Assess and address pasture runoff to road ditch that may be a stream. The north heavy use area may be discharging runoff to the flow path going SE to the road ditch. There is a large pile of dry manure stacked on the west side of the buildings that needs to be managed and have the runoff path addressed.	AGR 1	Lower Millecoquins River	CLMCD, NRCS, SWP	TBD	NRCS Environmental Quality Incentives Program (EQIP), Clean Water Act (CWA) Section 319	2035
High	Non-Point Source Pollution, Habitat Restoration	Large operation. Several feed piles near the stream. It appears the owner operates on east and west sides of the road. The west side of the road has unlimited animal access to the stream, animal access to the ponded area, and a very poor animal crossing east of the pond. There are eroded stream banks in the pasture areas west of the road. The east side of the road pastures have animal access also. Install fencing, alternate water source, and restore stream bank erosion.	AGR 13	Lower Millecoquins River	CLMCD, NRCS, SWP	TBD	NRCS EQIP, CWA Section 319	2035

High	Non-Point Source Pollution	Medium operation. Evaluate feedlots south and west of the barn and barn roof runoff to the channel. Implement stormwater runoff management BMP's if needed.	AGR 14	Lower Millecoquins River	CLMCD, NRCS, SWP	TBD	NRCS EQIP, CWA Section 319	2035
High	Non-Point Source Pollution	Small operation. Cattle access to the stream from the pasture north of the barns. Streambanks appear to be eroding. Evaluate the two ponds just south of the stream channel.	AGR 31	Lower Millecoquins River	CLMCD, NRCS, SWP	TBD	NRCS EQIP, CWA Section 319	2035
High	Non-Point Source Pollution	Large dairy operation with liquid manure storage pit. Evaluate manure management and suitable fields for manure spreading. Evaluate animal access to the pond in the SW quadrant of McKelvey Rd and Krause Rd. Does this pond have an outfall to the road ditch and to the flow channel crossing just east of the intersection on McKelvey Rd?	AGR 38	Lower Millecoquins River	CLMCD, NRCS, SWP	TBD	NRCS EQIP, CWA Section 319	2035
High	Road Stream Crossing, Non-Point Source Pollution, Habitat Restoration	The road stream crossing at North Branch Cold Creek and the trail off of Cold Creek Trail has high sediment erosion (estimated at 1.99 tons per year). Because the structure has no substrate and is perched at the outlet with a cascade over rip-rap, it is also a complete barrier to fish passage. For improved aquatic habitat connectivity, the structure should be replaced with one which is open-bottomed or embedded. To address erosion, rip-rap should also be added to the inlet and outlet banks for stabilization, and native woody vegetation planted in the approach ditches.	6342019999	Lower Millecoquins River	CLMCD, NRCS, SWP, HSC, County Road Commission	\$10,000-500,000	NRCS EQIP, EGLE Nonpoint Source (NPS) Grants, Great Lakes Fishery Trust (GLFT), USFWS National Fish Passage Program, DNR Fisheries Habitat Grant Program, GLRI, National Fish and Wildlife Foundation (NFWF) Sustain Our Great Lakes Program, Private Foundations, MDOT	2035

High	Road Stream Crossing, Habitat Restoration, Non-Point Source Pollution	The road stream crossing at Cold Creek and Cold Creek Trail is likely undersized, evidenced by the very high water velocity at the structure (2.9 ft per sec) compared to upstream and downstream of the structure. This high water velocity will contribute to increased sediment erosion, which is a concern since this creek is an important fish habitat and empties into Millecoquins Lake. Additionally, the structure is perched very high (1.6 ft), providing a complete barrier to fish passage. This culvert should be replaced with a structure which is open-bottomed or embedded with native substrate and which is properly sized to accomodate the stream.	634279788	Lower Millecoquins River	SWP, NRCS, HSC, County Road Commission	\$10,000-200,000	NRCS EQIP, EGLE Nonpoint Source (NPS) Grants, Great Lakes Fishery Trust (GLFT), USFWS National Fish Passage Program, DNR Fisheries Habitat Grant Program, GLRI, National Fish and Wildlife Foundation (NFWF) Sustain Our Great Lakes Program, Private Foundations	2035
High	Road Stream Crossing	Forested areas and road stream crossings to the east contribute a lot of sediment to the streams, ending up in Millecoquins Lake. Reinforce streambanks with native vegetation to reduce sediment erosion.	N/A	Lower Millecoquins River	CMLCD, NRCS, SWP	\$10,000-300,000	NRCS EQIP, EGLE Nonpoint Source (NPS) Grants, Great Lakes Fishery Trust (GLFT), USFWS National Fish Passage Program, DNR Fisheries Habitat Grant Program, GLRI, National Fish and Wildlife Foundation (NFWF) Sustain Our Great Lakes Program, Private Foundations	2035
Medium	Non-Point Source Pollution	Medium operation. Large pasture area north and south of the road. Need to assess if animals are fenced out of the series of ponds to the SE and if there is an adequate buffer. Restore shoreline of ponds, install fencing, and provide alternate water source if needed.	AGR 11	Lower Millecoquins River	CLMCD, NRCS, SWP	TBD	NRCS EQIP, CWA Section 319	2035

Medium	Non-Point Source Pollution	Medium operation. Check flow path that is directly north of the barn and evaluate that runoff toward Krause Rd and the channel. Evaluate access to a feed lot directly adjacent to the channel to the south.	AGR 15	Lower Millecoquins River	CLMCD, NRCS, SWP	TBD	NRCS EQIP, CWA Section 319	2035
Medium	Non-Point Source Pollution	Medium dairy operation with a lagoon. This operation might have access to a lot of land for pasture but needs evaluation. This operation needs to be evaluated for pastureland with unrestricted cattle access to streams and drainages. Evaluate the low area that drains to the tributary stream in the southwest corner of the south field. Evaluate land ownership/leasing.	AGR 26	Lower Millecoquins River	CLMCD, NRCS, SWP	TBD	NRCS EQIP, CWA Section 319	2035
Medium	Non-Point Source Pollution	Small operation. Fields straight west of the house and field to the south appear to be the same owner. Evaluate land ownership and if there are any access points to streams and drainage ways.	AGR 28	Lower Millecoquins River	CLMCD, NRCS, SWP	TBD	NRCS EQIP, CWA Section 319	2035
Low	Non-Point Source Pollution	Small operation. Heavy use area adjacent to Krause Road should be evaluated. Evaluate land ownership/leasing.	AGR 29	Lower Millecoquins River	CLMCD, NRCS, SWP	TBD	NRCS EQIP, CWA Section 319	2035
Low	TBD	Small operation. Evaluate land use.	AGR 33	Lower Millecoquins River	CLMCD, NRCS, SWP	TBD	NRCS EQIP, CWA Section 319	2035

Figure 25. Selected BMP's for implementation in the Upper Millecoquins River Sub-Watershed:

Priority	Watershed Goal(s) Addressed	Project	Site ID(s)*	Subwatershed	Potential Partners/ Technical Assistance	Cost	Possible Funding Sources	Timeline
High	Non-Point Source Pollution	Small operation. Pasture area includes channels that flow to Maloney Creek. It appears that the animals are fenced into the pasture area surrounding the channels and Maloney Creek. Evaluate for number of animals and animal exclusion fencing.	AGR 45	Upper Millecoquins River	CLMCD, NRCS, SWP	TBD	NRCS Environmental Quality Incentives Program (EQIP), Clean Water Act (CWA) Section 319	2035
High	Road Stream Crossing, Non-Point Source Pollution, Habitat Restoration	The two culverts at Maloney Creek and Sandtown Rd are currently undersized, resulting in high erosion (a combined estimate of 3.58 tons of sediment per year). Both structures are also a complete barrier to fish passage. Culverts should be replaced with an open-bottom or embedded crossing structure lined with native substrate. The inlet and outlet banks should also be reinforced with rip-rap.	6341721204, 6341721744	Upper Millecoquins River	NRCS, SWP, County Road Commission	\$10,000-500,000	NRCS EQIP, EGLE Nonpoint Source (NPS) Grants, Great Lakes Fishery Trust (GLFT), USFWS National Fish Passage Program, DNR Fisheries Habitat Grant Program, GLRI, National Fish and Wildlife Foundation (NFWF) Sustain Our Great Lakes Program, Private Foundations	2035
High	Road Stream Crossing, Non-Point Source Pollution	Road stream crossings in the forested areas to the east and north are contributing excess sediment to the Upper Millecoquins River and Jocko Creek. Plant native vegetation along streambanks to reinforce bank stability and reduce erosion.	N/A	Upper Millecoquins River	CLMCD, NRCS, SWP	\$10,000-300,000	NRCS EQIP, EGLE Nonpoint Source (NPS) Grants, Great Lakes Fishery Trust (GLFT), USFWS National Fish Passage Program, DNR Fisheries Habitat Grant Program, GLRI, National Fish and Wildlife Foundation (NFWF) Sustain Our Great Lakes Program, Private Foundations	2035

Medium	Non-Point Source Pollution	Medium operation. Cattle appear to be fenced out of the Maloney Creek riparian area but needs to be evaluated. The pasture land east of the barns is very close to what may be a flowing ditch/tributary to Maloney Creek. Evaluate dry manure storage and runoff paths. Both private road stream crossings need evaluation.	AGR 34	Upper Millecoquins River	CLMCD, NRCS, SWP	TBD	NRCS EQUIP, CWA Section 319	2035
Medium	Non-Point Source Pollution	Small operation. Blue line stream on the aerial photo needs to be evaluated. Animals appear to have access to that flow path and there is limited fencing to restrict access. Evaluate possible dry manure storage near the barn.	AGR 36	Upper Millecoquins River	CLMCD, NRCS, SWP	TBD	NRCS EQUIP, CWA Section 319	2035
Medium	Non-Point Source Pollution	Medium operation. There appears to be two flow paths from the north side and the south side of the barn that have a connection to Maloney Creek. Evaluate the fencing around the pond east of the barn. Evaluate the need for fencing along the flow path flowing to the pond and the grazing activity.	AGR 43	Upper Millecoquins River	CLMCD, NRCS, SWP	TBD	NRCS EQUIP, CWA Section 319	2035
Medium	Non-Point Source Pollution, Habitat Restoration, Climate Resilience, Road Stream Crossing	Small horse operation. The heavy use area is at the headwater reaches of the grass swales discharging to a tributary of the Upper Millecoquins River. Needs further evaluation for possible site of a grassed waterway.	AGR 51	Upper Millecoquins River	CLMCD, NRCS, SWP	TBD	NRCS EQUIP, CWA Section 319	2035

Low	Non-Point Source Pollution	Small operation. Animals do not appear to be pasturing near the stream to the north. Further evaluation would be helpful to confirm the current conditions.	AGR 37	Upper Millecoquins River	CLMCD, NRCS, SWP	TBD	Farm Bill EQIP, CWA Section 319	2035
Low	Non-Point Source Pollution	Small operation. Evaluate the usage of the large northern barn that is close to the Maloney Creek tributary crossing the property. Animals appear to be limited to the heavy use area southwest of the small barn.	AGR 47	Upper Millecoquins River	CLMCD, NRCS, SWP	TBD	NRCS EQIP, CWA Section 319	2035

Figure 26. Selected BMP's for implementation in the McAlpine Creek Sub-Watershed:

Priority	Watershed Goal(s) Addressed	Project	Site ID(s)*	Subwatershed	Potential Partners/ Technical Assistance	Cost	Possible Funding Sources	Timeline
High	Road Stream Crossing, Non-Point Source Pollution, Habitat Restoration	The road stream crossing at Skunk Creek and County Road 405 has a very high erosion estimate (8.63 tons of sediment per year), likely due to improper positioning. The present structure is also a complete barrier to fish passage. A structural lining should be added to the culvert to minimize site erosion, and native substrate added to the interior of the culvert to support aquatic passability. Additionally, amoring the structure's inlet and outlet banks with rip-rap and planting native vegetation in the road ditches and streambanks would reduce sediment erosion.	6341647097	McAlpine Creek	CLMCD, NRCS, SWP, County Road Commission	\$10,000-300,000	NRCS EQIP, EGLE Nonpoint Source (NPS) Grants, Great Lakes Fishery Trust (GLFT), USFWS National Fish Passage Program, DNR Fisheries Habitat Grant Program, GLRI, National Fish and Wildlife Foundation (NFWF) Sustain Our Great Lakes Program, Private Foundations	2035

Medium	Non-Point Source Pollution	Small operation. There is a stream channel cutting through this property. Evaluate if the heavy use area north of the barn allows animals access to the stream.	AGR 50	McAlpine Creek	CLMCD, NRCS, SWP	TBD	NRCS Environmental Quality Incentives Program (EQIP), Clean Water Act (CWA) Section 319	2035
Medium	Road Stream Crossing, Habitat Restoration, Non-Point Source Pollution	The current road stream crossing structure at McAlpine Creek and County Rd 405 is undersized, leading to high water velocity, upstream ponding, a scour pool, and a complete barrier to fish passage. The culvert should be replaced with a properly-sized embedded or open-bottom structure. Since there is currently no bank armoring, rip-rap should be added to the inlet and outlet banks. Adding a thicker fill of well-compacted gravel to the road crossing surface would also prevent sediment erosion and road overtopping.	Crossing 22	McAlpine Creek	NRCS, SWP, County Road Commission	\$10,000-300,000	NRCS EQIP, EGLE Nonpoint Source (NPS) Grants, Great Lakes Fishery Trust (GLFT), USFWS National Fish Passage Program, DNR Fisheries Habitat Grant Program, GLRI, National Fish and Wildlife Foundation (NFWF) Sustain Our Great Lakes Program, Private Foundations, MDOT	2035

6.3 Pollution Load Reduction Estimates

The SWP's primary data shows that all three subwatersheds are experiencing the most intense negative water quality impacts associated with agricultural land use and stream bank erosion. Between these three subwatersheds, approximately 9,000 acres are under agricultural land use including pastures, cropland, and feedlots.

The EPA's Pollutant Load Estimation Tool (PLET) estimates that the three subwatersheds are impacted by several nonpoint source pollutants with specific pollutants causing especially troublesome impacts in each. Given local stakeholder's concerns regarding E. coli, high biological oxygen demand is especially concerning in these watersheds.

Watershed	N Load (lbs per year)	P Load (lbs per year)	BOD Load (lbs/year)	Sediment Load (tons/year)
Jocko/Upper Millecoquins	24,961	2,368	32,640	112
Furlong Creek	1,902	341	3,294	16
Lower Millecoquins	32,573	2,985	58,770	91
Totals	59,436	5,694	94,704	219

Figure 30. Total pollutant load estimates by subwatershed

By combining primary field information, remote sensed data, and modelling from the PLET, the SWP identified a suite of best practices for key sites in the Jocko/Upper Millecoquins, Furlong, and Lower Millecoquins subwatersheds. Pollutant reductions were also calculated by BMP in the subwatersheds; specific sites will not be identified in this report to protect landowner privacy. The following

table lists the most effective BMP by pollutant in each subwatershed relevant land use type.

Land Use	BMP	N	P	BOD	Sediment
Cropland	Land Retirement	.90	.81		.95
Cropland	Streambank Stabilization and Fencing	.75	.75		.75
Pastureland	Grass Buffer (35ft)	.87	.89		.65
Pastureland	Streambank Stabilization and Fencing	.75	.75		.75
Feedlot	Solids Separation Basin with Infiltration Bed		.80	.85	
Feedlot	Waste Management System	.80	.90		
Forest	Site Preparation, Straw, Polymer, Seed, Fertilizer, and Transplant				.86

Figure 31. BMPs and their efficiency at reducing pollutant loads

After using Stolum's method to calculate approximate total agriculture impacted stream miles in the Jocko/Upper Millecoquins, Furlong, and Lower Millecoquins subwatershed, the SWP estimates that approximately 43, 51, and 27 miles of stream and river are impacted by agriculture in the subwatersheds respectively (Stolum, 1996). The following assessments utilize these figures to model pollution reduction scenarios, providing insights into various scales of application.

Jocko/Upper Millecoquins	Land Use	BMP	Percent of Area BMP Applied	% N Reduction	% P Reduction	% BOD Reduction	% Sediment Reduction
Jocko/Upper Millecoquins	Cropland	Land Use Retirement	25	.62	.62	.06	2.47
Jocko/Upper Millecoquins	Cropland	Streambank Stabilization and Fencing	40	.81	.88	.07	3.12
Jocko/Upper Millecoquins	Pastureland	Grass Buffer (35ft)	7	3.53	1.79	.03	1.34
Jocko/Upper Millecoquins	Pastureland	Streambank Stabilization and Fencing	3	1.31	.66	.01	.66
Jocko/Upper Millecoquins	Feedlot	Solids Separation Basin with Infiltration Bed	100	N/A	3.74	1.33	N/A
Jocko/Upper Millecoquins	Feedlot	Waste Management System	100	2.97	4.2	N/A	N/A
Jocko/Upper Millecoquins	Forest	Site Preparation, Straw, Polymer, Seed, Fertilizer, and Transplant	25	.11	.26	.07	3.02

Furlong	Land use	BMP	Percent of Area BMP Applied	% N Reduction	% P Reduction	% BOD Reduction	% Sediment Reduction
Furlong	Cropland	Land Use Retirement	58	10.14	8.49	.35	9.86
Furlong	Cropland	Streambank Stabilization and Fencing	28	4.07	3.72	.14	3.76
Furlong	Feedlot	Solids Separation Basin with Infiltration Bed	100	N/A	20.46	8.07	N/A
Furlong	Feedlot	Waste Management System	100	16.81	23.02	N/A	N/A

Lower Millecoquins	Land Use	BMP	Percent of Area BMP Applied	% N Reduction	% P Reduction	% BOD Reduction	% Sediment Reduction
Lower Millecoquins	Cropland	Land Use Retirement	62	1.18	1.22	.02	1.61
Lower Millecoquins	Cropland	Streambank Stabilization and Fencing	30	.49	.56	.01	.64
Lower Millecoquins	Pastureland	Grass Buffer (35ft)	2	1.21	.74	.16	N/A
Lower Millecoquins	Pastureland	Streambank Stabilization and Fencing	1	.52	.31	N/A	.09
Lower Millecoquins	Feedlot	Solids Separation Basin with Infiltration Bed	100	N/A	3.68	1.02	N/A
Lower Millecoquins	Feedlot	Waste Management System	100	2.32	4.14	N/A	N/A
Lower Millecoquins	Forest	Site Preparation, Straw, Polymer, Seed, Fertilizer, and Transplant	25	.06	.17	.03	2.92

6.4 Management Goals by Sub-watershed

Jocko/Upper Millecoquins

Pasturelands in the Millecoquins River Watershed are producing the largest numbers of N and BOD impacts; the Jocko/Upper Millecoquins Subwatershed has the second largest pastureland acreage. In addition, the subwatershed has close to the most forest lands in the watershed as well. Given that water quality issues in the upland Jocko/Upper Millecoquins flow into the Lower Millecoquins Subwatershed, maximizing BMPs in pastureland is a high priority. Specifically, large grass buffers combined with animal exclusion (fencing) and streambank reinforcement should be implemented wherever possible. While the subwatershed does not have the largest feedlot acreage, implementing solid waste filtration beds and waste

management systems will decrease animal waste seepage into surface and groundwater. Road stream crossings in the forested areas were found to be a troublesome source of excess sediment, which can be remedied through streambank reinforcement with native vegetation.

Jocko/Upper Millecoquins	N Load (lbs/year)	P Load (lbs/year)	BOD Load (lbs/year)	Sediment Load (tons/year)
No BMP	10,113.56	1,607.75	31,900.59	111.31
With BMP	9,393.45	1493.08	31,847.27	102.98
% Reduction	7.42	7.13	.17	7.49

Furlong Creek

The Furlong subwatershed sees most impact from its croplands and larger share of feedlot acreage. Again, to reduce excess BOD and N levels stemming from agriculture, reducing fertilizer application and animal exclusion should be prioritized. Land retirement, while a difficult ask for agricultural businesses, would also have a strong impact in this area. Promoting vegetation regeneration on streambanks to reduce E. coli blooms along Doe Creek would likely be effective.

Furlong Creek	N Load (lbs/year)	P Load (lbs/year)	BOD Load (lbs/year)	Sediment Load (tons/year)
No BMP	4213.04	692.03	12425.68	69.83
With BMP	3785.90	491.66	11378.59	62.95
% Reduction	10.14	28.95	8.43	9.86

Lower Millecoquins

The Lower Millecoquins Subwatershed has the highest acreages for both pastureland and forest in the Millecoquins River Watershed. Also, its low position in the hydrological table, with Lake Millecoquins receiving all streams and rivers before the Lower Millecoquins River continues to Lake Michigan, means that the subwatershed is impacted by many water quality issues upstream and upgrade. Again, targeting over sedimentation at forest road stream

crossings with vegetative reinforcement is a good strategy. The Hiawatha Sportsman's Club is also a major forest landowner that is likely to support these interventions. Similarly for pasturelands in the Jocko/Upper Millecoquins, animal exclusion along with grass buffers wherever possible are a strong strategy for reducing BOD and N impacts. However, it must be emphasized that the Lower Millecoquins Subwatershed's continued health is contingent upon BMP adoption upstream.

These modelled best management practices are most useful as goalposts rather than specific recommendations; every agricultural operation has different needs, impacts, and financial capabilities. The SWP's fieldwork in these watersheds will allow for the specified application of measures like those described above with key landowners to maximize pollution reductions.

Lower Millecoquins	N Load (lbs/year)	P Load (lbs/year)	BOD Load (lbs/year)	Sediment Load (tons/year)
No BMP	19014.78	2397.22	61089.09	112.51
With BMP	18551.24	2257.96	60430.84	107.23
% Reduction	2.44	5.81	1.08	4.70

6.5 Additional Funding Sources

Funding diversity is encouraged for the long-term sustainability of the work. Funding can come from federal, state, local and private funding sources, but this list is by no means exhaustive and can be adjusted and added to as necessary.

- Clean Michigan Initiative - Nonpoint Source Pollution Control Grants
- EPA Environmental Education Grants
- EPA 319 Non-Point Source Pollution grants
- Federal Clean Water Act, Section 319(h)
- Great Lakes Commission: Michigan Clean Water Corps
- Great Lakes Sediment and Nutrient Reduction Program (formally known as the Great Lakes Basin Program for Soil Erosion and Sediment Control)
- Great Lakes Restoration Initiative (GLRI)
- Great Lakes Stewardship Initiative
- Michigan Coastal Zone Management Program
- MDNR Aquatic Habitat Grant Program
- MDNR Michigan Invasive Species Grant Program
- Community Forest Program
- National Fish and Wildlife Foundation
- North American Wetlands Conservation Act Small Grants Program
- Superior Health Foundation
- Woollam Foundation
- Other Private Foundations
- Donations

7.0 INFORMATION & EDUCATION PLAN

This section is designed to address USEPA *Element E* by providing an Information/Education component to enhance public understanding and to encourage early and continued participation in selecting, designing, and implementing recommendations provided in the Watershed-Based Plan. Stakeholders are an integral part of the watershed-management process. Therefore, contacting all stakeholders should be a priority during all stages of the development and implementation of the Millecoquins River Watershed Management Plan. Target audiences include:

1. Households and Landowners
2. Local Organizations/Societies
3. Farmers
4. Local schools
5. Municipalities
6. Businesses and Industries
7. Governments (state, federal, local, tribal)
8. Developers & Construction Entities

Raising awareness by presenting information and educational materials to target audiences is the first priority. Methods include in-person/direct contacts, K-12 educational lessons, mailings, presentations, special events/volunteer opportunities, and social media. K-12 outreach and education should be relevant, differentiated, and aligned with Michigan Academic Standards and Great Lakes Literacy Principles. Social media can be an effective tool, when used appropriately, which should be used to engage the public, especially the younger generations. Social media accounts may be created and used to update stakeholders and interested citizens on current news, scheduled activities within the watershed, and opportunities to get involved. Priority outreach and education topics will include:

1. The Major Watershed Concerns (non-point source pollution, invasive species, threatened and endangered species, habitat, and climate change)
2. Land Use Strategies and BMPs
3. Restoration and Protection Projects
4. Water Quality
5. Invasive Species
6. Habitat Protection
7. Septic Systems and Sewage Lagoons
8. Erosion, Runoff, and Pollution
9. Livestock Access
10. Environmental Monitoring
11. Local and Traditional Ecological Knowledge

All restoration and protection projects and programs planned within the watershed will require consultation with the affected stakeholders prior to implementation. Consultation will be continued throughout the entire course of projects and programs to monitor stakeholder approval and suggestions. Interested stakeholders will be encouraged to aid in ongoing/future monitoring efforts.

Figure 27 below outlines broad recommendations for outreach/education actions, including target audiences, methods, a timeline for implementation and who will lead the effort. Figure 28 outlines information and education goals which address specific watershed concerns and pollutant issues. The expected outcomes of these actions include increased community awareness of the hydrological, ecological, cultural, and economic importance (ecosystem services) of maintaining water quality not only to the immediate watershed but regionally; increased awareness of potential sources of water pollutants and conditions that can impact water quality especially those that may be exacerbated by changing climate conditions; and increased awareness of management practices and potential support (e.g. cost-sharing, equipment-sharing opportunities,

management tools, and labor resources that could assist in implementing practices.

Figure 27. Recommended outreach/education actions, target audiences, methods and responsible parties.

Actions	Target Audiences	Methods	Timeline	Responsible Parties
Create contact lists of focus groups and target audiences	All	Assemble contacts/ mailing lists from available sources.	Year 1	Superior Watershed Partnership
Conduct a social survey of watershed stakeholders to identify watershed and conservation priorities of landowners, inform policy development, and improve land use planning and actions by local units of government and landowners	Households/landowners	Direct mailings with online response options	Year 1	Superior Watershed Partnership
Develop and distribute informational & educational materials (articles, newsletters, brochures, etc.) to target audiences	All	Direct mailings, utility bill inserts, social media, etc.	Years 1-5	Superior Watershed Partnership, local municipalities
Conduct K-12 education aligned with State standards/curriculum and Traditional Ecological Knowledge	Local school(s), households	Direct contact with school officials	Years 1-10	Superior Watershed Partnership, Local School(s)
Train and host volunteer monitoring events to engage residents and tourists in water quality protection efforts	Residents/tourists	Host water quality training and monitoring events for residents/tourists. Share monitoring results with residents	Years 1-10	Superior Watershed Partnership, Great Lakes Climate Corps (GLCC) Hiawatha Sportsman's Club
Invite/engage landowners and other stakeholders to participate in hands-on restoration demonstrations	Landowners/farmers	Host restoration volunteer events (erosion control, native plantings, etc.)	Years 1-5	Superior Watershed Partnership, Hiawatha Sportsman's Club, Great Lakes Climate Corps (GLCC)

Education Goal	Pollutant	Pollutant Source	Target Audience	Message	Delivery Mechanism	Potential Partners	Timeline	Milestones	Costs	Evaluation Criteria
1. Reduce risks of non-point source pollution	Sediment, nitrogen, phosphorus	Road-stream crossings, streambank erosion, stormwater runoff, agriculture, urban development	Landowners, Farmers, Municipalities , Developers & Construction Entities, Local Organizations	Implement BMPs to reduce runoff, erosion, and nutrient loading. Protect waterways through proper land management.	Workshops, field demonstrations , fact sheets, social media, outreach events, technical assistance visits	SWP, CLMCD, NRCS, County Road Commission, Local Governments	Years 1-5	Annual workshops held; BMP implementation on priority sites; educational materials distributed	\$2,500-\$10,000 /year	Number of participants; BMPs installed; reduction in sediment/nutrient loading; road stream crossing surveys
2. Aquatic habitat protection and restoration	Sediment, nutrients, habitat degradation	Streambank erosion, riparian vegetation loss, channel modification	Landowners, Municipalities , Local Schools, Local Organizations	Healthy riparian areas improve water quality and wildlife habitat. Restoration increases ecosystem resilience.	Demonstration projects, volunteer events, lessons at schools, educational signage, presentations to public	SWP, CLMCD, Trout Unlimited, DNR	Years 1-10	Restoration projects completed; volunteer events held annually	\$2,500->\$10,000 /year	Acres restored; trees planted; volunteer participation; habitat assessments
3. Improved water quality/ monitoring	Nutrients, bacteria (E. coli), sediment, contaminants	Stormwater runoff, septic failures, agriculture, urban development	General Public/ Households and Landowners, Municipalities , Local Schools, Volunteers	Everyday actions affect local water quality. Prevention is less costly than restoration. Monitoring provides data for informed watershed management decisions.	Public outreach campaign, newsletters, community meetings, training workshops, monitoring events	SWP, Health Department, CLMCD, Municipalities , Schools	Years 1-10	Annual outreach campaign; educational materials updated; volunteer monitoring network established; annual data reports	\$2,500-\$10,000 /year	Survey responses; increased awareness levels; volunteer engagement and participation; samples collected; data quality and use
4. Maintained septic systems	Nutrients, pathogens, bacteria (E. coli)	Failing or poorly maintained septic systems	Homeowners/ Households and Landowners, Municipalities , Businesses and Industries	Proper septic maintenance protects drinking water and surface waters.	Fact sheets, mailings, workshops, townhalls, local media	Health Department, Municipalities , SWP	Years 1-5	Septic education campaign launched; annual workshops/meetings held	\$2,500-\$10,000 /year	Workshop attendance; septic inspections conducted; homeowner surveys

5. Limited livestock access	Sediment, nutrients, bacteria (E. coli)	Direct livestock access to streams and wetlands	Farmers, Agricultural Landowners	Excluding livestock from waterways improves herd health and water quality.	Farm visits, demonstrations , cost-share promotion, producer meetings	NRCS, CLMCD, Farm Bureau, MSU Extension, SWP	Years 1-5	Fencing and alternative watering systems promoted annually	\$2,500-\$10,000 /year	Number of producers reached; number of farm visits conducted; exclusion projects completed
6. Promoting local and Traditional Ecological Knowledge	N/A	N/A	Governments/ Tribal Communities, Local Residents and Landowners, Municipalities , Educators and Local Schools	Local and traditional knowledge contributes valuable insights for watershed stewardship and resource management.	Listening sessions, workshops, collaborative planning meetings, educational curricula	Tribal Nations (Hannahville, Sault Ste Marie Tribe, Bay Mills, etc.), SWP, Local Historical Societies and Schools	Years 1-10	Community engagement sessions completed; knowledge incorporated into planning	\$2,500-\$10,000 /year	Participation levels; documented knowledge contributions; stakeholder feedback

8.0 MEASURING PLAN PROGRESS & SUCCESS

Continual evaluation provides information regarding the success of ongoing efforts to improve watershed characteristics. It allows for an assessment of the effectiveness and appropriateness of the original goals and objectives of this plan as tasks are implemented and conditions change over time. Evaluation also provides a feedback mechanism for periodically assessing the effectiveness of management practices and allows stakeholders to identify areas where program improvements are possible. The measurements identified in relation to the goals and objectives of this plan provide helpful tools for local stakeholders to assess the effectiveness of their implementation projects or educational/outreach efforts. These measures however, are by no means exhaustive. Many other evaluation measures exist and local stakeholders must ensure evaluation programs and protocols meet local needs.

Evaluation programs typically include two types of measures: quantitative and qualitative. Quantitative attributes are those which it is possible to measure. Qualitative measures try to shed light on changes in attitudes, perceptions and knowledge levels. Monitoring results will be compared to State and Federal water quality criteria where available. Examples of the two approaches as they related to the goals and objectives of the Millecoquins River Watershed Management Plan are provided below.

Quantitative Measures

- Biological monitoring of surface waters (e.g. E. coli bacteria, macroinvertebrate communities)
- Chemical monitoring of surface waters (e.g. temperature, dissolved oxygen)
- Stream flow monitoring (e.g. volume, velocity)

- Sediment monitoring (e.g. deposition, quantity)
- Number of buffer ordinances adopted by townships
- Number of acres protected (conservation easements)
- Educational workshop attendance levels
- Number of storm water Best Management Practices implemented
- Number of restoration projects completed

Qualitative Measures

- Workshop/demonstration project evaluation surveys
- Public opinion surveys (e.g., increased awareness of impacts of nonpoint source pollutants on aquatic habitats, etc.)
- Increased cooperation and networking between stakeholders and other entities
- Volunteer and partner participation in watershed projects including annual monitoring and evaluation.

Continual evaluation will be essential to monitor the success of improvement, protection, and restoration efforts. Continued evaluation will also be of great value for future projects as compiled data can be used to inform decisions and confirm the need for further funding. Additionally, the monitoring will help determine whether non-point source pollutant load reductions are being achieved.

The prioritized tasks outlined in the Management Measures Action Plan (Chapter 6) of this document will also be evaluated on a continuous basis. These projects will be evaluated by using the project milestones/timeline. Projects should also include pre- and post-project monitoring to assess the success of the projects and provide data and information for additional projects. In addition to data collection, projects should also include photographic documentation. These

photographs will be particularly valuable in education and outreach efforts.

Whenever possible, the public should be involved in monitoring efforts. This will enhance education and instill in these stakeholders a personal sense of responsibility and care. By building upon these sentiments, future projects should prove to be more efficient and effective.

Education and outreach efforts will be evaluated based on number of people reached, number of k-12 school students participating, public responses to newsletters and social media efforts and public involvement in monitoring efforts, restoration demonstrations and other opportunities. If these outreach efforts are not effectively engaging the public, different avenues of reaching stakeholders and interested citizens or certain groups which are underrepresented will be considered.

To account for any necessary changes, the watershed management plan should be updated every ten years. Prior to making changes, the SWP will meet with stakeholders to discuss and evaluate the plan. Report cards for each plan goal will be used to determine if Management Measures are being implemented on schedule, how effective they are at achieving plan goals, and need for adaptive management if milestones are not being met.

Appendix A- Road Stream Crossing Inventory

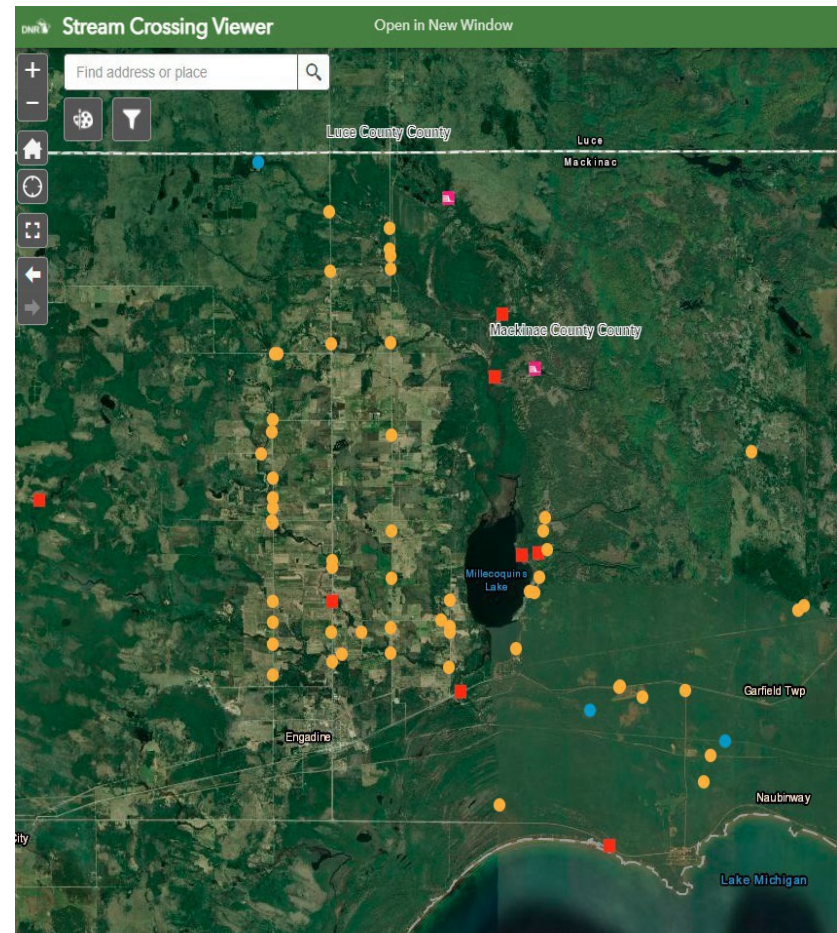
Background

In 2021, SWP field technicians inventoried 61 road-stream crossings within the HSC and Millecoquins River Watershed to identify structural concerns including crushed, plugged, or undersized culverts. Dozens of detailed measurements were also collected to identify concerns related to fish passage including perched, scoured, or unnatural substrate culverts. Photos were taken of each culvert's inlet and outlet, creek's upstream and downstream, and road in both directions.

To the right is a screenshot from the Michigan DNR Stream Crossing Viewer database, which includes the 61 road stream crossing locations inventoried by SWP field technicians. By clicking on a point, the viewer can see detailed measurements and observations collected by the SWP field technicians and view photos of the site. This data was reviewed and analyzed by SWP staff in 2025 to identify and report to HSC culverts that threaten infrastructure or impede fish passage. The following pages contain summary tables of the inventory findings, as well as a breakdown of the most at-risk crossings and their recommended improvements.

Visit the Michigan DNR Stream Crossing Viewer here:

<https://midnr.maps.arcgis.com/apps/webappviewer/index.html?id=1229b87ecb3f4d23bbacb2900d2b1135>



Screenshot of SWP's Inventoried Road Stream Crossings in and around the HSC

Road Stream Crossings with Major Estimated Site Erosion (>1 ton sediment erosion per year)

Site ID	Stream Name	Crossing Name	Road/Crossing Surface	Diversion Potential	Structure/Stream Alignment	Structure Skew	Site Erosion Estimate Total (tons/year)	Upstream Fill Depth (feet)	Downstream Fill Depth (feet)	Inlet Armoring/ Rip-Rap	Outlet Armoring/ Rip-Rap	Inlet Bank Armoring/ Rip-Rap Functionality	Outlet Bank Armoring/ Rip-Rap Functionality
6341647097	Skunk Creek	County Road 405	Gravel	Yes	Poor Alignment	No Skew	8.63	3.6	2.4	Woody Vegetation	Woody Vegetation	Fair	Good
6341984018	Doe Creek	Kovar Road	Gravel	Yes	Fair Alignment	No Skew	3.94	3.2	3	Woody Vegetation	Woody Vegetation	Good	Good
6341986804	Unnamed Creek	Mile Rd	Gravel	Yes	Good Alignment	No Skew	3.92	0.5	0.5	None	None	Poor	Poor
6341633327	Unnamed Stream	Krause Rd	Gravel	Yes	Good Alignment	No Skew	3.69	0.5	0.8	Gravel	Gravel	Fair	Good
6341721204	Maloney Creek	Sand town Rd	Paved	Yes	Good Alignment	Major Skew	2.54	4	3.8	Rock	Rock	Fair	Fair
Crossing 23	Unnamed Creek	Krause Rd	Paved	Yes	Poor Alignment	No Skew	2.44	10	8	Woody Vegetation	Woody Vegetation	Poor	Fair
6342057017	Doe Creek	Raski Rd	Gravel		Good Alignment	Moderate Skew	2.08	2.7	2.6	Woody Vegetation	Woody Vegetation	Fair	Fair
6342019999	North Branch Cold Creek	Trail off of Cold Creek Trl	Sand	Yes	Good Alignment	No Skew	1.99	1.1	33	None	Rock	Poor	Fair
Crossing 27	Unnamed Stream	Indian Trail	Gravel		Good Alignment	No Skew	1.84	3	4.2	Woody Vegetation	Woody Vegetation	Fair	Fair
634179751	Millecoquin River	Krause Rd	Paved	Yes	Good Alignment	Moderate Skew	1.8	20	15	Rock	Rock	Good	Good
6341986358	Doe Creek	Pleasant Ave	Gravel	Yes	Good Alignment	Moderate Skew	1.73	3.6	3.4	Woody Vegetation	Woody Vegetation	Good	Good
Crossing 14	Unnamed Stream	Unmarked Trail	Native Surface	Yes	Good Alignment	No Skew	1.6	1.8	1.6	Woody Vegetation	Woody Vegetation	Fair	Fair
6341641450	Skunk Creek	State Highway M-117	Paved	Yes	Good Alignment	Moderate Skew	1.46	26	25	Woody Vegetation	Concrete	Good	Good
6341960261	Jocko Creek	Trail B	Sand	No	Good Alignment	No Skew	1.43		13	Concrete	Rock	Good	
6341659329	Furlong Creek	Unnamed Trail	Native Surface	No	Good Alignment	No Skew	1.4			Rock	Rock	Fair	Good
6342050581	Doe Creek	State Highway M117	Paved	Yes	Good Alignment	No Skew	1.14	10	10	Woody Vegetation	Woody Vegetation	Good	
6341721744	Maloney Creek	Sand town Road	Paved	Yes	Fair Alignment	Moderate Skew	1.04	2.6	3.3	Woody Vegetation	Woody Vegetation	Good	Good

Road Stream Crossings with Minor Estimated Site Erosion (<1 ton sediment erosion per year)

Site ID	Stream Name	Crossing Name	Road/Crossing Surface	Diversion Potential	Structure/Stream Alignment	Structure Skew	Site Erosion Estimate Total (tons/year)	Upstream Fill Depth (feet)	Downstream Fill Depth (feet)	Inlet Armoring/ Rip-Rap	Outlet Armoring/ Rip-Rap	Inlet Bank Armoring/ Rip-Rap Functionality	Outlet Bank Armoring/ Rip-Rap Functionality
634279788	Cold Creek	Cold Creek Trail	Sand	No	Fair Alignment	No Skew	0.97	2.4	2.5	Woody Vegetation	Woody Vegetation	Good	Good
6341845757	Furlong Creek	Pleasant Ave	Paved	Yes	Good Alignment	Moderate Skew	0.89	4.3	5	Woody Vegetation	Woody Vegetation	Good	Good
Site 9 Hagler Creek	Hagler Creek	Krause Road	Paved	Yes	Good Alignment	No Skew	0.86	4	6	Woody Vegetation	Woody Vegetation	Good	Good
	McAlpine Creek	County Road 405	Gravel	Yes	Poor Alignment	No Skew	0.82	0.2	0.2	None	None	Poor	Poor
6341986926	Doe Creek	Pleasant Ave	Gravel	Yes	Good Alignment	Moderate Skew	0.74	1	0.8	Woody Vegetation		Fair	Fair
6341983115	Unnamed Stream	Peasant Ave	Gravel	Yes	Good Alignment	No Skew	0.7	3.2	2.8	None	None	Poor	Poor
6341947795	North Branch Cold Creek	Cold Creek Trail	Sand	Yes	Good Alignment	No Skew	0.69	1.5	2	Woody Vegetation	Woody Vegetation	Good	Good
6341610000	Millecoquin Pond	Trail off of County Rd 405	Sand	No	Good Alignment	No Skew	0.66	3.5	15	Woody Vegetation	Woody Vegetation	Good	Good
Culvert 20	Doe Creek	Pleasant Ave	Gravel	Yes	Good Alignment	No Skew	0.64	2.4	3	Woody Vegetation	Woody Vegetation	Fair	Fair
6342309548	O'Niel Creek	Greylock Trail	Sand	No	Good Alignment	No Skew	0.58	1.3	1	Woody Vegetation	Woody Vegetation	Good	Good
Crossing 25	Unnamed Stream	Krause Rd	Paved	Yes	Good Alignment	No Skew	0.51	1.1	2	Woody Vegetation	Woody Vegetation	Fair	Fair
Crossing 21	McAlpine Creek	Co Rd 405	Gravel	Yes	Good Alignment	No Skew	0.46	0.6	1	Woody Vegetation	Woody Vegetation	Fair	Fair
Crossing 28	Trib into Furlong Creek	Raski Road	Gravel	Yes	Good Alignment	Major Skew	0.44	5	7.5	Woody Vegetation	Woody Vegetation	Fair	Good
6342267719	Three Mile Creek	Hiawatha Trail	Paved	Yes	Good Alignment	No Skew	0.44			Rock	Rock	Good	Fair
Crossing 1	South Branch Threemile Creek	Airfield Trail	Gravel	Yes	Good Alignment	No Skew	0.36	1.4	1.7	Rock	Rock	Good	Good
6341856828	Unnamed Stream	Pleasant Ave	Paved	Yes	Good Alignment	No Skew	0.34	1.7	1.5	None	None	Poor	Poor
Crossing 15	Unnamed Stream	Unnamed Trail	Sand	No	Fair Alignment	Moderate Skew	0.27	0.6	0.8	Woody Vegetation	Woody Vegetation	Good	Good
Crossing 16	Unnamed Stream	Millecoquin Lake Drive	Paved	Yes	Good Alignment	No Skew	0.22	2.3	2.4	None	None	Poor	Poor
Site 8 Unnamed Creek	Unnamed Creek	Indian Trail	Paved	Yes	Fair Alignment	No Skew	0.22	5	5	Woody Vegetation	Woody Vegetation	Fair	Fair
6341726095	Maloney Creek	State Highway M-117	Paved	Yes	Good Alignment	No Skew	0.16	17	20	Woody Vegetation	Woody Vegetation	Fair	Good
6341196123	Furlong Creek	State Highway M117	Paved	Yes	Good Alignment	No Skew	0.16	15	15	Woody Vegetation	Woody Vegetation	Good	Good
Crossing 29	Tributary into Furlong Creek	State Highway M-117	Paved	Yes	Good Alignment	No Skew	0.14	5.7	5	Woody Vegetation	Woody Vegetation	Fair	Fair
Crossing 24	Unnnamed Stream	Krause Road	Paved	No	Good Alignment	No Skew	0.14	6	8	Woody Vegetation	Woody Vegetation	Good	Good
6342291565	Lower Millecoquin River	Hiawatha Trail	Paved	Yes	Good Alignment	No Skew	0.12			None	None		
6342348555	South Branch Three Mile Creek	US Highway 2	Paved	Yes	Good Alignment	No Skew	0.11			Concrete	Concrete	Good	Good
6342121463	Furlong Creek	Krause Road	Paved	Yes	Good Alignment	Moderate Skew	0.1	2	2.6	Woody Vegetation	Woody Vegetation	Fair	Fair
Scoliosis Sample	Unnamed Stream	Indian Trail	Paved	Yes	Good Alignment	No Skew	0.1	4.7	5	Woody Vegetation	Woody Vegetation	Good	Good
6342175021	Furlong Creek	Indian Trail	Paved	Yes	Fair Alignment	Major Skew	0.1	10	8	Rock	Rock	Good	Good
Crossing 2	South Branch Three Mile Creek	Naubinway Rd	Paved	Yes	Fair Alignment	Moderate Skew	0.09	3.3	3.9	None	None	Poor	Poor
6342138463	Unnamed Stream	Lake Blvd	Gravel	No	Good Alignment	No Skew	0.08			None	None	Poor	Poor
Crossing 31	Unnamed Creek	Pleasant Ave	Paved	Yes	Good Alignment	No Skew	0.08	0.9	0.7	None	None	Poor	Poor
6342054059	Doe Creek	State Hwy M-117	Paved	No	Good Alignment	No Skew	0.08			Concrete	Concrete	Good	Good
Crossing 26	Unnnamed Stream	Raski Road	Paved	Yes	Good Alignment	No Skew	0.08	4	3.8	Woody Vegetation	Woody Vegetation	Good	Good
Crossing 30	Unnamed Stream	Pleasant Ave	Paved	Yes	Fair Alignment	No Skew	0.08	1.2	1.5	Woody Vegetation	Woody Vegetation	Good	Good
6341989910	Doe Creek	State Highway M-117	Paved	Yes	Poor Alignment	Moderate Skew	0.08	12	15	None	None	Poor	Poor
6341577775	McAlpine Creek	State Highway M-117	Paved	Yes	Good Alignment	Moderate Skew	0.07	14	8	Concrete	Concrete	Good	Good
6341982688	Unnamed Stream	McKelvey Road	Paved	Yes	Fair Alignment	No Skew	0.04	1.8	1.6	Woody Vegetation	Woody Vegetation	Good	Good
6341570098	McAlpine Pond	Trail off of Co Road 468	Native Surface	Yes	Good Alignment	No Skew	0.03	12	20	Woody Vegetation	Woody Vegetation	Good	Good

Road Stream Crossings that are 100% Barriers to Aquatic Passage

Site ID	Stream Name	Crossing Name	Structure/Stream Alignment	Structure Length (feet)	Substrate in Structure	Inlet Water Depth (feet)	Outlet Water Depth (feet)	Inlet Water Velocity (feet/second)	Outlet Water Velocity (feet/second)	Outlet Type	Perch Height (feet)	Passability	Upstream Ponding	Scour Pool
6341647097	Skunk Creek	County Road 45	Poor Alignment	67.5	None	1.5	0.4	0.6	0.6	At Stream Grade	0.4	100% Barrier		
6341721204	Maloney Creek	Sand Town Rd	Good Alignment	1	None	0.8	0.5	2.3	2.3	At Stream Grade	0.3	100% Barrier		
6342019999	North Branch Cold Creek	Trail off of Cold Creek Trail	Good Alignment	70	None	8	1.3			Cascade Over Riprap	1.5	100% Barrier	Yes	
Crossing 14	Unnamed Stream	Unmarked Trail	Good Alignment	20.5	Mixture	0.6	0.6	0.1		Freefall into Pool	0.1	100% Barrier		
6341721744	Maloney Creek	Sand Town Road	Fair Alignment	66.5	Mixture	1.3	0.9	2	2	Freefall into pool	0.5	100% Barrier		Yes
634279788	Cold Creek	Cold Creek Trail	Fair Alignment	20	None	1.2	1	2.9	2.9	Freefall into pool	1.6	100% Barrier		
Crossing 22	McAlpine Creek	County Road 405	Poor Alignment	40	None	2.1	2.8	4	4	At Stream Grade	0	100% Barrier	Yes	
Crossing 16	Unnamed Stream	Millecoquin Lake Drive	Good Alignment	40	None	0.3	0.6			Freefall into Pool	0.2	100% Barrier		

Road Stream Crossings that are Partial Barriers to Aquatic Passage (Barrier at Most Flows and Barrier at High Flows)

Site ID	Stream Name	Crossing Name	Structure Length (feet)	Substrate in Structure	Inlet Water Depth (feet)	Outlet Water Depth (feet)	Inlet Water Velocity (feet/second)	Outlet Water Velocity (feet/second)	Passability	Upstream Ponding	Scour Pool
6341984018	Doe Creek	Kovar Road	46	None	0.2	0.2	0.2	0.2	Barrier at Most Flows		
6341986804	Unnamed Creek	Mile Rd	34	Sand	0.2	0.2			Barrier at Most Flows		
6341633327	Unnamed Stream	Krause Rd	39	None	0.1	0.1	0.1	0.1	Barrier at Most Flows		
6342057017	Doe Creek	Raski Rd	60	Mixture	0.2	0.2	0.1	0.1	Barrier at Most Flows		
Crossing 27	Unnamed Stream	Indian Trail	60	None	0.1	0.1	0	0	Barrier at Most Flows		
6341986358	Doe Creek	Pleasant Ave	67	None	0.8	1	1.1	1.1	Barrier at Most Flows	Yes	
6341641450	Skunk Creek	State Highway M-117	75	Sand	0.3	0.2	0.6	0.6	Barrier at Most Flows		
6341845757	Furlong Creek	Pleasant Ave	90	Rock	0.2	0.4	0.3	0.3	Barrier at Most Flows		
6341610000	Millecoquin Pond	Trail off of County Road 405	80	None		0.5		2	Barrier at Most Flows	Yes	
Culvert 20	Doe Creek	Pleasant Ave	58	None	0.1	1	0	0	Barrier at Most Flows		
Crossing 28	Trib into Furlong Creek	Raski Road	100	None	0	0.4	0	0	Barrier at Most Flows		Yes
Crossing1	South Branch Threemile Creek	Airfield Trail	24	None	0.2	0.4	2.4	2.4	Barrier at Most Flows		
6341856828	Unnamed Stream	Pleasant Ave	40	Sand	0.1	0.1	0	0	Barrier at Most Flows		
Crossing15	Unnamed Stream	Unnamed Trail	12	Mixture	0.2	0.3			Barrier at Most Flows		
Site 8 Unnamed Creek	Unnamed Creek	Indian Trail	68	None	0.3	0.2	0	0	Barrier at Most Flows		
6342348555	South Branch Three Mile Creek	US Highway 2	44	Sand					Barrier at Most Flows		
Crossing 2	South Branch Three Mile Creek	Naubinway Rd	70	Mixture	0.1	0.2	0.72	0.72	Barrier at Most Flows		
Crossing 31	Unnamed Creek	Pleasant Ave	40	None	0.1	0.2	0	0	Barrier at Most Flows		
Crossing 30	Unnamed Stream	Pleasant Ave	53	None	0.4	0.2	0	0	Barrier at Most Flows		
6341570098	McAlpine Pond	Trail off of County Road 468	100	Sand		0.4		1.2	Barrier at Most Flows	Yes	
Crossing13	Unnamed Stream	Millecoquin Lake Road	40	Mixture	0.2	0	0	0	Barrier at Most Flows		
6341960261	Jocko Creek	Trail B	55	None	6	1.5			Barrier at High Flows		Yes
6341983115	Unnamed Stream	Peasant Ave	49	None	2.7	2.7	0.1	0.1	Barrier at High Flows		Yes
6341947795	North Branch Cold Creek	Cold Creek Trail	19.5	Sand	2.9	2.9	1.2	1.2	Barrier at High Flows	Yes	Yes
6342309548	O'Niel Creek	Greylock Trail	20	None	1.9	1.5	0.7	0.7	Barrier at High Flows		

Road Stream Crossings with Plugged or Crushed Structure

Site ID	Stream Name	Crossing Name	% Plugged	Plugged Where	% Crushed	Crushed Where	General Condition
Crossing 27	Unnamed Stream	Indian Trail	61%-80%	Inlet, Outlet	None or 0%		10- No deficiencies
Site 9 Hagler Creek	Hagler Creek	Krause Road	61%-80%	Inside	1%-20%	Inlet,Outlet	6- Moderate to major deterioration
Crossing 25	Unnamed Stream	Krause Rd	41%-60%	Inlet, Outlet	21%-40%	Inlet,Outlet	7- Moderate deterioration
Crossing 16	Unnamed Stream	Millecoquin Lake Drive	41%-60%	Inlet	None or 0%		9- No noticeable changes
Crossing 31	Unnamed Creek	Pleasant Ave	41%-60%	Inlet, Outlet	1%-20%	Inlet,Outlet	9- No noticeable changes
Crossing24	Unnamed Stream	Krause Rd	21-40%	Inside	None or 0%		7- Moderate deterioration
Crossing 21	McAlpine Creek	Co Rd 405	None or 0%		1%-20%	Outlet	8- Light superficial
Site 8 Unnamed Creek	Unnamed Creek	Indian Trail	None or 0%		1%-20%	Outlet	8- Light superficial
6341982688	Unnamed Stream	McKelvey Road	None or 0%		1%-20%	Inlet	7- Moderate deterioration
Crossing13	Unnamed Stream	Millecoquin Lake Road	None or 0%		1%-20%	Inlet	7- Moderate deterioration

Road Stream Crossings with Ponding or Scour Pools Present

Site ID	Stream Name	Crossing Name	Ponding Present	Ponding Length (feet)	Ponding Width (feet)	Scour Pool Present	Scour Pool Length (feet)	Scour Pool Width (feet)	Scour Pool Depth (feet)
6342019999	North Branch Cold Creek	Trail off of Cold Creek Trl	Yes	500	200	No			
6341986358	Doe Creek	Pleasant Ave	Yes	3	10	Yes	15	20	3
Crossing 22	McAlpine Creek	County Road 405	Yes	7	12	Yes	17	20	4
6341947795	North Branch Cold Creek	Cold Creek Trail	Yes	50	30	Yes	100	30	5
6341610000	Millecoquin Pond	Trail off of County Road 405	Yes	500	80	No			
6341570098	McAlpine Pond	Trail off of County Road 468	Yes	30	15	No			
Crossing 28	Trib into Furlong Creek	Raski Road	No			Yes	12	5	1
6341721744	Maloney Creek	Sand town Road	No			Yes	10	7	2
6341983115	Unnamed Stream	Peasant Ave	No			Yes	25	30	3

Summary of Road Stream Crossings by Ownership

Crossing Ownership	Total # of Crossings Surveyed	Not a Barrier (%)	Barrier at Most Flows (%)	Barrier at High Flows (%)	100% Barrier (%)	Not Assessed (%)	Total Estimated Sediment Erosion (tons/yr)
County	24	12.5%	42%	4%	12.5%	29%	29.87
Federal	1	-	100%	-	-	-	0.11
Private	15	7%	26.5%	20%	26.5%	20%	10.17
State	8	37.5%	12.5%	-	-	50%	3.29
Township	12	33%	42%	-	8%	17%	10.08
Tribal	1	100%	-	-	-	-	1.8

Appendix B- Priority Road Stream Crossings

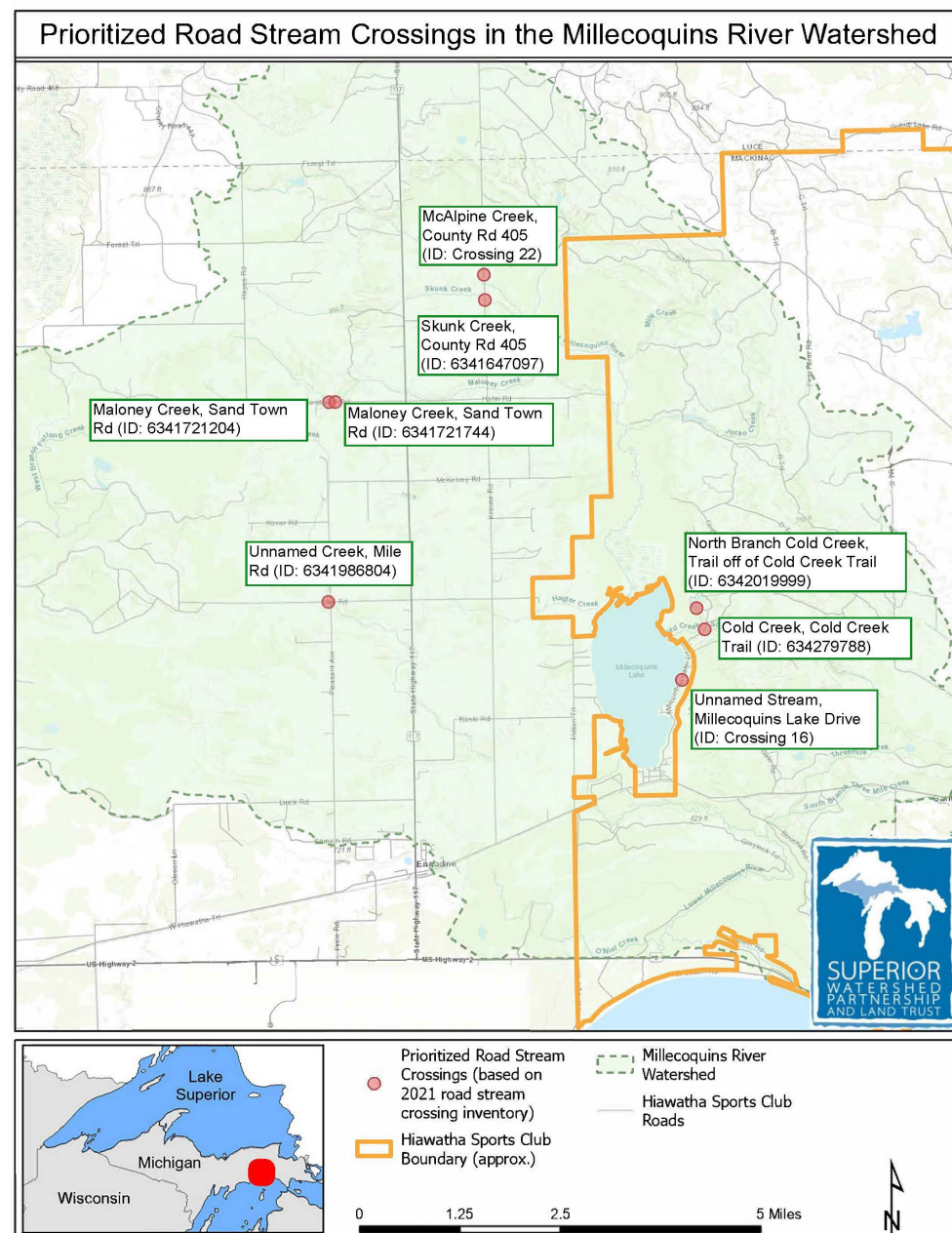
After the Road Stream Crossing Inventory was conducted by SWP field technicians in 2021, eight sites were identified as priorities for replacement or improvement. This appendix contains site-specific information and conditions of these eight crossings, as well as SWP's recommended Best Management Practices (BMP's). Crossings were prioritized by the estimated site sediment erosion, calculated in tons of sediment per year, and the level of passability for aquatic species. The recommended BMP's aim to protect water quality, improve aquatic habitat connectivity, and reduce nonpoint source pollution via sedimentation. The locations of the eight prioritized crossings are labeled in the map on this page.

The site sediment erosion estimate was calculated by the MI DNR Stream Crossing Inventory Viewer, using data collected by SWP field technicians at the time of the inventory. The equation takes into account crossing surface, stream and bank slope, water flow and velocity, bank stability, sediment size, and alignment between the crossing, stream, and structure. Total estimated sediment erosion for all 61 inventoried sites was 55.32 tons/year. The eight prioritized crossings in this appendix range from 0.22 to 8.63 tons of sediment eroded per year. These estimates provide baseline reduction targets for each site.

Aquatic life passability was also calculated by the MI DNR Stream Crossing Inventory Viewer. This parameter takes into account outlet perching, water velocity, water depth in the structure, the presence of natural substrate, and scour pools.

More information on the MI DNR Fish Passability Estimate can be found here:

<https://www.mcgi.state.mi.us/miculverts/aboutEstimate.aspx>



Cold Creek; Cold Creek Trail (Site ID: 634279788)

Current conditions include a sand crossing measuring 12.8 ft wide, which is used as a trail. The trail has no evidence of overtopping and doesn't have diversion potential. Both approach ditches from the left and right are heavily vegetated with no signs of erosion. The upstream embankment slope is vertical and the downstream embankment slope is steep, but both are armored with woody vegetation in good function.

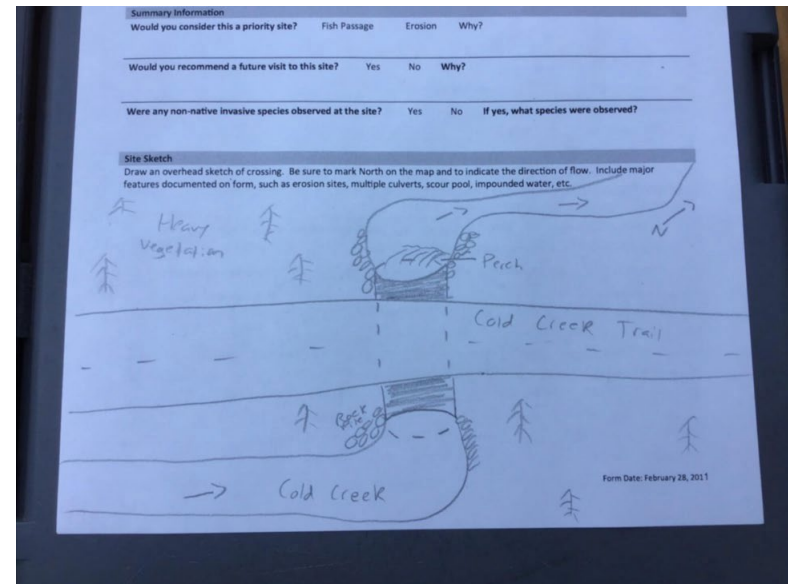
The structure present is a round metal culvert in good condition that is 3 ft wide by 3 ft high. The culvert is 20 ft long with no substrate inside, and is fairly aligned with the stream. The water velocity at the structure's inlet and outlet are both very high, at 2.9 ft/sec. The structure is not embedded and its outlet is perched 1.6 ft above stream grade, resulting in a freefall into a pool. This is the highest perch height of all 61 inventoried crossings, and impairs aquatic passability. Field technicians noted a very fast water velocity immediately at the culvert as compared to upstream and downstream from the culvert.

Site Erosion Estimate Total: 0.97 tons/year

Aquatic Passability: 100% Barrier

Recommended BMP's: This culvert, given its perched outlet, very high water velocity, and lack of substrate, is a barrier to fish passage. Additionally, the water velocity increasing right at the culvert suggests that the culvert is undersized, presenting an increased risk of damage to the crossing during a flood or high-flow event. SWP recommends replacing the culvert with an open-bottom culvert which is

appropriately sized to allow for the free flow of water and the connection of fish habitat.



Site sketch by SWP technicians in the field



Right approach to crossing



Left approach to crossing



Structure inlet



Upstream from structure



Structure outlet



Downstream from structure

North Branch Cold Creek; Trail off of Cold Creek Trail (Site ID: 6342019999)

Current conditions include a sand road crossing which is well-graded and in good condition. The road has diversion potential, so there is a risk for water overtopping the road to flow away from the stream. The road crossing is 19.5 ft wide and the ditches approaching the crossing are partially vegetated with some bare, eroding places.

The present structure is a round, metal culvert, measuring 4.3 ft wide by 4.3 ft high. The culvert inlet projects from a pond, and the structure is 70 ft long in total with no substrate inside. The culvert outlet is a cascade over rip-rap, with the structure perched 1.5 ft above stream grade (the second highest perch height of all inventoried crossings). The bank at the structure's inlet has no armoring or rip-rap. The outlet bank has rock armoring that is undersized or incomplete.

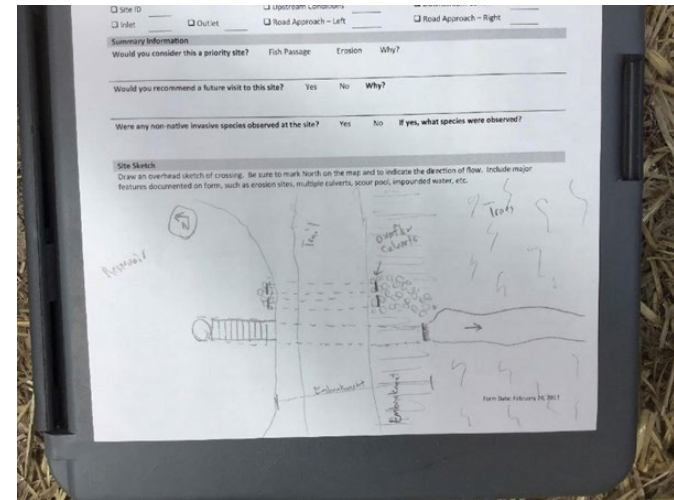
Site Erosion Estimate Total: 1.99 tons/year

Aquatic Passability: 100% Barrier

Upstream Ponding: 500 ft long x 200 ft wide

Recommended BMP's: The structure's lack of substrate and perched, cascading outlet form a barrier to fish passage. This crossing also has a high erosion estimate, which could prove harmful to the road's integrity and stream's health in the event of a flood or high-flow event. SWP recommends replacing the culvert with an open-bottom structure or an embedded structure with natural substrate inside for improved aquatic habitat connectivity. SWP also recommends

planting additional trees in the approach ditches and adding well-functioning rip-rap to the inlet and outlet banks to mitigate sediment erosion.



Site sketch by SWP technicians in the field



Structure inlet projecting from pond



Left approach to crossing



Right approach to crossing



Upstream from structure



Structure inlet



Structure outlet



Downstream from structure

Maloney Creek; Sand Town Road (Site ID: 6341721204)

Current conditions include a paved road surface, 28.5 ft wide, crossing over one round metal culvert. The road has diversion potential and minor cracking, rutting, or ponding at the crossing. The culvert is in good alignment with the stream, but is majorly skewed from the road crossing. The ditches approaching the crossing are heavily vegetated with no signs of erosion.

The culvert structure measures 3 ft wide by 3 ft high, and is 1 ft long with no substrate inside. The inlet and outlet sides of the culvert are both armored with rock, but the rip-rap is undersized or incomplete. The water velocity at the inlet and outlet is 2.3 ft/sec and the structure is perched 0.3 ft above stream grade. The erosion estimate at this site is the 4th highest of all inventoried crossings.

Site Erosion Estimate Total: 2.54 tons/year

Aquatic Passability: 100% Barrier

Recommended BMP's: The culvert's perched outlet and fast water velocity both provide a barrier to fish passage, and the water velocity hints towards the structure being undersized. The high erosion estimate for this site is also a concern. SWP recommends replacing the structure with a culvert which is properly sized and is open-bottomed or embedded in the streambed. This would improve the stream's aquatic passability as well as slow its water velocity, thus reducing sediment erosion. To further address the erosion, SWP

recommends adding more rip-rap to the inlet and outlet of the culvert, making the rock armoring more complete to improve bank and crossing stability.

Site ID ☐ Inlet ☐ Outlet ☐ Upstream Conditions ☐ Downstream Conditions ☐ Road Approach - Left ☐ Road Approach - Right

Summary Information

Would you consider this a priority site? ☐ Fish Passage ☐ Erosion ☐ Why?

Would you recommend a future visit to this site? Yes ☐ No ☐ Why?

Were any non-native invasive species observed at the site? Yes ☐ No ☐ If yes, what species were observed?

Site Sketch

Draw an overhead sketch of crossing. Be sure to mark North on the map and to indicate the direction of flow. Include major features documented on form, such as erosion sites, multiple culverts, scour pool, impounded water, etc.

Form Date: February 28, 2011

Site sketch by SWP technicians in the field



Left approach to crossing



Right approach to crossing



Structure inlet



Upstream from structure



Structure outlet



Downstream from structure

Maloney Creek; Sand Town Road (Site ID: 6341721744)

Current conditions include a paved road surface measuring 27.5 ft wide. The road has diversion potential and minor cracking, rutting, or ponding at the crossing. There is one structure present at the crossing, a round metal culvert that is 3 ft high by 3 ft wide. The structure is at a moderate skew to the road crossing, and both approach ditches are heavily vegetated.

The culvert measures 66.5 ft long with a mixture of substrate inside. The banks at the inlet and outlet are armored with woody vegetation, both with good coverage and in good functional condition. The water velocity at the culvert inlet and outlet is 2 ft/sec. The structure is not embedded and its outlet is perched 0.5 ft above the stream, resulting in a freefall into a pool. Bank erosion is present on either side of the culvert (at the inlet and outlet) and a scour pool is present.

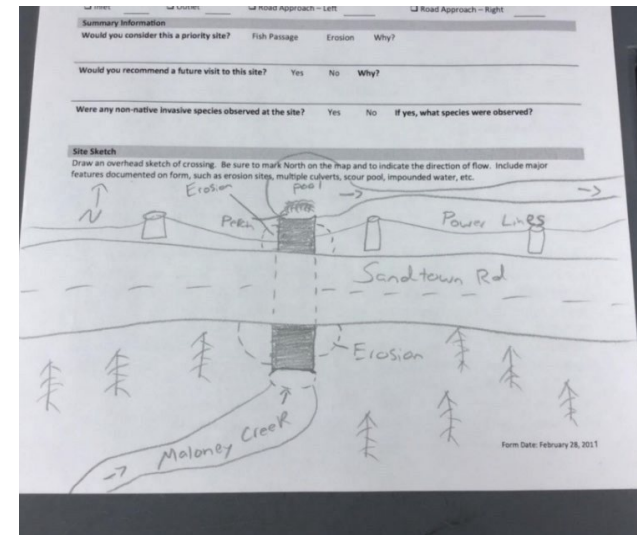
Site Erosion Estimate Total: 1.04 tons/year

Aquatic Passability: 100% Barrier

Scour Pool: 10 ft long x 7 ft wide x 2 ft deep

Recommended BMP's: The high water velocity through the culvert, the bank erosion, and the scour pool all provide evidence that the current structure is undersized. SWP recommends replacing the culvert with an open-bottomed or embedded structure which is properly sized to accommodate

the stream's flow. Replacing the structure and slowing the water velocity would improve aquatic habitat connectivity, as well as reduce the bank erosion and sediment scouring occurring at this location.



Site sketch by SWP technicians in the field





Left approach to crossing



Right approach to crossing



Structure inlet



Upstream from crossing



Structure outlet



Downstream from crossing

McAlpine Creek; County Road 405 (Site ID: Crossing 22)

Current condition includes a well-graded gravel crossing surface, 30 ft wide, with diversion potential. The fill depth of the gravel is 0.2 ft both upstream and downstream of the crossing, which is under the recommendation of at least 1 foot of fill depth. SWP field technicians noted that, given the extreme proximity of the road to the culvert and stream, it is very likely that the road gets overtopped with water during high-flow events.

There is one structure present at the crossing, an ellipse metal culvert that is 4 ft wide by 3 ft high. The culvert is 40 ft in length with no substrate inside and is poorly aligned with the stream. There is no bank armoring or rip-rap at the inlet or outlet, leaving the embankment slopes unprotected. The water velocity at the inlet and outlet is 4 ft/sec, which is extremely fast for the passage of aquatic life, and was the fastest recorded water velocity of all inventoried crossings. The structure is not embedded and is not perched, with the outlet being at stream grade. There is both ponding and a scour pool present.

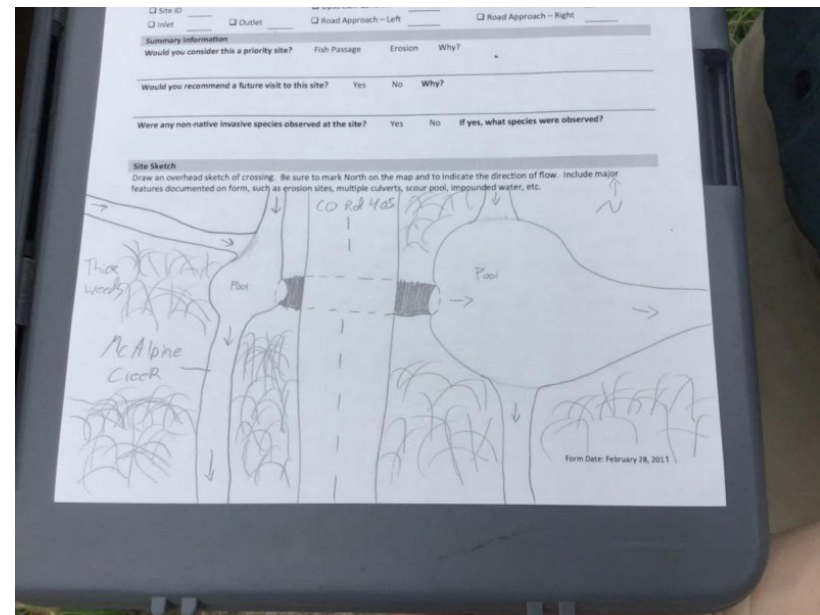
Site Erosion Estimate Total: 0.82 tons/year

Aquatic Passability: 100% Barrier

Ponding: 7ft long x 12 ft wide

Scour Pool: 17ft long x 20 ft wide x 4 ft deep

Recommended BMP's: The high water velocity, ponding, and scour pool indicate that this structure is undersized. SWP recommends replacing this culvert with one that is properly sized, which will reduce water velocity and erosion at the site. The structure being open-bottomed or embedded and lined with substrate would also allow for the improved passage of fish. Furthermore, SWP recommends adding rip-rap to the inlet and outlet of the culvert to stabilize the banks. Adding well-compacted gravel to the road surface for a thicker fill would also stabilize the crossing and reduce road overtopping and sediment erosion.



Site sketch by SWP technicians in the field



Left approach to crossing



Right approach to crossing



Structure inlet



Upstream from structure



Structure outlet



Downstream from structure

Skunk Creek; County Road 405 (Site ID: 6341647097)

Current conditions include a gravel road crossing with a well-graded surface. The crossing is 31 ft wide and has diversion potential. The fill depth of the gravel road is 3.6 ft upstream and 2.4 ft downstream. The ditches approaching the crossing are heavily vegetated. There are two old, smaller culverts no longer in use at this location.

The in-use structure is an ellipse metal culvert, 9 ft wide by 3.5 feet high, in good condition. The culvert is 67.5 feet long with no substrate inside, and is poorly aligned with the stream. The culvert is not embedded in the streambed, and water depth varies throughout, measuring 1.5 ft at the inlet and 0.4 ft at the outlet. The outlet of the culvert is also perched 0.4 ft above stream grade, impairing aquatic passage. The velocity of the water flowing through the structure is 0.6 ft/sec. The banks at the culvert's inlet and outlet are armored with woody vegetation, which is undersized or incomplete at the inlet and in good condition at the outlet. One non-native invasive species was observed at the site: Canadian thistle. The estimated sediment erosion at this crossing is the highest of all surveyed crossings.

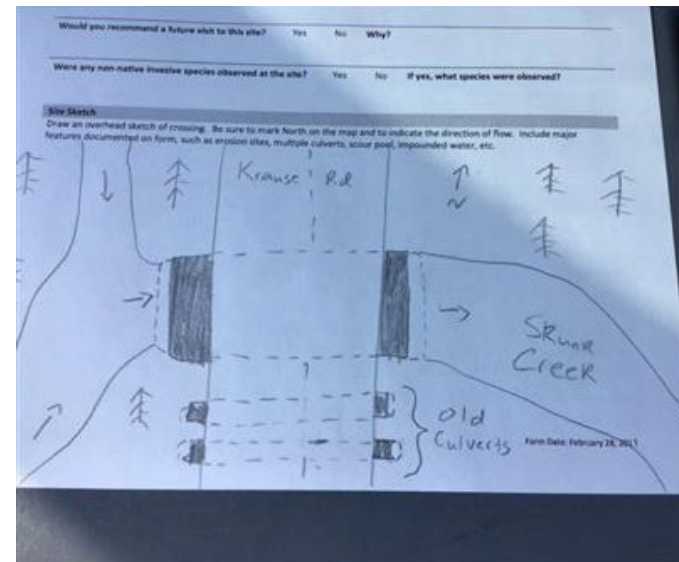
Site Erosion Estimate Total: 8.63 tons/year

Aquatic Passability: 100% Barrier

Recommended BMP's: Although the culvert is in nearly new condition, there is likely an issue with the installation; evidenced by the structure's poor alignment with the stream, perched outlet, and lack of embedding or substrate. The

varying water depth throughout the structure and the varying road fill depth also indicates the culvert is at an angle, positioned lower at the inlet and higher at the outlet. However, the culvert is wide and seems properly sized to accommodate the stream.

SWP recommends inserting a structural lining in the culvert to minimize disturbance and erosion at the site and improve water flow. SWP also recommends adding substrate to the inside of the structure to support fish passage. Adding rip-rap to the inlet and outlet banks for stabilization, minimizing road disturbance when possible, and planting more vegetation along the sides of road would also help reduce sediment erosion at this crossing.



Site sketch by SWP technicians in the field



Left approach to crossing



Right approach to crossing



Structure inlet



Upstream from structure



Structure outlet



Downstream from structure

Unnamed Stream; Millecoquin Lake Drive (Site ID: Crossing 16)

Current conditions include a paved road crossing, 16.8 ft wide and in good condition, with diversion potential. The road's left approach ditch has some vegetation and some bare, eroding places, and the right approach ditch is heavily vegetated.

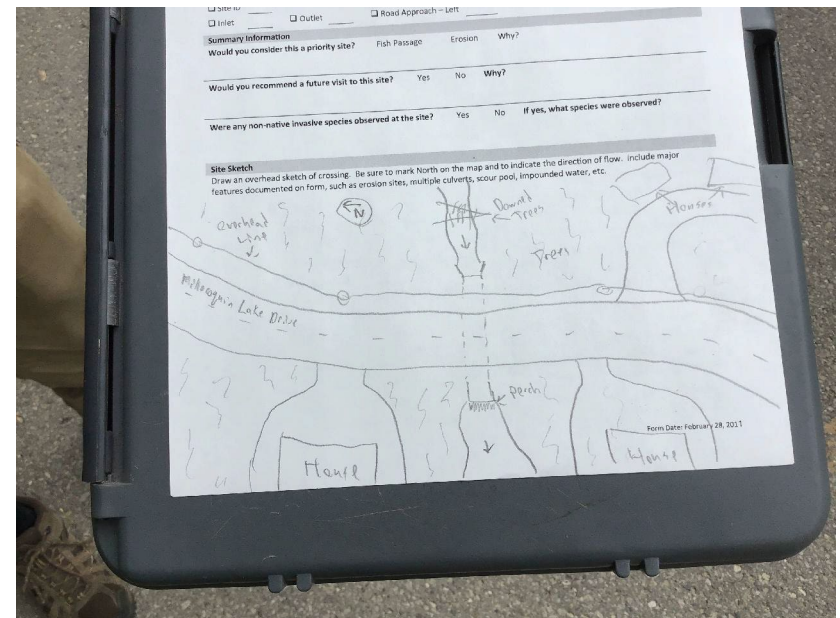
There is one round plastic culvert present at the site, 2.3 ft wide by 2.3 ft high and 40 ft long. The culvert is well-aligned with the stream but has no substrate inside. The structure's inlet is a plastic wingwall and the outlet is a freefall into pool, perched 0.2 feet. The water depth in the structure ranges from 0.3 at the inlet to 0.6 ft at the outlet. Water velocity was not recorded in the field but appears fast according to pictures of the outlet. No bank armoring or rip-rap is present at the inlet or outlet, leaving both embankment slopes unprotected. The culvert is plugged at the inlet with sticks and brush.

Site Erosion Estimate Total: 0.22 tons/year

Aquatic Passability: 100% Barrier

Recommended BMP's: For improved aquatic habitat connectivity, SWP recommends replacing the culvert with an open-bottom or embedded structure. The current structure is likely undersized, evidenced by the water velocity and plugging, so a properly-sized structure would reduce erosion and maintain natural streamflow. SWP also recommends adding rip-rap to the inlet and outlet banks for stabilization and reduced sedimentation. Regular maintenance at this site to remove brush and unclog the culvert would also maintain

proper streamflow and connectivity.



Site sketch by SWP technicians in the field



Left approach to crossing



Right approach to crossing



Structure inlet



Upstream from structure



Structure outlet



Downstream from structure

Unnamed Creek; Mile Road (Site ID: 6341986804)

Current conditions include a gravel road, 24.8 ft wide, with minor rutting or ponding at the crossing and diversion potential. The fill depth of the road upstream and downstream is 0.5 ft, lower than the recommended minimum of 1 foot of fill depth. The crossing is located in close proximity to farm fields and pastures with cows.

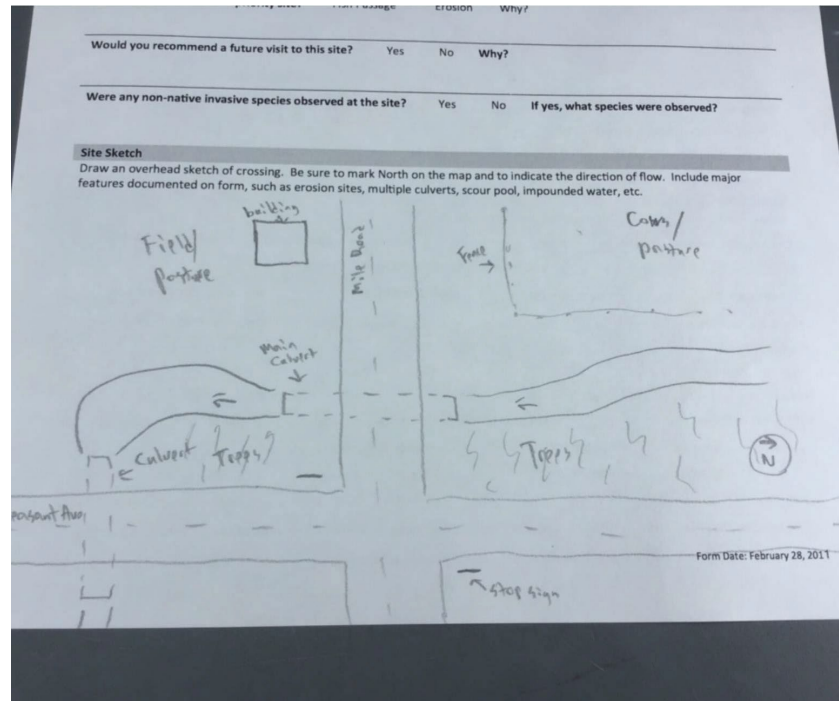
There is one structure present, a round metal culvert, 6 ft wide by 6 ft high. The structure is 34 ft long with sand substrate inside. The outlet is at stream grade and the structure is not perched. The water depth at both the culvert's inlet and outlet is 0.2 ft, which is a relatively shallow flow and is on the low end for aquatic passability. There is a small amount of plugging at the inlet and outlet of the structure, with woody debris restricting flow on both sides. The inlet and outlet banks lack armoring or rip-rap, leaving the embankment slopes unprotected. A slight scour pool has formed downstream of the culvert outlet.

Site Erosion Estimate Total: 3.92 tons/year

Aquatic Passability: Barrier at Most Flows

Proposed Improvements: The estimated erosion at this site is the third highest of all 61 crossings which were inventoried. The road fill depth is also lower than the majority of the inventoried crossings. For reducing sediment erosion, SWP recommends adding more gravel to the road to reach at least

a 2 ft fill depth, ensuring the gravel is properly compacted and that site disturbance is minimal. SWP also recommends adding rip-rap or armoring to the inlet and outlet banks for proper stabilization. Regular maintenance at the crossing to remove brush and plugging would help maintain aquatic passability.



Site sketch by SWP technicians in the field



Left approach to crossing



Right approach to crossing



Structure inlet



Structure outlet



Upstream from structure



Downstream from structure

Appendix C- Water Quality & E. coli Sampling Results

Methods

SWP field technicians used a YSI water quality monitoring meter to observe seven water chemistry characteristics including water temperature, specific conductivity, conductivity, dissolved oxygen percent (DO%), dissolved oxygen (DO mg), pH, and oxidation reduction potential (ORP). The YSI probe was suspended close to the riverbed midstream for several minutes at each site and readings were recorded.

SWP followed the LMAS District Health Department surface water E. coli sampling procedure to collect, transport, and deliver samples for analysis. SWP field technicians wore gloves to handle and collect the surface water sample upstream of where they entered the water to avoid sediment contamination. Samples were kept chilled and returned to LMAS Regional Laboratory for analysis on the same day as collection (14150 Hamilton Lake Rd. Newberry, MI 49868).

Site Selection

During the fall of 2020, ten sites were chosen to assess water quality using water chemistry data. Seven water chemistry characteristics were recorded at each site. Additionally, three sites (site numbers 7-9) were chosen to assess the effects of nonpoint source pollution on E. coli concentrations. Stream crossings and culverts were inventoried when present at sites to document erosion, fish passability, and structural integrity of

culverts. The following includes a brief description of the site locations and conditions:

Site #1 – Three Mile Creek South:

The site is the location of a washed-out earthen dam. The former dam basin is revegetated with grasses, shrubs, and red osier dogwood. The creek is forded for ATV crossing blocking fish passage and the trail down a steep sand bank is showing signs of erosion. This ford is accessed by following the HSC “G-trail.”

Site #2 – Cold Creek:

The site is located just below the access pad for a previously constructed sand trap just off the HSC “Cold Creek Trail”. A fisherman’s access trail located along the north bank is stable and not contributing any sediment to the stream.

Site #3 – Cold Creek South Branch:

The site is located on the upstream side of the HSC “Cold Creek Trail” of the South Branch of Cold Creek as it passes through a northern white cedar and tag alder wetland.

Site #4 – Jocko Creek:

The site is located downstream from an earthen dam and the outflow culvert for Jocko Pond, on the downstream side of HSC “B-trail” access road. HSC “B-trail” crosses over the dam and is open to vehicle traffic.

Site #5 – Upper Millecoquins River:

The site is located where the HSC “H-Trail” access road crosses the Upper Millecoquins River with a wooden ATV bridge. The “H-trail” turns into a footpath on the west bank of the river.

Site #6 – Milk Creek:

The site is located upstream of the confluence of Milk Creek with the Upper Millecoquins River. Milk Creek is accessed by HSC “J-trail” and crossed by a wooden ATV bridge. ATV traffic on the west bank of the creek is prohibited (foot traffic only).

Site #7 – Furlong Creek:

The site is located downstream on the east side of Indian Trail below a double culvert. Access to the site was requested from and granted by a local landowner. This site was sampled to determine the concentration of E. coli to identify potential nonpoint source pollution in Furlong Creek.

Site #8 – Kisro/Blakes Creek: The site is located at the confluence of Kisro and Blakes Creek downstream and to the east side of Indian Trail. Access to the site was requested from and granted by a local landowner. This site was sampled to determine the concentration of E. coli to identify potential nonpoint source pollution.

Site #9 – Hagler Creek:

The site is located downstream and to the east of Krause Road. Access to the site was requested from and granted by a local landowner. Hagler Creek was dry at the time of data collection, so baseline data for E. coli and water chemistry was not collected in the fall of 2020.

Site #10 – Three Mile Creek North:

The site is located upstream and to the west of the paved Hiawatha Trail. The culvert on the upstream side is new corrugated metal with a trash guard while downstream there’s a double concrete culvert.

Figure 1. Map of Water Quality Sampling Locations, Sites #1-10

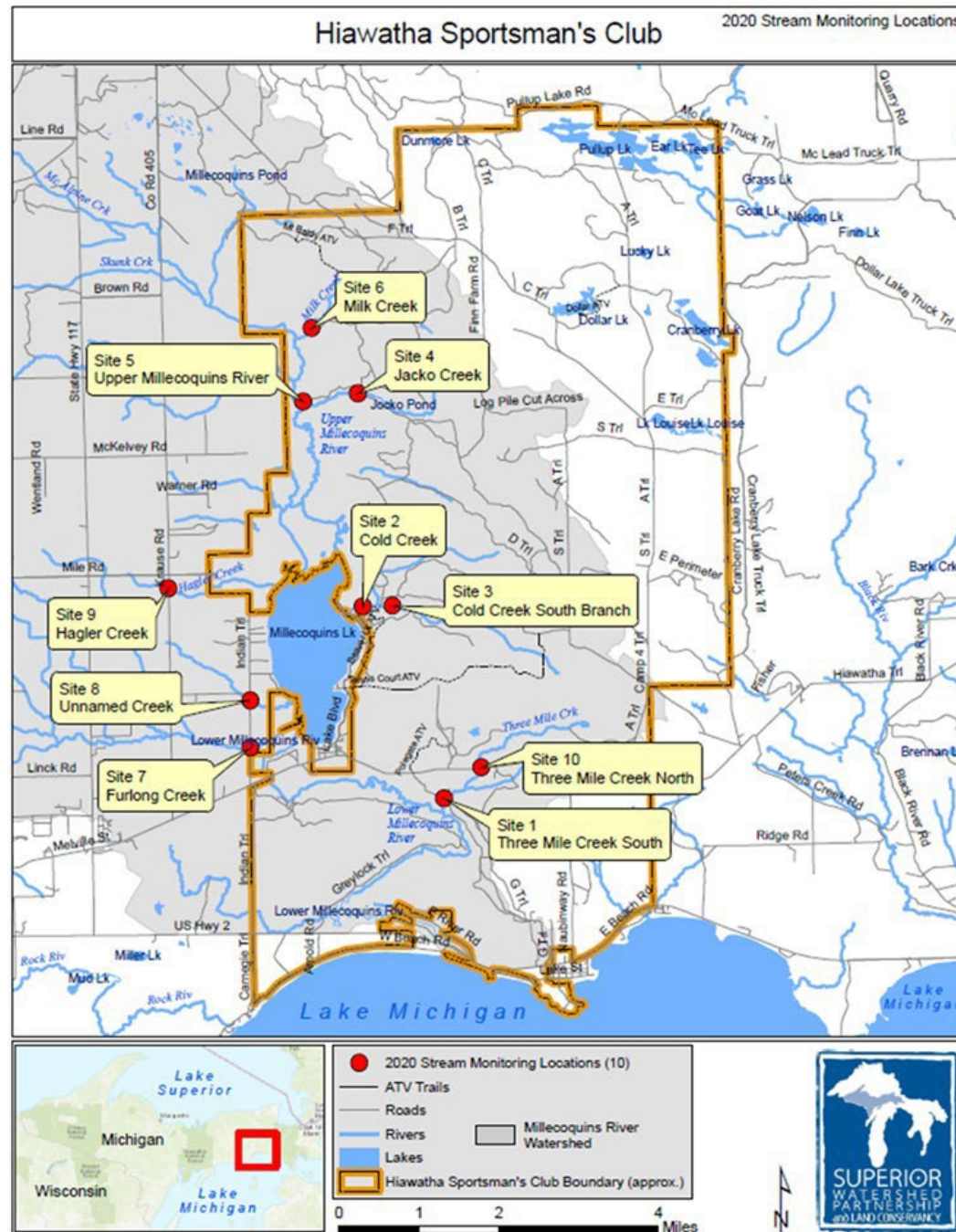
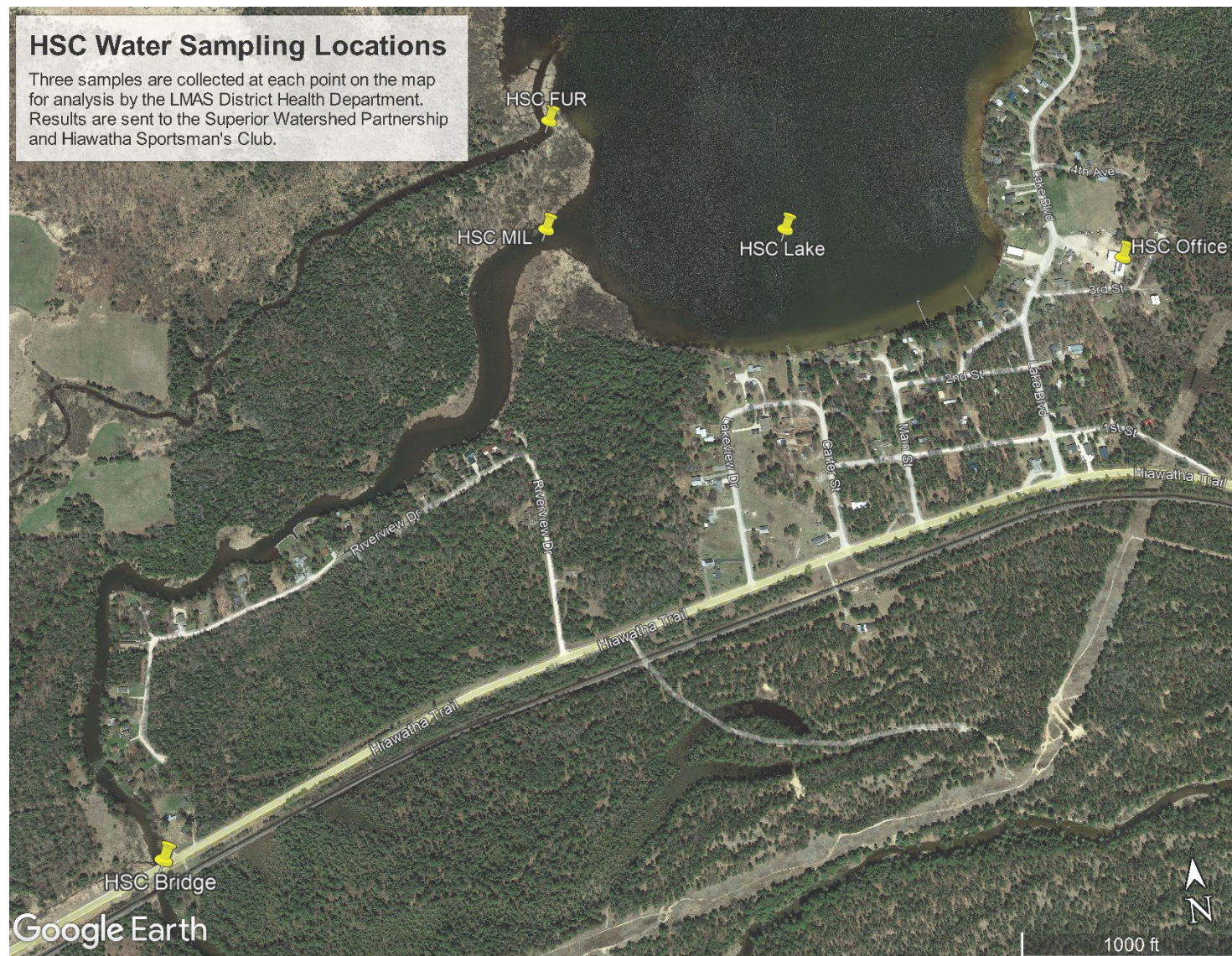


Figure 2. Map of HSC E. coli Water Sampling Locations



2020 Results

2020 Water Quality Baseline Data

The fall 2020 water quality monitoring established baseline data for 9 of 10 sites. Data was collected from the sites on October 22nd and 23rd of 2020. Visual observation of relatively high-water levels were noted for each site by SWP field technicians. Consistent light rain and mist had saturated the ground in the days prior to sampling, not the result of a high intensity storm. Baseline data was not collected from site #9 because Hagler Creek was dry. Results of the water quality monitoring are displayed in Table 1 below.

Table 1. 2020 Water Quality Baseline Results

Location	Date	Weather	Air Temp (°C)	Water Temp (°C)	Specific Conductivity (µS/cm @ 25°C)	Conductivity (µS/cm)	DO%	DO (mg/L)	pH	ORP
Site #1	10/23/2020	Raining	3.9	4.7	57.5	35.2	93.2	11.72	7.57	172.0
Site #2	10/23/2020	Cloudy	3.9	5.1	131.0	81.3	92.3	11.48	7.53	198.8
Site #3	10/23/2020	Cloudy	3.9	5.3	123.7	77.0	90.5	11.22	7.64	203.6
Site #4	10/23/2020	Raining	3.9	5.6	163.7	102.8	89.6	11.01	7.70	218.8
Site #5	10/23/2020	Misting	3.9	4.5	164.0	101.4	84.8	10.69	7.35	202.0
Site #6	10/23/2020	Misting	3.9	6.7	174.3	113.3	86.4	10.30	7.64	194.3
Site #7	10/22/2020	Cloudy	2.8	5.0	220.9	136.5	91.7	11.56	7.80	232.6
Site #8	10/22/2020	Cloudy	2.8	4.9	544.4	335.8	86.6	10.91	7.72	216.9
Site #9	10/22/2020	Cloudy	2.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Site #10	10/22/2020	Cloudy	2.8	4.6	54.9	33.5	96.7	12.29	8.23	232.3

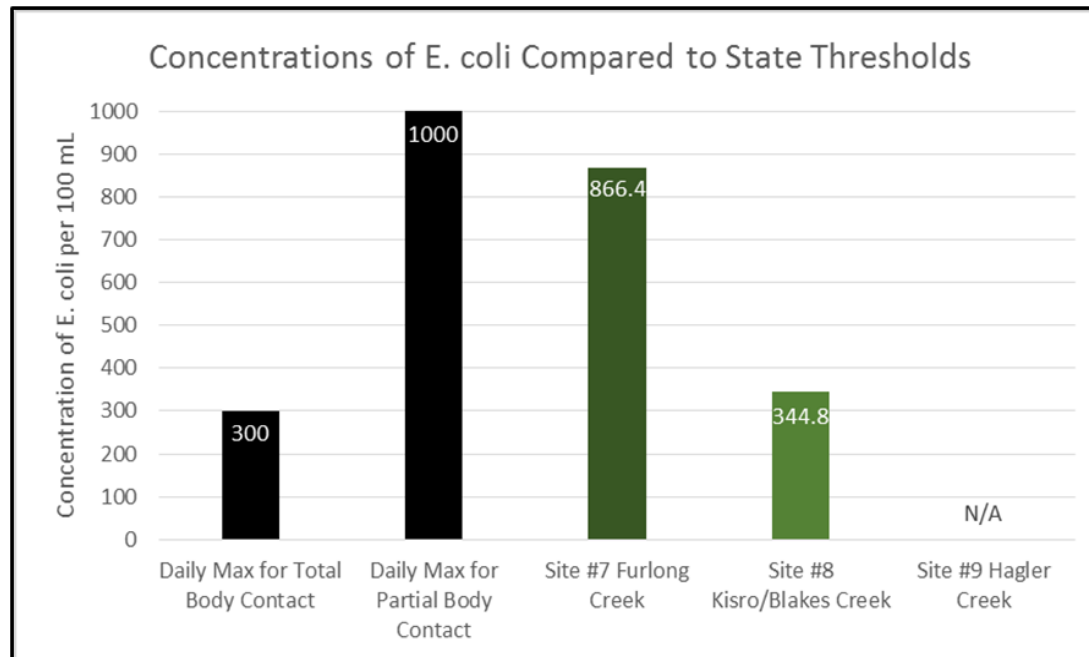
2020 E. coli Data

The fall 2020 surface water E. coli samples were received and processed by the LMAS Regional Laboratory. E. coli was detected in both samples that were collected. Again, Hagler Creek was dry so a sample couldn't be collected as intended. The results of the analyses are displayed in Table 2 and Graph 1 below alongside the State of Michigan's daily maximum thresholds. Both the Furlong Creek and Kistro/Blakes Creek sites tested above the daily maximum threshold for total body contact.

Table 2. 2020 E. coli Results for Three Priority Sites Compared to MI Water Quality Thresholds

Site	E. coli Concentrations per 100 ml (October)	Daily max for E. coli Total Body Contact per 100 ml	Daily Max for E. coli Partial Body Contact per 100 ml
Furlong Creek	866.4	300	1000
Kistro/Blakes Creek	344.8	300	1000
Hagler Creek	N/A	300	1000

Graph 1. 2020 E. coli Results Compared to MI Water Quality Thresholds



2021 Results

2021 Road Stream Crossing Inventory

SWP field technicians took initial measurements of the Three Mile Creek South ATV ford for future erosion prevention and restoration work. These measurements will be used to calculate average annual volume of eroded sediment into Three Mile Creek South to help inform restoration of the site. It was determined that the ATV ford of the creek, accessed by following the HSC “G-trail,” is also likely blocking fish passage.

In 2021, SWP field technicians also inventoried 61 road-stream crossings within the Millecoquins Watershed. The data from this inventory was uploaded to the Michigan DNR Stream Crossing Viewer database. Summarized tables of the inventory’s findings are located in Appendix B. Crossings which are prioritized for replacement and recommended crossing improvements are located in Appendix C. Table 3 summarizes the surveyed road stream crossings by site ownership, detailing their level of aquatic organism passage and total site erosion.

Table 3. 2021 Road Stream Crossing Inventory Results by Crossing Ownership

Crossing Ownership	Total # of Crossings Surveyed	Not a Barrier (%)	Barrier at Most Flows (%)	Barrier at High Flows (%)	100% Barrier (%)	Not Assessed (%)	Total Estimated Sediment Erosion (tons/yr)
County	24	12.5%	42%	4%	12.5%	29%	29.87
Federal	1	-	100%	-	-	-	0.11
Private	15	7%	26.5%	20%	26.5%	20%	10.17
State	8	37.5%	12.5%	-	-	50%	3.29
Township	12	33%	42%	-	8%	17%	10.08
Tribal	1	100%	-	-	-	-	1.8

2021 E. coli Data

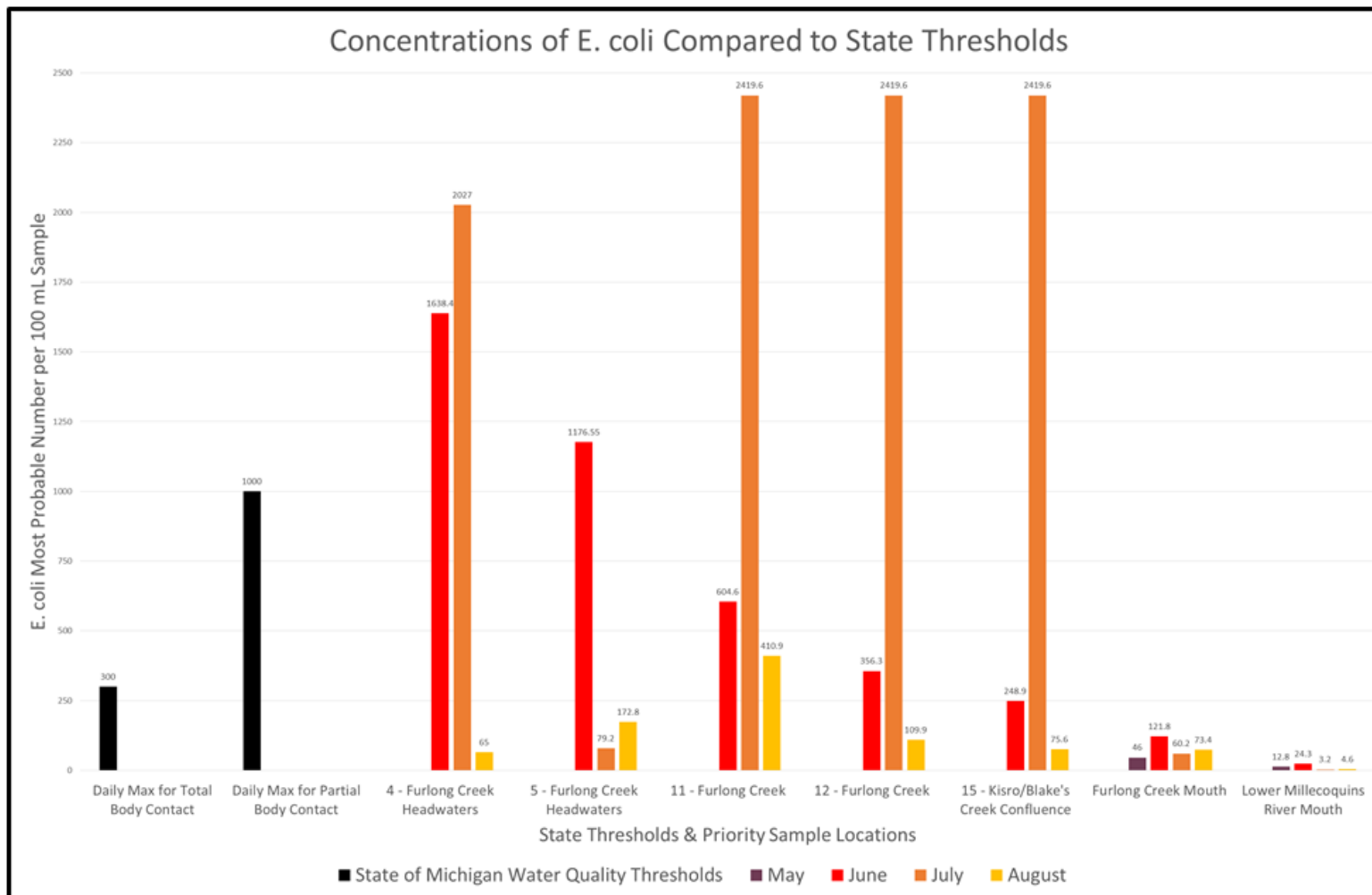
The 2021 surface water E. coli samples were received and processed by the LMAS Regional Laboratory. The results of the analyses are displayed below in Table 4 and Graph 2 alongside the State of Michigan's daily maximum thresholds for allowable E. coli concentrations for total and partial body contact. A general trend emerged in 2021 showing E. coli concentrations well above state thresholds in the headwaters of Furlong Creek that feed into Lake Millecoquins dissipating as the water approached the lake. The peak months for E. coli concentrations were June and July of 2021. Many factors including temperature, recent precipitation patterns, water levels, nutrient load, and human activity in the watershed impacted the concentrations each month.

Read more about Michigan's E. coli water quality standard here: https://www.michigan.gov/documents/deq/wrd-sw-as-ecoli_527147_7.pdf

Table 4. 2021 E. coli Results for Seven Priority Sites Compared to MI Water Quality Thresholds

Site	E. coli Concentrations per 100 ml (May)	E. coli Concentrations per 100 ml (June)	E. coli Concentrations per 100 ml (July)	E. coli Concentrations per 100 ml (August)	Daily max for E. coli Total Body Contact per 100 ml	Daily Max for E. coli Partial Body Contact per 100 ml
Furlong Creek	N/A	1638.4	2027	65	300	1000
Headwaters (2)	N/A	1176.55	79.2	172.8	300	1000
Furlong Creek (3)	N/A	604.6	2419.6	410.9	300	1000
Furlong Creek (4)	N/A	356.3	2419.6	109.9	300	1000
Kisro/Blakes	N/A	248.9	2419.6	75.6	300	1000
Furlong Creek	46	121.8	60.2	73.4	300	1000
Millecoquins	12.8	24.3	3.2	4.6	300	1000

Graph 2. 2021 E. coli Concentrations by Month for Seven Priority Sites Compared to MI Water Quality Thresholds



2022 Results

2022 Water Quality Data

Baseline water quality data was collected in October 2020. On October 26th and 27th, 2022, SWP field technicians collected water quality data from the same 10 sites which were sampled for baseline data in October of 2020. No baseline data was able to be taken from site #9, Hagler Creek, which was dry in 2020 and remained dry at the time of data collection in 2022. The water quality data results are displayed in Table 5.

Table 5. 2022 Water Quality Results

Location	Date	Weather	Air Temp (°C)	Water Temp (°C)	Specific Conductivity (µS/cm @ 25°C)	Conductivity (µS/cm)	DO%	DO (mg/L)	pH	ORP
#1 Three Mile Creek South	10/26/2022	Cloudy	4.4	8.4	100.2	68.4	85.6	9.84	7.66	112.6
#2 Cold Creek	10/26/2022	Cloudy	4.4	8.5	145.5	99.5	87.7	10.03	7.95	117.0
#3 Cold Creek South Branch	10/26/2022	Cloudy	4.4	7.6	130.4	87.1	86.4	10.11	7.85	118.1
#4 Jocko Creek	10/27/2022	Sunny	4.4	5.1	191.3	118.3	89.0	11.36	8.20	108.5
#5 Upper Millecoquins River	10/27/2022	Sunny	4.4	5.5	239.2	149.8	77.0	9.64	8.14	124.3
#6 Milk Creek	10/27/2022	Sunny	1.7	5.8	184.2	116.2	83.9	10.46	8.34	103.0
#7 Furlong Creek	10/26/2022	Cloudy	4.4	8.8	237.7	164.0	74.6	8.45	7.75	142.6
#8 Unnamed Creek	10/27/2022	Sunny	-1.1	4.9	560.0	344.6	76.9	9.82	7.90	111.7
#9 Hagler Creek	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
#10 Three Mile Creek North	10/26/2022	Cloudy	4.4	8.8	46.1	31.9	86.1	9.73	7.60	147.9

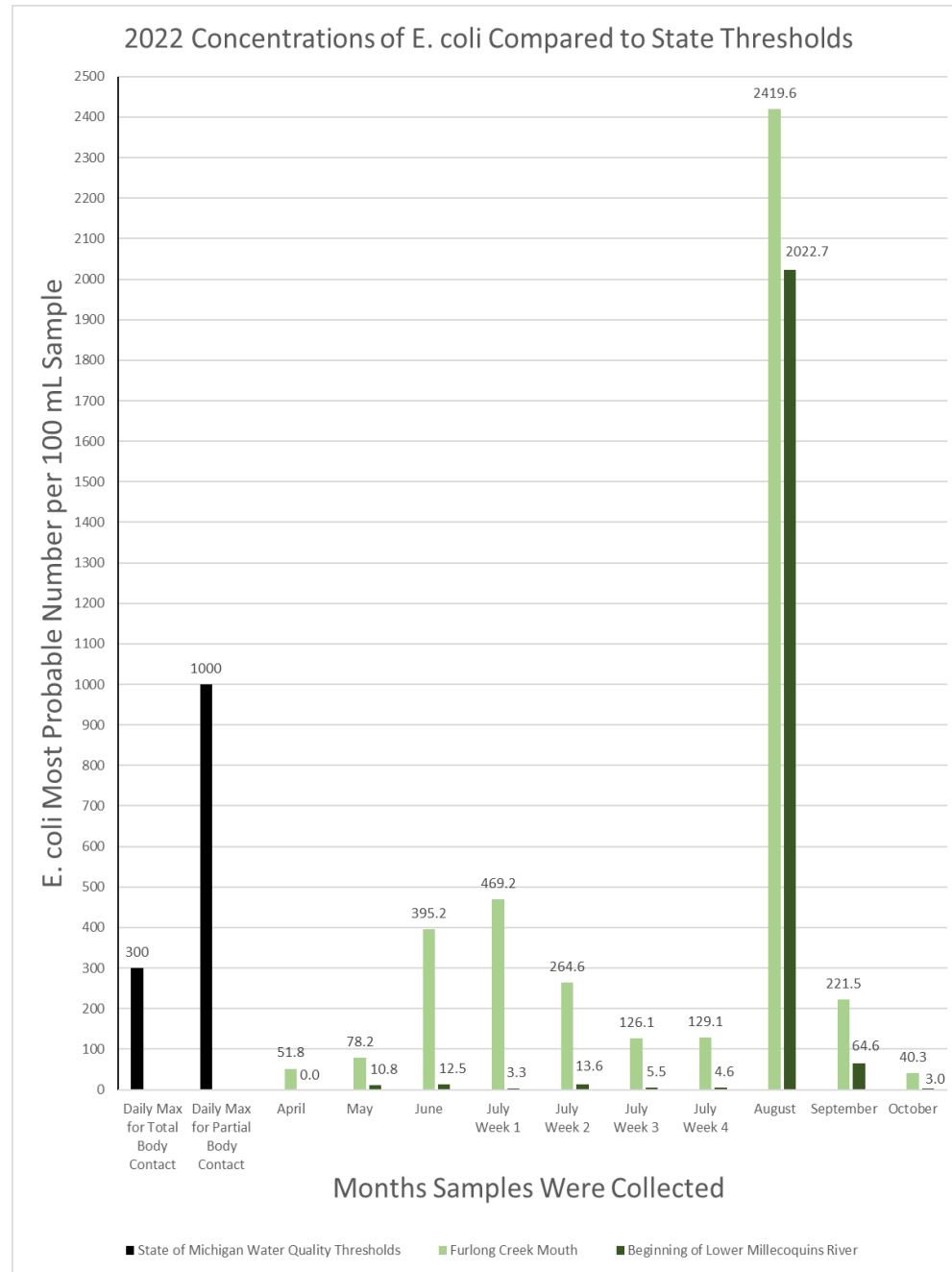
2022 E. coli Data

Surface water E. coli samples were received and processed by the LMAS Regional Laboratory. The results of the analyses are displayed on Table 6 and Graph 3 below alongside the State of Michigan's daily maximum thresholds for allowable E. coli concentrations for total and partial body contact. The Furlong Creek mouth exceeded state thresholds in June and July. A substantial rain storm preceded SWP's August sampling event and E. coli concentrations at both sample locations approached or exceeded the maximum value LMAS District Health Department is able to observe: 2022.7 at the beginning of the Lower Millecoquins River and >2,419.6 at the mouth of Furlong Creek. Many factors including temperature, recent precipitation patterns, water levels, nutrient load, and human activity are known to impact E. coli concentrations.

Table 6. 2022 E. coli Results by Month for Two Priority Sites Compared to MI Water Quality Thresholds

Site	E. coli Concentrations per 100 ml (April)	E. coli Concentrations per 100 ml (May)	E. coli Concentrations per 100 ml (June)	E. coli Concentrations per 100 ml (July Week 1)	E. coli Concentrations per 100 ml (July Week 2)	E. coli Concentrations per 100 ml (July Week 3)	E. coli Concentrations per 100 ml (July Week 4)	E. coli Concentrations per 100 ml (August)	E. coli Concentrations per 100 ml (September)	E. coli Concentrations per 100 ml (October)	Daily max for E. coli Total Body Contact per 100 ml	Daily Max for E. coli Partial Body Contact per 100 ml
Furlong Creek (1)	51.8	78.2	395.2	469.2	264.6	126.1	129.1	2419.6	221.5	40.2	300	1000
Lower Millecoquins River Mouth (2)	0	10.8	12.5	3.3	13.6	5.5	4.6	2022.7	64.6	3	300	1000

Graph 3. 2022 E. coli Concentrations by Month for Two Priority Sites Compared to MI Water Quality Thresholds



2023 Results

2023 E. coli Data

Surface water E. coli samples were received and processed by the LMAS Regional Laboratory. SWP staff collected samples from 4 priority sites established in cooperation with the HSC as well as 18 sites selected by EGLE’s water resource professionals based on their proximity to potential water quality impact sites. A map of the HSC sites is shown in Figure 2, but the locations of the 18 EGLE sites are withheld as requested by the HSC to protect the privacy of HSC’s neighbors. The results of the analyses are displayed in Tables 7 and 8. In Table 8, the far-right column indicates the number of times each sample location tested above the State of Michigan’s daily maximum threshold for allowable E. coli concentrations for total body contact (300 cfu/100 mL). Many factors including temperature, recent precipitation patterns, water levels, nutrient load, and human activity are known to impact E. coli concentrations. In 2023, none of the HSC’s priority sites tested above state thresholds, but many sample locations off club property produced high levels of E. coli, some repeatedly. SWP will work with EGLE to identify the root causes of E. coli at these highly impacted sites and approach landowners with funding and solutions.

Site	E. coli Concentrations per 100 ml (April)	E. coli Concentrations per 100 ml (May)	E. coli Concentrations per 100 ml (June)	E. coli Concentrations per 100 ml (July)	E. coli Concentrations per 100 ml (August)	E. coli Concentrations per 100 ml (September)	Daily max for E. coli Total Body Contact per 100 ml	Daily Max for E. coli Partial Body Contact per 100 ml
1-1	N/A	N/A	802.2	136.3	367.7	119.5	300	1000
1-2	N/A	N/A	308.0	220.8	93.5	195.4	300	1000
1-3	N/A	N/A	255.4	155.1	152.5	15.5	300	1000
1-4	N/A	N/A	23.8	238.5	N/A	N/A	300	1000
2-1	N/A	N/A	1336.6	100.3	143.9	53.0	300	1000
2-2	N/A	N/A	61.7	193.5	856.7	347.8	300	1000
2-3	N/A	N/A	N/A	8.4	9.7	1.0	300	1000
2-4	N/A	N/A	N/A	253.4	801.0	132.2	300	1000
2-5	N/A	N/A	35.9	38.9	452.3	N/A	300	1000
3-1	N/A	N/A	1583.3	452.1	70.4	17.5	300	1000
3-2	N/A	N/A	360.0	128.4	60.0	36.6	300	1000
3-3	N/A	N/A	59.0	105.5	74.3	217.8	300	1000
3-4	N/A	N/A	63.7	49.4	108.5	23.8	300	1000
3-5	N/A	N/A	2164.6	313.5	295.4	100.5	300	1000
3-6	N/A	N/A	2419.6	2419.6	2419.6	321.3	300	1000
4-1	N/A	N/A	107.3	101.9	74.3	54.7	300	1000
4-2	N/A	N/A	56.6	53.5	54.0	28.4	300	1000
HSC Bridge	2.0	7.3	39.3	16.5	23.1	24.5	300	1000
HSC FUR	25.1	262.9	23.3	24.2	7.0	38.4	300	1000
HSC Lake	2.0	1.0	3.2	1.4	1.0	3.2	300	1000
HSC MIL	13.5	1.3	6.0	2.9	17.2	1.8	300	1000

Table 7. 2023 E. coli Results by Month for 22 Priority Sites Compared to Water Quality Thresholds

Table 8. 2023 E. coli Data by Month for 22 Priority Sites Compared to MI Water Quality Thresholds

Sampling Locations		E. coli Results - Daily Geometric Means (cfu/100 mL)						Tested Above State Threshold
HSC Priority Sites	HSC Lake	2.0	1.0	3.2	1.4	<1	3.2	0
	HSC Bridge	2.0	7.3	39.3	16.5	23.1	24.5	0
	HSC FUR	25.1	262.9	23.3	24.2	7.0	38.4	0
	HSC MIL	13.5	1.3	6.0	2.9	17.2	1.8	0
EGLE's Drainages to Millecoquin Lake	1-1	N/S	N/S	802.2	136.3	367.7	119.5	2
	1-2	N/S	N/S	308.0	220.8	93.5	195.4	1
	1-3	N/S	N/S	255.4	155.1	152.5	15.5	0
	1-4	N/S	N/S	23.8	238.5	Dry	Dry	0
EGLE's Furlong Creek	2-1	N/S	N/S	1336.6	100.3	143.9	53.0	1
	2-2	N/S	N/S	61.7	193.5	856.7	347.8	2
	2-3	N/S	N/S	Dry	8.4	9.7	1.0	0
	2-4	N/S	N/S	Dry	253.4	801.0	132.2	1
	2-5	N/S	N/S	35.9	38.9	452.3	Dry	1
EGLE's Doe Creek	3-1	N/S	N/S	1583.3	452.1	70.4	17.5	2
	3-2	N/S	N/S	360.0	128.4	60.0	36.6	1
	3-3	N/S	N/S	59.0	105.5	74.3	217.8	0
	3-4	N/S	N/S	63.7	49.4	108.5	23.8	0
	3-5	N/S	N/S	>2164.8	313.5	295.4	100.5	2
	3-6	N/S	N/S	>2419.6	>2419.6	>2419.6	321.3	4
EGLE's Maloney Creek	4-1	N/S	N/S	107.3	101.9	74.3	54.7	0
	4-2	N/S	N/S	56.6	53.5	54.0	28.4	0
EGLE's Hagler Creek	5-1	N/S	N/S	Dry	Dry	Dry	Dry	0
		Apr. 26	May 30	June 29	July 31	Aug. 30	Sept. 28	
		2023 Sampling Dates						

Note on Table: "N/S" indicates the location was not sampled that month. The greater than sign (>) indicates that the concentration of E. coli in the sample was so high that it exceeded the lab's ability to quantify it. Due to weather conditions, some sample locations had no running water and were not sampled that month as indicated by "Dry."

2024 Results

2024 E. coli Data

Surface water E. coli samples were received and processed by the LMAS Regional Laboratory. SWP staff collected samples from 4 priority sites established in cooperation with the HSC (displayed on the map in Figure 2). The results of the analyses are outlined in Table 9 below, and were compared to the State of Michigan’s daily maximum threshold for allowable E. coli concentrations for total body contact and for partial body contact. In 2024, one of the HSC’s priority sites tested above state thresholds, specifically the site at Furlong Creek, which exceeded the daily maximum for total body contact.

Table 9. 2024 E. coli Results by Month for Four Priority Sites Compared to MI Water Quality Thresholds

Site	E. coli Concentrations per 100 ml (June)	E. coli Concentrations per 100 ml (July)	E. coli Concentrations per 100 ml (August)	Daily max for E. coli Total Body Contact per 100 ml	Daily Max for E. coli Partial Body Contact per 100 ml
HSC Bridge	7.3	24.0	12.9	300	1000
HSC FUR	268.4	420.8	54.3	300	1000
HSC Lake	0.0	0.0	0.0	300	1000
HSC MIL	0.0	11.5	2.6	300	1000

Appendix D- 2023 Aquatic Plant Survey of Millecoquin Lake

By Mark Jaunzems

After an initial visit in the fall of 2022 and extensive research on earlier survey work done on this lake, intensive field surveys of the lake were completed during the growing season of 2023. Field surveys were done by rowboat on June, 19, 20, 21; July 10, 11, 12, 31; August 1, 2, 29, 30; September 11, 12, 13; and Oct 1, 2.

Targeted searching was done for one invasive species, Starry Stonewort, (*Nitellopsis obtusa*) which was found during field surveys in 2007 and reported in a paper titled 'A Decade of Starry Stonewort in Michigan'. (Pullman and Crawford, in LakeLine, Summer 2010). This invasive species was reported in Millecoquin Lake and was the only lake in the Upper Peninsula where it was found. This plant is highly invasive and was not reported from an earlier aquatic plant survey done in 2005 by the Tip of the Mitt Watershed Council, (Cronk, 2006).

After extensive visual gridding and bottom sampling by rake no Starry Stonewort was observed. This was a surprising finding as in lower Michigan this species is a very aggressive invasive which has taken over extensive portions of large lakes there. It may be the fact that Millecoquin Lake is so well stocked with dense native plants that it has no open space or available habitat for a new plant to establish itself. The only open habitats seen were the shallow sandy bottom portions of the lake which are disturbed by ice formation and movement. The dense growth of aquatic plants in most of the lake may be an issue with boaters using the lake but it seems to also have protective value in keeping non-native invasive plants from getting established in this lake.

A very similar list of species to the 2006 survey (Cronk, 2006) were found and as the earlier survey also found only native species of aquatic plants. Two new plants are found, Wild Rice, (*Zizania palustris*), and one new species of Pondweed, (*Potamogeton illinoensis*). Abundant aquatic plant populations were noted throughout the entire waterbody, but the densest growths were seen in the northwestern quadrant and northern half of the lake. These denser populations of plants seem to be associated closely with the outflow of nutrients from the Upper Millecoquin River. Another factor which was noted and may be contributing to nutrient inputs in the northern portion of the lake were large concentrations of waterfowl and seagulls which were roosting along the shore along the shallow sandy areas associated with the outflow of the Upper Millecoquin River. Their droppings were obvious along the shore and large amounts of molted feathers were also seen along the northern shoreline.

One notable change since the 2006 survey work was a larger area of dense Hard-stem Bulrush (*Schoenoplectus acutus*) along the south and southwestern portion of the lake near the outflow of the Lower Millecoquin River. This is also the area with the new population of Wild Rice and may indicate some changes in water chemistry in this part of the lake. Most of the aquatic plants in the lake are very loosely rooted or free floating in the water and would be costly and difficult to eradicate. For a detailed discussion of aquatic plant control see pages 23-31 in Cronk 2006 and the Plant Control Option Matrix on pages 49-52, also in Cronk, 2006). However to carry out most of these options within the main body of the lake would require extensive time and a large budget. But Hard-stem Bulrush, unlike the other aquatic species, is a deeply rooted and relatively slow growing plant and at least along the southern shoreline and margin of the lake it may be possible to mechanically remove this plant relatively easily or at least control the spread of it more effectively than the other aquatics.

Although it is not possible to say with 100% confidence that no small populations of non-native plants were present, there certainly were no large populations in the 2023 growing season. The lake seems to be basically healthy, if a somewhat over fertilized (eutrophic) system. It is very well stocked with nutrients coming into the lake from its large watershed. Some nutrients may also be entering the lake from the homes along the shore, from agricultural inputs, a few older septic systems, and even some runoff from lawn fertilization but no algal blooms were ever seen near any homes. The only algal blooms or concentrations were seen along the northern shore of the lake and at the mouths of both Furlong and Cold Creeks. The report, A Shoreline Survey of Millecoquin Lake, by Tip of the Mitt Watershed Council, in 2003 stated “no individual severe water pollution problems were evident along the lake shoreline.” This still seemed to be the case in 2023.

It is highly recommended that survey work focused on early detection of non-native invasive plants be continued on at least a limited annual basis in the future. A targeted attempt to control the Hard-stem Bulrush might also be attempted on at least an experimental basis along the southern shoreline of the lake.

Millecoquin Lake Shore Survey 2002:

https://watershedcouncil.org/uploads/7/2/5/1/7251350/millecoquin_lake_shore_survey_2002_report.doc

A Decade of Starry Stonewort in Michigan 2010:

<https://aquaweed.com/pdf/Starry%20Stonewort%20Lakeline%20report.pdf>

Millecoquin Lake Aquatic Vegetation Report 2005:

https://www.watershedcouncil.org/uploads/7/2/5/1/7251350/millecoquin_lake_aquatic_vegetation_report_2005.pdf

Appendix E- 2009 Stream Monitoring Results

Introduction

During the spring of 2009, six sites were chosen to assess water quality and instream habitat conditions. Each site included assessment of 300 feet of stream. The following includes a brief description of the site locations and conditions:

Site #1: Three Mile Creek:

The site is located downstream from the outflow culvert for Three Mile pond, on the downstream side of HSC “G-trail” access road. The upstream impoundment (Three Mile Pond) was identified as a possible source of stream degradation. This section of stream is not treated regularly for sea lampreys.

Site #2: Cold Creek:

The site is located just below the access pad for a previously constructed sand trap just off the HSC “Cold Creek Trail”. A fisherman’s access trail located along the north bank is stable and not contributing any sediment to the stream. This section of stream was treated for sea lampreys in the summer 2009.

Site #3: South Branch Cold Creek:

The site is located on the upstream side of the HSC “Cold Creek Trail” crossing of the South Branch of Cold Creek. This section of stream has not been treated for sea lampreys.

Site #4: Jocko Creek:

The site is located downstream from the outflow culvert for Jocko pond, on the downstream side of HSC “B-Trail” access road. The upstream impoundment (Jocko Pond) was identified as a possible source of stream degradation. This section of stream is not treated regularly for sea lampreys.

Site #5: Upper Millecoquins River:

The site is located downstream from HSC “H-Trail” access road and the access site for an existing sand trap and artificial habitat structure. This section of stream is treated regularly for sea lampreys but was not treated in 2009.

Site #6: Milk Creek:

The site is located at the mouth of Milk Creek and accessed from HSC “J-Trail” access road. This section of stream has not been treated for sea lampreys.

Methods

The Superior Watershed Partnership coordinated the first stream monitoring event in the spring of 2009 with volunteers from the HSC using the MiCorps Volunteer Stream Monitoring Procedures and Datasheets (www.micorps.net). The procedures and data forms included two types of assessments: a stream habitat assessment and macroinvertebrate community assessment. The stream habitat assessment is a visual assessment of stream conditions and watershed

characteristics. The macroinvertebrate community assessment provides a measure of water quality and stream health.

For the habitat assessment, physical appearance is recorded throughout a 300-foot reach, recording only observations that are seen. The physical characteristics of the stream that are recorded include, but are not limited to width, depth, velocity, water color, temp, water body type, stream flow, and substrate. For the macroinvertebrate community assessment, macroinvertebrates are collected, identified to the Order level and listed as rare or common based on abundance. Macroinvertebrates are sampled for approximately 30 minutes per 300 foot station, collecting from all available habitats within the station. Identifications are made by qualified personnel or trained MiCorps volunteers.

Spring and fall monitoring events included macroinvertebrate community assessments at each of the six sites. Stream habitat assessments were conducted during the spring monitoring event in conjunction with the macroinvertebrate community assessments and will be conducted only once per year for future events.



Volunteers collecting macroinvertebrates

Results

The spring 2009 monitoring event marked the first round of assessments with project volunteers. Data on stream habitat was collected from six sites in the watershed on June 22nd and 23rd. Habitat assessments indicated that the physical characteristics of most sites in the river system are predominately sand with woody debris and undercut banks serving as the primary source of available habitat for fish and aquatic macroinvertebrates. All stations had substantial amounts of riparian vegetation aiding in the stabilization of stream banks and reducing the possibility of stream degradation. All water levels and conditions observed appeared to be normal with no major weather events occurring near the time of sampling. A brief summary of conditions observed at each of the sites is provided below:

Site #1: Three Mile Creek had fair amounts of pools and riffles as well as significant amounts of downed trees and overhead cover. The site is characterized by steep wooded banks that provide good riparian cover (shade), and fallen trees that provide instream habitat and cover. Natural gravel and riffle habitats were present.

Site #2: Cold Creek is located below a sand trap with a number of manmade habitat improvements such as riffles, j hooks and log vanes, directed at improving trout habitat. The site is characterized by wooded banks that provide good riparian cover (shade) and fallen trees that provide instream habitat and cover. The stream bottom is predominantly sand and no natural gravel substrate is present. The artificial habitat structures provide oxygenation and additional instream habitat and cover. The fishermen access trail on the north side of the river is currently stable but could become an erosion issue in the future if use increases.

Site #3: South Branch Cold Creek is a narrow feeder creek with substantial amount of soft sand and silt. Limited pools were observed and there was an apparent lack of gravel throughout the reach. Tag alders and other shrubs along the stream banks provide good riparian cover (shade) and fallen trees provide instream habitat and cover. No natural gravel substrate is present.

Site #4: Jocko Creek is fed from an upstream impoundment (Jacko Pond) that is seasonally planted with trout. The substrate is predominantly sand and no natural gravel substrate is present. Pools, riffles, undercut banks, and woody debris provide good instream habitat. Tag alders and other shrubs and trees along the stream banks provide good riparian cover (shade). Gravel has been placed in a small section of stream immediately downstream from the outflow culvert.

Site #5: Upper Millecoquins River is characterized by wooded banks that provide good riparian cover (shade). The stream substrate is predominantly sand and no natural gravel is present. Deep pools, undercut banks and woody debris help aid in habitat quality. Several spawning phase sea lampreys were observed on the artificial habitat structure upstream from the monitoring site on June 22, 2009.

Site #6: Milk Creek is characterized by a soft and silty bottom with tag alders and other shrubs along the stream banks that provide good riparian cover (shade). No natural gravel substrate is present. Physical appearances that aided in habitat were pools, riffles, undercut banks, and woody debris. There appeared to be beaver activity at the upper end of the station.

Macroinvertebrate community assessments were conducted during the spring (June 22nd and 23rd) and fall (September 21st and 22nd) monitoring events. Because of their varying tolerances to physical and chemical conditions, macroinvertebrates are a good indicator of the ecological condition of a stream. Group 1 organisms are the most sensitive to environmental conditions, Group 2 organisms are somewhat sensitive and Group 3 organisms are the most tolerant. Stream quality scores are based on abundance of organisms in each group and were calculated in accordance with MiCorps Volunteer Monitoring procedures.

Site Ratings are based on the following scale: Excellent (>48), Good (34-48), Fair (19-33), and Poor (<19). Of the six sites that were monitored during the spring of 2009, two had ratings of Good

and three had ratings of Fair. As expected, the rating of each station increased in the fall of 2009 (with the exception of Site #5) as volunteers became more experienced in collection and identification methods. A summary of the scores and ratings for each site is provided in the table below.

Stream Quality Scores and Site Ratings for six sites in the Millecoquins River Watershed:

	MiCorps Site Number					
SPRING 2009	1	2	3	4	5	6
Group 1: Sensitive	15.3	15.9	10	10.6	15.6	10.6
Group 2: Some-what sensitive	18.4	12	18.2	12	15.6	9.2
Group 3: Tolerant	4.2	1.1	2.1	5.3	3	4.3
Total Stream Quality Score	38	29	30	28	34	24
Site Rating	Good	Fair	Fair	Fair	Good	Fair
FALL 2009	1	2	3	4	5	6
Group 1: Sensitive	15.6	20.9	15.9	15.6	10.6	15.6
Group 2: Some-what sensitive	24.4	18.2	18	15.4	12.2	15.2
Group 3: Tolerant	1.1	2.2	4.4	3.1	4.1	3.3
Total Stream Quality Score	41	41.3	38.3	34	26.9	34.1
Site Rating	Good	Good	Good	Good	Fair	Good

Spring/Fall 2009 Macroinvertebrate Community Results*:

SPRING/FALL 2009	MiCorps Site Number					
Taxa	1	2	3	4	5	6
Group 1: Sensitive						
Caddisfly larvae (Trichoptera)	C/R	C/C	R/C	C/C	C/C	C/C
Hellgrammites (Megaloptera)						
Mayfly nymphs (Ephemeroptera)	R/C	C/C	R/C	C/C	C/C	C/C
Gilled snails (Gastropoda)						
Stonefly nymphs (Plecoptera)	R/C	C/C	C	R	R	R
Water penny (Coleoptera)		R				
Water snipe fly (Diptera)						
Group 2: Somewhat Sensitive						
Alderfly larvae (Megaloptera)					R	
Beetle adults (Coleoptera)	R/R	R/R	R/R	R/R	C	R
Beetle larvae (coleoptera)	R/R	R/R	R/R	R/R	C/R	R
Black fly larvae (Diptera)	R	R	R	C	R	R
Clams (Pelecypoda)	R		R			R
Crayfish (Decapoda)	R					
Crane fly larvae (Diptera)	R	R		R	R	
Damselfly nymphs (Odonata)						
Dragonfly nymphs (Odonata)	R/R	R/R	R		R	R
Net-spinning caddisfly larvae (Hydropsychidae; Trichoptera)	C/C	R/C	C/R	R/C	C/C	C/R
Scuds (Amphipoda)	C/C		R	R		R/C
Sowbugs (isopoda)			R/R			
Group 3: Tolerant						
Aquatic worms (Oligochaeta)	C			R	R	C
Leeches (Hirudinea)	R	R	C/R	R		
Midge larvae (Diptera)	C/R	R	R/R	C/R	C/C	R/R
Pouch snails (Gastropoda)	R	R	R	R/C	C/C	R/R
True bugs (Hemiptera)			R	C/C	C/C	R
Other true flies (Diptera)						

*Letter codes [R (rare) = 1-10, C (common) = 11 or more] are used to record the numbers of organisms in each taxa found in the stream reach.