

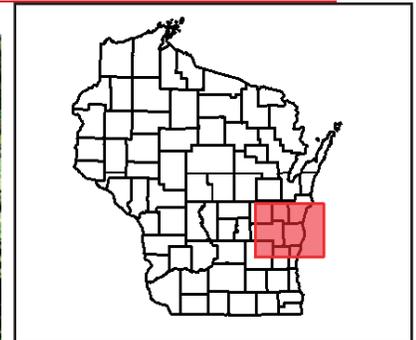
2010 Water Quality Management Plan Update

Sheboygan River Basin, Wisconsin

August, 2010

Executive Summary

The intent of this plan is to provide updated information about current water quality conditions known for the major waterways contained within the Mullet River Watershed. In addition, the plan identifies current watershed issues. It lists opportunities and recommendations for improving waterway and watershed conditions. Five sub-watershed planning areas were identified in the plan to afford an increased focus on local conditions and an improved planning scale.



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This plan is an update to information contained in the October, 2001 “State of the Sheboygan River Basin” report, specific to the Mullet River watershed. This plan is intended to satisfy federal and state watershed planning laws contained in State Administrative Code NR121 and Section 208 of the Federal Clean Water Act. Comments on the plan were solicited from key stakeholders and partners in the watershed area and from the general public. It provides a framework for improving Mullet River watershed conditions in the coming years, by addressing the following issues which impact the river:

- Lack of water quality inventory, monitoring, and biological assessment data
- Polluted runoff from agricultural areas
- Polluted runoff from developed areas
- Wastewater and stormwater discharges
- Loss of wetlands, woodlands and riparian vegetative buffers
- Population by non-native invasive species
- Disruption of fish migration by dams and other barriers
- Lack of awareness, understanding and participation in watershed stewardship

Recommendations specific to each sub-watershed have been developed in addition to watershed-wide management opportunities and recommendations. The watershed-wide opportunities and recommendations include:

- Increase water quality inventory, monitoring and biological assessment data
- Minimize polluted runoff from agricultural areas
- Minimize polluted runoff from developed areas
- Review wastewater and stormwater discharges for compliance
- Restore and manage key wetlands, woodlands, shorelands, and riparian buffers
- Facilitate and provide incentives for increased management by private land-

owners, organizations, businesses, municipalities and agencies to monitor and control the invasion by non-native exotic species

- Improve fish passage
- Increase awareness, understanding and participation in watershed stewardship

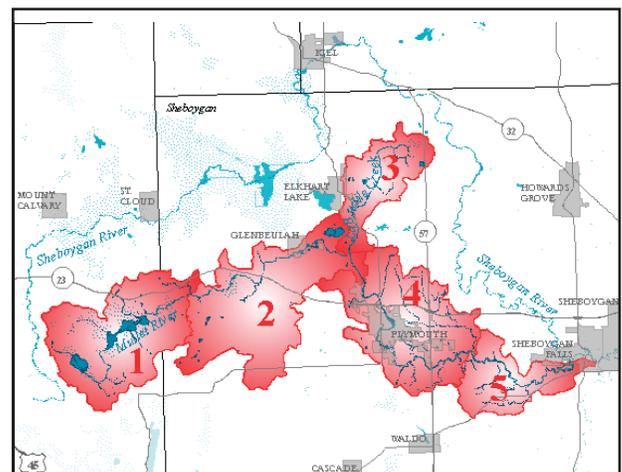
Introduction

A watershed is the area of land that drains surface runoff to a particular lake, river, stream or wetland. This land area is also called a drainage area or basin. The more land use planners and natural resource managers learn about watersheds the more they realize that what happens on the land directly affects downstream waters. In other words, activities on the land have an effect not just at the point of origin, but ripple throughout the basin. Today we are challenged with finding ways to balance our use of land and water with our need to protect, restore and enhance the natural resources in the Mullet River watershed.

The Wisconsin Department of Natural Resources (WDNR) is required to conduct watershed planning by federal and state laws. Section 208 of the Clean Water Act requires each state to inform the public and congress about general water quality conditions within their boundaries. The U.S. Environmental Protection Agency (EPA) uses this information to compile what's called the National Water Quality Inventory and Report to Congress. WDNR is the agency responsible for fulfilling this role in Wisconsin as outlined in State Administrative Code NR121. WDNR has conducted water quality management planning since the 1970's when plans were first instituted to identify wastewater treatment plants for federal financial assistance.

In the 1980's, area-wide water quality management plans (the forerunners for today's watershed plans) were updated every five years, and evolved from a focus on point source dischargers to include non-point source evaluation. In the 1990's these plans were modified to address land and water resource issues holistically. The plans produced during this period were called "State of the Basin" reports and still help guide current WDNR water resource management efforts.

Today the WDNR is moving watershed planning into the electronic realm to provide flexibility in format, to save money, and to take better advantage of information and monitoring data located in the agency's relational databases and website. The goal is to provide agency staff and the public with the most accurate and up-to-date information possible on the condition of Wisconsin's water resources.



Map 1. The sub-watersheds of the Mullet River Watershed

Mullet River sub-watershed planning concept

In order to facilitate watershed planning at a meaningful scale, the Mullet River has been subdivided into five sub-watershed planning areas. Characteristics and features, including land cover and land uses, are distinct within these sub-watersheds and have a direct influence on the water quality of the streams, lakes, ponds and rivers within their boundaries. Map 1 shows the five sub-watersheds areas: 1. Mullet Creek (24.5% of Mullet River watershed), 2. Kettle Moraine (28.3% of Mullet River watershed), 3. La Budde Creek (11.1% of Mullet River watershed), 4. Municipal Plymouth (25.1% of Mullet River watershed), and 5. Lower Mullet (11.0% of Mullet River watershed).

Watershed Description

The Mullet River watershed is approximately 88 square miles in size and is located in eastern Fond du Lac and western Sheboygan counties. The Mullet River watershed ultimately connects to and is part of the Sheboygan River watershed and is located within the Lake Michigan Basin. Crop farming and public and private forestry make up the majority of the land uses in the watershed, with 57% of the land cover in agriculture, followed by 21% in forest. Forested lands occur primarily within the Kettle Moraine sub-watershed and landscape. The City of Plymouth, which encompasses approximately 4% of the land use within the watershed, is the principal urban area.

Water Resources

The watershed includes 3.9 miles of Class I trout water, 9.6 miles of Class II trout water, and 33.9 miles of warm water sport fishery. Water quality is impacted by rural and urban nonpoint source pollution.

The Mullet River originates from the outflow of Mullet Lake and the Mullet Creek State Wildlife Area in Fond du Lac county and flows in an easterly direction for approximately 40 miles to its confluence with the Sheboygan River in the Town of Sheboygan Falls, 17 miles upstream of Lake Michigan.

The water quality of the Mullet River is considered good from its headwaters to Plymouth (approximately 25 miles) and fair from Plymouth downstream to its confluence with the Sheboygan River (approximately 15 miles) (WDNR 1968, 1995). The middle of the river, from Glenbeulah to Plymouth, has an increase in spring flow that lowers stream water temperatures and is classified as a Cold Water Community stream (trout). Upstream of Glenbeulah, and downstream of STH 67 near Plymouth, the Mullet River is classified as a Warm Water Sport Fish Community stream. This classification difference is due primarily to the increase in spring flow between Glenbeulah and Plymouth.

The Mullet River is unique in that it flows from the warm water headwaters into a cold water segment. All of the other major tributaries in the Sheboygan Basin, including the Sheboygan and Onion Rivers, originate as coldwater streams and change over to warm water further downstream.

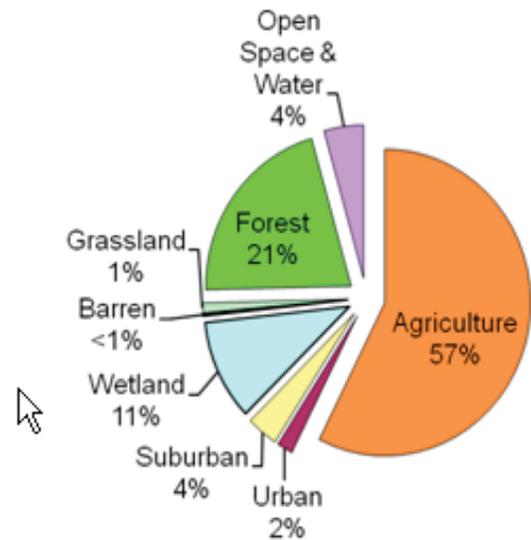


Figure 1. Land cover percentages for the Mullet River Watershed. Data source: 2001 National Land Cover Database.

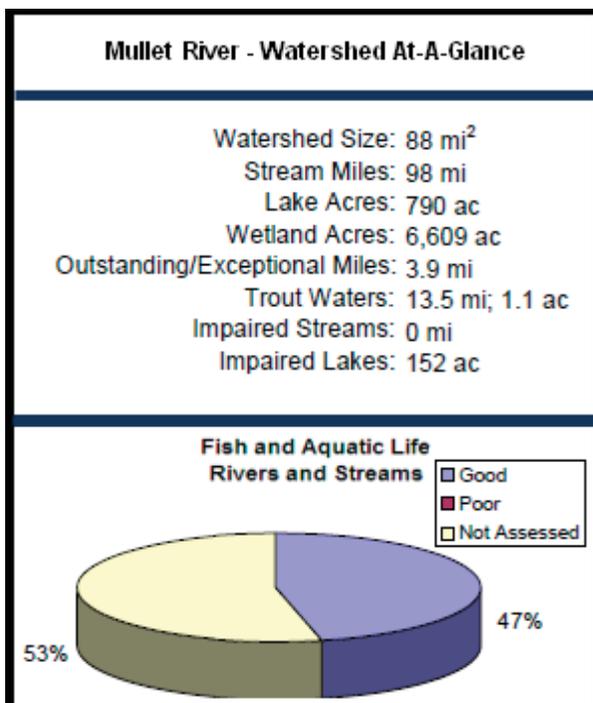
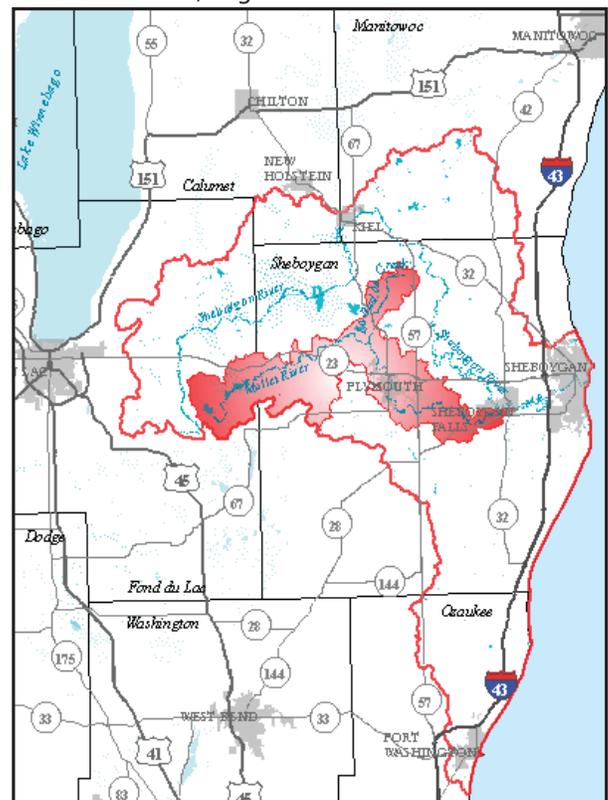
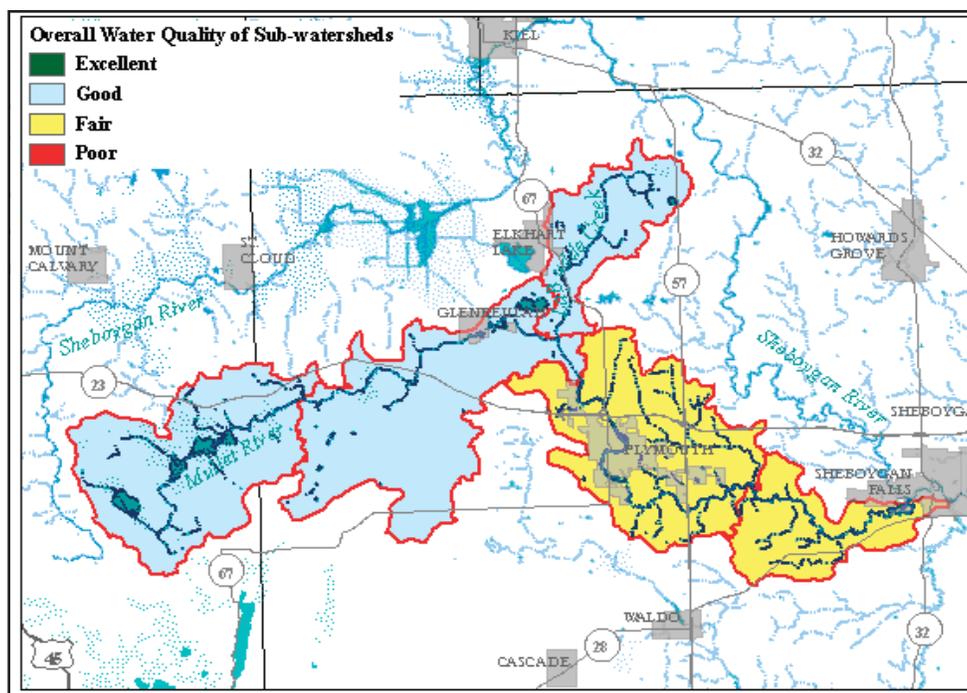


Figure 2 Water resources summary table



Map 2. Mullet River watershed proximity within the Sheboygan River Basin

The existing chemical and biological water quality information supports the Mullet River's current biological classification. The river segment that flows through the Mullet Creek State Wildlife Area, Northern Unit-Kettle Moraine State Forest, and the Old Wade House Historic Site are all located within the warm water sport fish community segment.



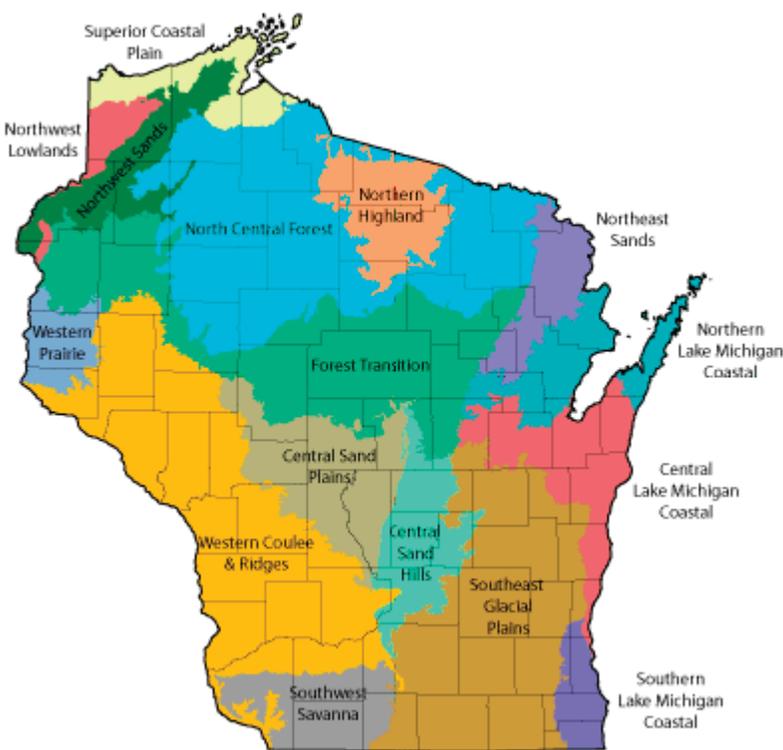
Map 3. Overall water quality of the Mullet River Subwatersheds

Ecological Landscapes

The Mullet River Watershed is covered by two ecological landscapes: the Southeast Glacial Plains and the Central Lake Michigan Coastal. Appendix A includes a map showing the watershed boundary on the Ecological Landscapes.

The Southeast Glacial Plains Ecological Landscape makes up the bulk of the non-coastal land area in southeast Wisconsin. This Ecological Landscape is made up of glacial till plains and moraines. Most of this Ecological Landscape is composed of glacial materials deposited during the Wisconsin Ice Age, but the southwest portion consists of older, pre-Wisconsin till with a more dissected topography. Soils are lime-rich tills overlain in most areas by a silt-loam loess cap. Agricultural and residential interests throughout the landscape have significantly altered the historical vegetation. Most of the rare natural communities that remain are associated with large moraines or in areas where the Niagara Escarpment occurs close to the surface.

Historically, vegetation in the Southeast Glacial Plains consisted of a mix of prairie, oak forests and savanna, and maple-basswood forests. Wet-mesic prairies, southern sedge meadows, emergent marshes, and calcareous fens were found in lower portions of the landscape. End moraines and drumlins supported savannas and forests. Agricultural and urban land use practices have drastically changed the land



Map 4. Ecological landscapes of Wisconsin.

cover of the Southeast Glacial Plains since Euro-American settlement. The current vegetation is primarily agricultural cropland. Remaining forests occupy only about 10% of the land area and consist of maple-basswood, lowland hardwoods, and oak. No large mesic forests exist today except on the Kettle Interlobate Moraine which has topography too rugged for agriculture. Some existing forest patches that were formerly savannas have succeeded to hardwood forest due to fire suppression.

The Central Lake Michigan Coastal Ecological Landscape stretches from southern Door County west across Green Bay to the Wolf River drainage, then southward in a narrowing strip along the Lake Michigan shore to central Milwaukee County. Owing to the influence of Lake Michigan in the eastern part of this landscape, summers there are cooler, winters warmer, and precipitation levels greater than at locations farther inland. Dolomites and shales underlie the glacial deposits that blanket virtually all of the Central Lake Michigan Coastal Ecological Landscape. The dolomite Niagara Escarpment is the major bedrock feature, running across the entire landscape from northeast to southwest. Series of dolomite cliffs provide critical habitat for rare terrestrial snails, bats, and specialized plants. The primary glacial landforms are ground moraine, outwash, and lakeplain. The topography is generally rolling where the surface is underlain by ground moraine, variable over areas of outwash, and nearly level where lacustrine deposits are present. Important soils include clays, loams, sands, and gravels. Certain landforms, such as sand spits, clay bluffs, beach and dune complexes, and ridge and swale systems, are associated only with the shorelines of Lake Michigan and Green Bay.

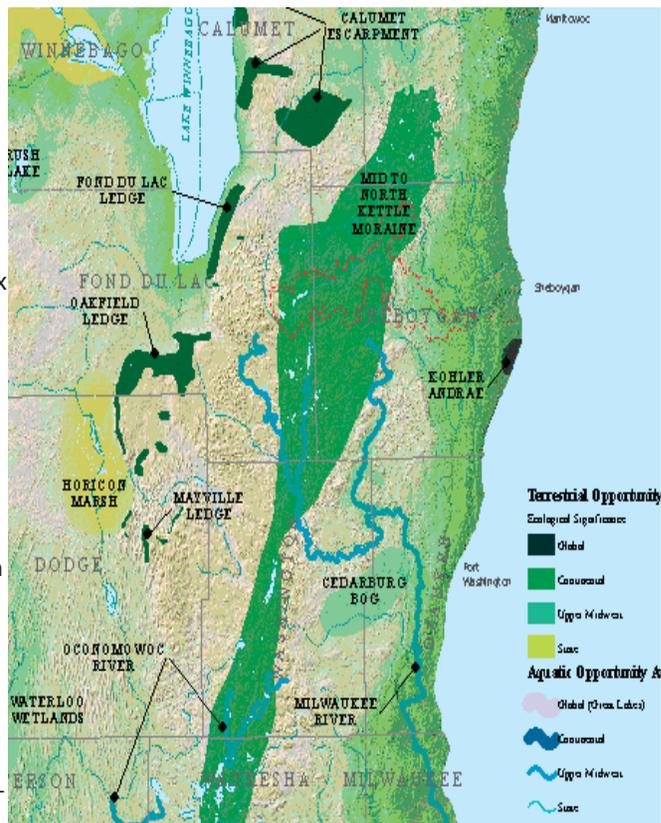
Historically, most of this landscape was vegetated with mesic hardwood forest composed primarily of sugar maple, basswood, and beech. Hemlock and white pine were locally important, but hemlock was generally restricted to cool moist sites near Lake Michigan. Areas of poorly drained glacial lakeplain supported wet forests of tamarack, white cedar, black ash, red maple, and elm. Lake Michigan shoreline areas featured beaches, dunes, interdunal wetlands, marshes, and highly diverse ridge and swale vegetation. Small patches of prairie and oak savanna were present in the southwestern portion of this landscape.

Rare Species, Natural Communities

Approximately 65% of the Mullet River watershed is located within the “North to Mid Kettle Moraine” Terrestrial Conservation Opportunity Area, as defined in the Wisconsin Wildlife Action Plan (WAP, WDNR 2005). The WAP is the result of a statewide effort to identify native Wisconsin wildlife species that have low or declining populations that are in need of conservation action. These are classified as Species of Greatest Conservation Need (SGCN) and are listed in Fig. 3. The “North to Mid Kettle Moraine” is defined by a complex mosaic of savanna, prairie, sedge meadow, marsh, calcareous fen, and southern forest communities. It is the largest forested block in Southeastern Wisconsin and, as such, is extremely important habitat for forest interior birds and other species that require large blocks of continuous forest. Interlobate moraines with this combination of natural features at this scale are exceedingly rare globally.

Map 5. North to Mid Kettle Moraine Terrestrial Conservation Opportunity Area. Mullet River watershed is outlined in red.

In the Mullet River watershed rare species concentrations are found primarily on public lands—the North Unit of Kettle Moraine State Forest, Mullet Creek State Wildlife Area, and La Budde Creek State Fisheries Area—and in the Mullet River. Seventeen species on WDNR’s Natural Heritage Inventory Working List have been documented in this watershed within the past 30 years (“non-historical” records). Of these 17 species, 3 are listed as WI Endangered, 10 as WI Threat-



Map 5. North to Mid Kettle Moraine Terrestrial Conservation Opportunity Area. Mullet River watershed is outlined in red.

ened, and 4 are WI Special Concern (Fig. 3). All thirteen rare wildlife species documented in the watershed are also considered SGCN.

Figure 3. Endangered (END), Threatened (THR), Special Concern (SC) Species, Wildlife Species of Greatest Conservation Need (SGCN), and Natural Communities found in the Mullet River watershed.

Common Name	Scientific Name	Taxonomic Group	State Status	SGCN
Yellow-billed Cuckoo	Coccyzus americanus	Bird	SC	Y
Cerulean Warbler	Dendroica cerulea	Bird	THR	Y
Acadian Flycatcher	Empidonax vireescens	Bird	THR	Y
Hooded Warbler	Wilsonia citrina	Bird	THR	Y
Red-shouldered Hawk	Buteo lineatus	Bird	THR	Y
Osprey	Pandion haliaetus	Bird	SC	Y
Queensnake	Regina septemvittata	Snake	END	Y
Butler's Gartersnake	Thamnophis butleri	Snake	THR	Y
Eastern Ribbonsnake	Thamnophis sauritus	Snake	END	Y
Blanding's Turtle	Emydoidea blandingii	Turtle	THR	Y
Slippershell Mussel	Alasmidonta viridis	Mussel	THR	Y
Ellipse	Venustaconcha ellipsiformis	Mussel	THR	Y
Rainbow Shell	Villosa iris	Mussel	END	Y
Yellow Gentian	Gentiana alba	Plant	THR	-
Snow Trillium	Trillium nivale	Plant	THR	-
Cuckooflower	Cardamine pratensis	Plant	SC	-
Many-headed Sedge	Carex sychnocephala	Plant	SC	-
Northern Mesic Forest	-	Community	-	-
Southern Dry-mesic Forest	-	Community	-	-
Bog Relict	-	Community	-	-
Emergent Marsh	-	Community	-	-
Lake--Shallow, Hard, Seepage	-	Community	-	-
Lake--Soft Bog	-	Community	-	-
Northern Sedge Meadow	-	Community	-	-
Northern Wet Forest	-	Community	-	-
Shrub-carr	-	Community	-	-
Springs and Spring Runs, Hard	-	Community	-	-
Stream--Fast, Hard, Cold	-	Community	-	-

Watershed-Wide Water Resources Issues

The issues presented here are common to all of the sub-watersheds within the Mullet River watershed. The sub-watershed sections of this plan will include additional issues unique to the sub-watersheds.

Lack of water quality inventory, monitoring and biological assessment data

Throughout this watershed, there are no water quality data for 145 out of the 154 water bodies. Additional support is needed to adequately inventory, monitor and assess the water resources in this watershed.

Polluted runoff from agricultural areas

Agriculture is the dominant land use within the Mullet River Watershed. Dairy and row crop farming along with pas-

turing are the main types of agricultural activity within the watershed. Over the years, a number of conservation practices have been employed on farms within the watershed including contour plowing, crop rotation, nutrient management planning, designed manure storage installations, grassed waterways, filter strips, stream buffers, and barnyard runoff measures. Use of these farm practices has a beneficial impact on water quality. Traditionally, installation of agricultural conservation practices has been voluntary and some federal, state and local cost share dollars have been made available for this purpose. However, runoff from agricultural lands continues to impact water quality in the watershed and there is a need to further reduce sediment and nutrient impacts to waterways in the Mullet River watershed.

Because funding for farm conservation practices is limited, these resources should be directed to the highest priority runoff areas first. The 2008 Fond du Lac County and 2009 Sheboygan County Land & Water Resource Management Plan identifies goals and a strategy for reducing runoff from agricultural land uses. It focuses on the agricultural performance standards contained in State Administrative Code NR151. The goals include reducing soil erosion, controlling animal waste runoff, and meeting nutrient management requirements.

Polluted runoff and altered stream hydrology in developed areas

Urban land uses within the watershed are relatively low (about 4%). Most of this land use is within the City of Plymouth. Even though land that contributes runoff from this category is relatively small in area in this watershed, urban runoff can have a significant negative impact to water quality. Impervious surfaces and storm sewer drains provide immediate delivery of pollutants to the waterways without any filtering capabilities. Construction sites within urban or suburban areas can also lead to significant delivery of sediment to waterways. Sediment covers habitat for fish and carries nutrients which further degrade water quality. Sheboygan County has an erosion control and stormwater ordinance for development in the unincorporated areas.

The City of Sheboygan Falls has a WDNR municipal stormwater permit that includes a number of requirements to reduce pollutant loadings from storm sewers and other runoff. As part of their permit, the City of Sheboygan Falls is also required to have and implement a stormwater runoff management ordinance. The City of Plymouth is not currently required to have a WDNR municipal stormwater permit.

Wastewater and stormwater discharges

There are a number of general wastewater and stormwater permits that cover a variety of runoff sources including stormwater permits for construction sites, stormwater runoff permits for industrial sites, and general permits for runoff from non-metallic mining. Most of these general permits include standard conditions or best management practices that must be followed to be in compliance with the permits. Changes in state law will require changes in the permits as they are reviewed by the WDNR. Although permits regulate the discharge, there is always the potential for an accidental or unplanned bypass or discharge.

The Northern Moraine Utility Commission Sewage Plant provides wastewater treatment for the Elkhart Lake, Crystal Lake, Glenbeulah and Greenbush communities. It has monthly average wastewater inflows between 221,000 and 475,000 gallons per day. Treatment consists of fine screening, conventional activated sludge, and final clarification. Treated wastewater (effluent) is discharged to 3 seepage ponds near the Mullet River below Glenbeulah. The Northern Moraine wastewater treatment plant is currently in substantial compliance with their State WPDES permit which was issued in December 2008.

The Plymouth Wastewater Treatment Plant has monthly average wastewater inflows between 1.38 and 2.72 million gallons per day. Treatment consists of primary clarification, conventional activated sludge, secondary clarification, anthracite filtration, and seasonal ultraviolet disinfection. Treated wastewater (effluent) is discharged directly to the Mullet River near the south corporate limits of the City of Plymouth. The City of Plymouth wastewater treatment plant is currently in substantial compliance with the State WPDES permit which was issued in March, 1997. Sartori Foods discharges approximately 200,000 gallons per day of non-contact cooling water and reverse osmosis water to the Mullet River via the City of Plymouth storm sewer system.

Loss of wetlands, woodlands and riparian vegetation buffers

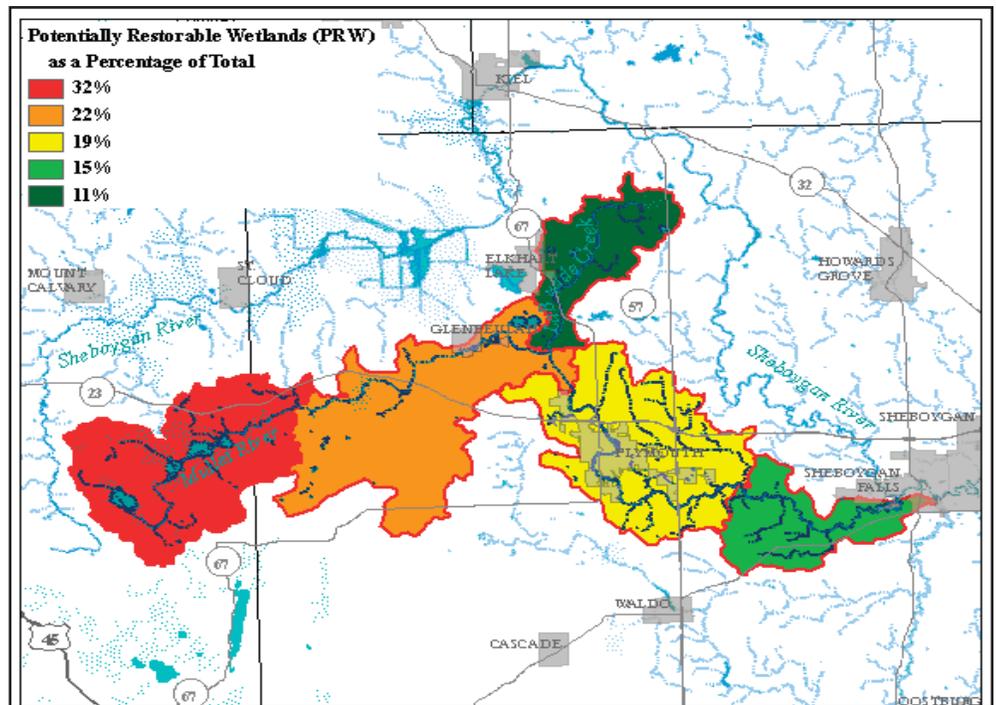
Historically, agricultural and urban development has resulted in the loss of about 41% of the original wetlands in this watershed and the removal of riparian vegetation and stream cover. In addition to providing valuable fish & wildlife habitat, some wetlands provide additional important watershed functions such as filtering out pollutants, maintaining

summer base flow in streams, and alleviating flooding concerns along waterways. Using a DNR GIS analysis, it is estimated that there are about 3,300 acres of potentially restorable wetland (PRW) in the Mullet River Watershed.

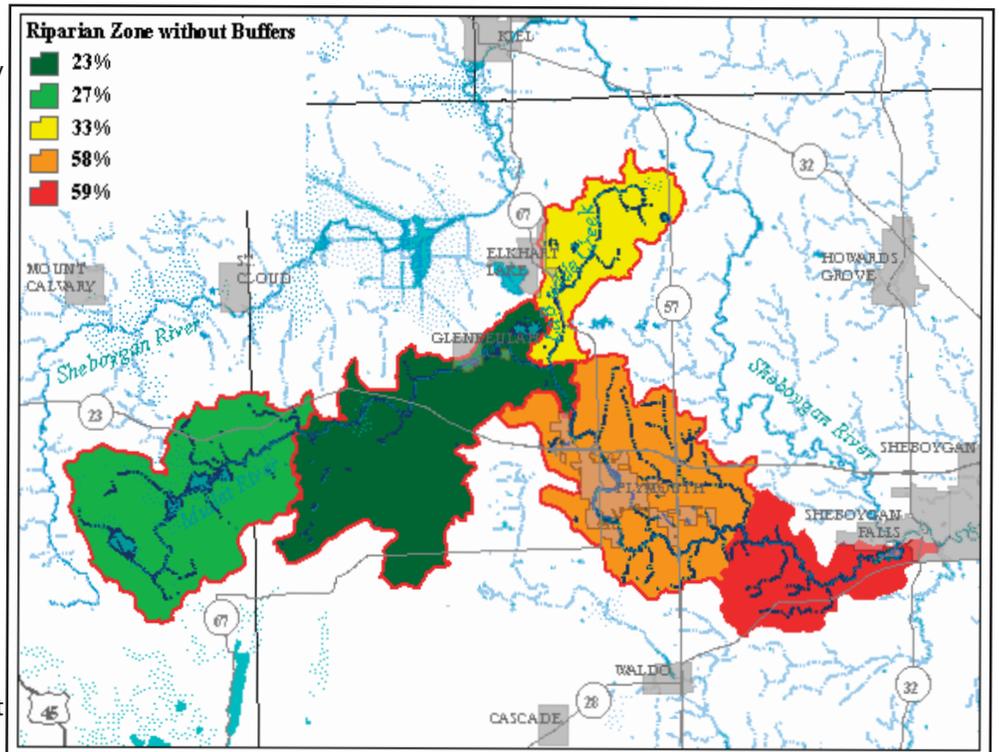
Map 7 shows that according to soil surveys, the Mullet Creek and Kettle Moraine sub-watersheds contain the highest concentrations of potentially restorable wetlands (this does not take into consideration the establishment of reed canary grass in the watershed. The existence of lost wetlands or potentially restorable wetlands is evidence of the strong agricultural heritage in the watershed and the opportunity to work with landowners to restore these wetland communities.

Woodlands and other permanent vegetation along streams also provide habitat, water quality benefits, and cooler water temperatures. Permanent vegetation buffers runoff from adjoining lands and can capture sediment and nutrients from being delivered to waterways. It is estimated that 57% of the Mullet River and its tributaries have adequate vegetative buffers. A minimum buffer width of 50 feet was used for this estimation.

The Lower Mullet and Municipal Plymouth sub-watersheds are in greatest need of additional riparian buffers, with 59% and 58%, respectively, of their 50' riparian corridors not protected by buffers. This equates to 157 acres of buffer needed in the Lower Mullet sub-watershed and 320 acres of buffer needed in the Municipal Plymouth sub-watershed. Of course, there still is room for



Map 7. Opportunity for restoring wetlands in each sub-watershed, presented as a percentage of the PRWs of the entire Mullet River watershed.



Map 8. Opportunity to establish buffers, presented as percentage of riparian zone without a buffer in each sub-watershed.

improvement in the other sub-watersheds with 33% of the riparian corridor or 57 acres of buffers needed in the La Budde Creek sub-watershed, 27% of the riparian corridor or 109 acres of buffers needed in the Mullet Creek sub-watershed, and 23% of the riparian corridor or 62 acres of buffers needed in the Kettle Moraine sub-watershed.

Population by non-native invasive species

Today, carp and rusty crayfish are assumed to be present throughout the watershed. Zebra mussels also were found in Crystal Lake in 2001. These non-native invasive species replace native species like emerald shiners, sculpin and northern clearwater crayfish. The movement of other non-native invasive species like sea lamprey and round goby migrating up the Sheboygan River from Lake Michigan has been stopped by several dams on the Sheboygan River in Sheboygan, Kohler and Sheboygan Falls.

Purple loosestrife, Eurasian water milfoil, Phragmites, reed canary grass, hybrid cattail, bush honeysuckle, garlic mustard, buckthorn, and Japanese knotweed are the primary non-native invasive plants present in the watershed.

Reed canary grass is present in most wetlands in the Mullet River watershed. The degree to which the reed canary grass dominates a wetland determines the wetland restoration potential. Vegetation management by landowners and land management agencies is essential in curtailing further establishment of this invasive plant.

Disruption of fish migration by dams and other barriers

There are seven dams which fragment the Mullet River between the headwaters at Mullet Creek and its confluence with the Sheboygan River at the City of Sheboygan Falls. Although dams may serve a variety of societal purposes, including wetland restorations like the Mullet Creek State Wildlife Area, they also trap sediment and pollutants, warm the water temperatures, and fragment fish populations and impede fish movement to spawning habitat. Additionally over time, impoundments formed by dams can fill in with sediment and develop water quality impairments including excessive algae or carp populations.

Poorly designed culverts and other barriers such as large, natural debris dams can also interfere with fish migration. There have not been any organized efforts to assess fish passage barriers on streams within the Mullet River watershed.¹

Figure 4. Summary table of dams in the Mullet River watershed

Dam Name	Hydraulic Height	Impoundment Size	Owner	Fish Passage
"G" Flowage, Mullet Creek State Wildlife Area	3 feet	500 acres	WDNR	No
"Steffes' Flowage," Mullet Creek State Wildlife Area	3 feet	225 acres	WDNR	No
Mullet Marsh Dam	1 foot	300 acres	WDNR	No
Wade House Dam	N/A *	15 acres	State of WI-Historical Soc.	Yes
Glenbeulah Dam	12 feet	7 acres	Village of Glenbeulah	No
Camp Evelyn Dam	6 feet	3 acres	Girl Scout Assn.	No
Plymouth Dam	9 feet	36 acres	City of Plymouth	No
Brickbauer/New Paris	8 feet	15 acres	Privately Owned	No
Richardson Brothers	8 feet	8 acres	Privately Owned	No

Lack of awareness, understanding and participation in watershed stewardship activities by individual citizens, businesses, municipalities and government agencies

The issues facing this watershed all hinge on decisions and behaviors by individuals, businesses, municipalities and government agencies, yet there are few, if any, targeted or unified efforts to increase awareness, understanding or participation in watershed stewardship.

¹ The Mullet River is free flowing around the Wade House Dam

Watershed-wide Management Opportunities and Recommendations

These opportunities and recommendations apply to all five of the sub-watersheds within the Mullet River watershed. Recommendations specific to the sub-watersheds can be found in each sub-watershed section of this plan.

Increase water quality monitoring, inventory and biological assessment data

- Secure resources to conduct water quality monitoring, inventory, and biological assessments to adequately assess the 154 water bodies in this watershed.
- Secure resources to develop partnerships to encourage, train, and engage citizen monitors.

Minimize polluted runoff from agricultural areas

- Secure resources to increase staffing for county conservation departments and the Natural Resource Conservation Service so that they can provide individualized attention to landowners to progressively implement NR151.
- Work with the USDA Natural Resources Conservation Service (NRCS), county conservation departments, WDNR foresters and wildlife biologists, and others to use available watershed assessment and planning tools to identify and prioritize key areas to address non-point runoff within the watershed.
- Develop databases and maps showing manure storage facilities, lands enrolled in nutrient management programs, established buffers, and lands where buffers are needed. Use this information to target and prioritize agency programs and work.
- Work in partnership with local units of government towards compliance with performance standards for agricultural non-point runoff contained within NR151, Wisconsin Administrative Code.
- Increase awareness and use of federal, state or local agricultural cost-share programs to work with landowners to reduce non-point runoff on agricultural facilities and lands.
- Incentivize landowners to maintain best management practices that have already been installed on agricultural lands.
- Address animal waste runoff.
- Incentivize and facilitate compliance with nutrient management and agricultural performance standards on crop land.
- Incentivize and facilitate acceptable crop field erosion rates.

Minimize polluted runoff and maintain or restore stream hydrology in developed areas

- Work with the City of Plymouth, City of Sheboygan Falls and villages of Glenbeulah and Greenbush to improve stormwater management practices, especially treating runoff from impervious areas to reduce discharge of nutrients, sediment and bacteria to area waterways.
- Facilitate the development and implementation of local stormwater management plans in local municipalities.
- Facilitate the adoption and enforcement of local erosion control ordinances.
- Enforce post construction site erosion control best management practices with emphasis on infiltration to maintain summer stream flow and thermal attributes of local streams, as per N.R. Code 216.
- Ensure that the quantity of runoff does not negatively impact waterways.

Review wastewater and stormwater permits for compliance

- Review permits on a timely basis and facilitate operational changes to comply with changes in state law.
- Encourage a cooperative relationship with permit holders to facilitate compliance and emergency tracking and response when accidental discharges occur.

Restore and manage key wetlands, woodlands, shorelands and riparian buffers

- As mandated in the new federal mitigation rule, develop a wetland restoration plan for the watershed that identifies priorities for flood control, wildlife habitat restoration, and criteria for prioritizing restoration projects.
- Use The Nature Conservancy's 2009 wetland functions assessment and the WDNR's wetland assessment tool to plan for wetland protection and restoration.
- Partner with the NRCS and county conservation departments to secure funding to design buffer programs that better fit the needs and desires of landowners in this area and work with landowners to install stream buffers along the Mullet River and its tributaries.
- Partner with NRCS, county conservation departments, WDNR wildlife biologists and foresters to work with landown-

ers to manage existing wetlands, woodlands and other habitats established through conservation programs, and to restore key wetlands and woodlands converted to other land uses.

- Ensure that landowners and local organizations are aware of funding opportunities for wetland restoration and management and the establishment of riparian buffers.
- Promote the streambank protection easement and fee program.
- Advance Sheboygan County's new shoreland restoration ordinance.

Facilitate and provide incentives for increased management by private landowners, organizations, businesses, municipalities and agencies to monitor and control the invasion by non-native exotic species

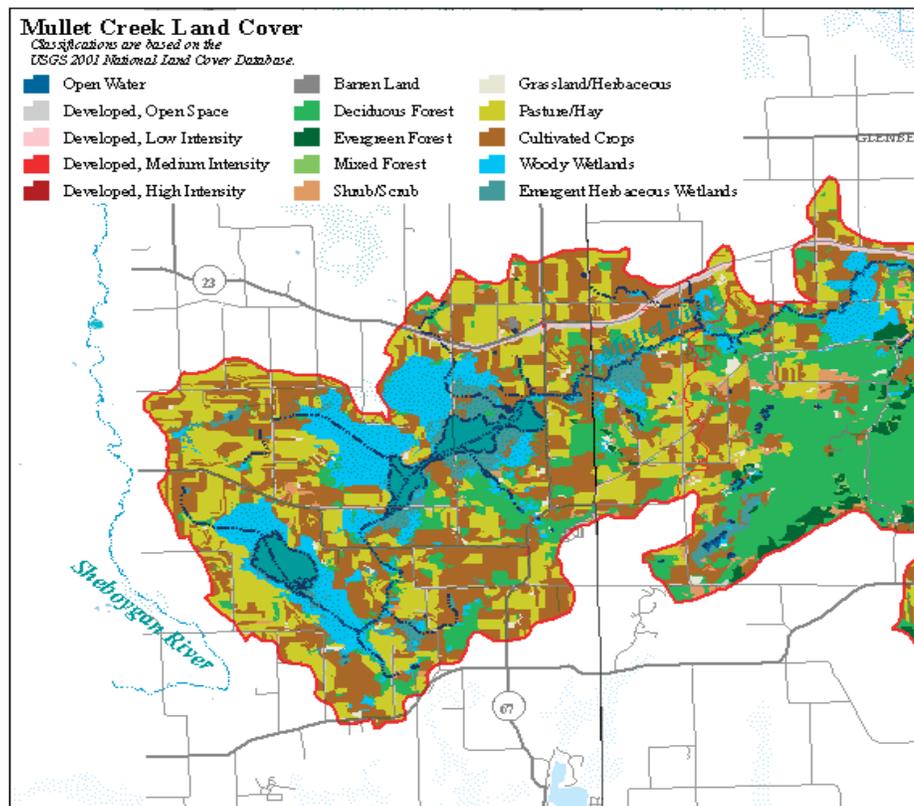
- Provide information and education to landowners and others regarding Wisconsin's new state rule (NR 40, Wisconsin Administrative Code) for identification, classification and control of invasive species.
- Ensure that landowners and organizations are aware of funding opportunities to support invasive species work.
- Incentivize landowners, organizations, businesses, municipalities, and agencies to monitor and control aquatic and terrestrial invasive species.
- Secure funding for monitoring wetlands and waterways on public lands for the presence of aquatic invasive species and implementing control measures.
- Establish county-based invasive species control programs in Fond du Lac and Sheboygan counties.

Improve fish passage

- Incentivize landowners, organizations, businesses, municipalities, and agencies to identify and prioritize fish passage barriers, like dams and improperly installed culverts, and seek funding for fish passage restoration.
- Ensure that owners of dams, local governments and organizations are aware of state and federal funding opportunities for dam removal and fish passage restoration.
- Work with property owners to identify and prioritize dams, and seek funding to remove them or pursue fish passage enhancements at those dams that will remain.
- Develop a fish passage restoration plan for the watershed or each of the sub-watersheds.

Increase awareness, understanding and participation in watershed stewardship

- Develop materials that interpret watershed issues and invite target audiences to participate in specific stewardship activities.
- Develop and implement educational programs designed specifically for target audiences.
- Secure resources to promote and implement the Sheboygan River Basin Partnership's Adopt-A-Stream program in the Mullet River watershed.
- Develop partnerships with formal (schools) and non-formal (nature centers, organizations, agencies) education partners in and near the watershed to enhance and increase watershed education efforts.



Map 9. Land Cover in Mullet Creek Subwatershed

Mullet Creek Subwatershed

The Mullet Creek sub-watershed represents 24% of the Mullet River watershed and is located at the river headwaters, primarily in Fond du Lac County. This sub-watershed is dominated by wetland and agricultural land cover (Figure 6). The uplands contain relatively steep relief (elevation differences) and the lower topographic areas include wide and flat expanses of wetlands that are dominated by shallow marsh (primarily cattail). Soil associations include the Theresa-Pella-Lamar-tine, Fox-Casco, and Houghton-Palms associations in Fond du Lac County and the Hochheim-Theresa and Casco-Fox-Rodman associations in Sheboygan County. The agricultural land is farmed primarily for cash grain crops.

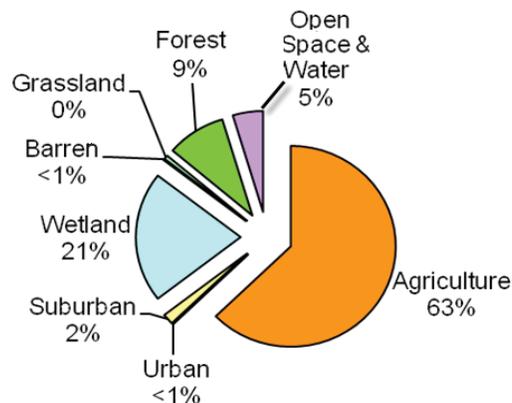


Figure 6. Mullet Creek sub-watershed land use percentages.

Mullet Lake, Fond du Lac County (WBIC 56200)
T15N R19E Sec. 33, Surface Acres = 200, S.D.F. = 1.41,
Maximum Depth = 7 feet

This is a shallow, hard-water, seepage lake valued primarily for waterfowl hunting and wildlife. Considerable numbers of ducks use the lake all year and the lake receives moderate hunting pressure during the open season. Its shallow depth of about seven feet and abundance of rooted aquatic plants contribute to annual winterkill conditions that limit the fishery to an occasional northern pike and perch. A few property owners recently installed a small aeration system, which may promote fish carryover during the winter months. Public access is absent.

Mullet Lake is located within the (currently) proposed 495-acre Mullet Lake State Natural Area. The lake is surrounded by a wetland complex of tamarack, shrub carr, sedge meadow, and swamp forest. This undeveloped inland lake with intact wetland vegetation provides important breeding, nesting, and migratory habitat for numerous bird, reptile, and amphibian species. The lake's outlet stream is the Mullet River, also called Mullet Creek in this section. The lake and swamp complex is the headwaters of the Mullet River.

Mullet River (RM 38.7 – 30.8)

This segment starts at Mullet Lake and ends at the confluence with an unnamed tributary (WBIC 5027191) at river mile 30.8. The segment runs through the Mullet Creek State Wildlife Area, which includes the Mullet Marsh. Little or no monitoring has been done within this stream reach. Therefore, the water quality conditions and stream biology are unknown, but the water quality is generally perceived to be in good condition. There are few springs in this reach, combined with altered flows resulting from channelization and impoundments. Because of these limiting factors the fishery is classified as a warm water sport fishery. Two impoundments are present in the Mullet Creek State Wildlife Area to provide habitat for waterfowl.

Mullet Creek State Wildlife Area, Fond du Lac County (WBICs 56000 and 5563544)
T15N R19E Sec. 24, Surface Acres = 344, Maximum Depth = unknown

Around 1968, two dams were placed on Mullet Creek in Fond du Lac County west of CTH "G" to restore wetlands lost by drainage practices. Fish passage has not been addressed and so the dam presents a barrier to fish migration, most of the year. Fish passage occurs during high spring flows and heavy rainfall events via the emergency spillways and water control structures. Fish passage also occurs when full draw-downs are performed on the impoundments. No recent water quality data exist for this portion of the river.

Mullet Creek State Wildlife Area is a 2,217 acre property located in east-central Fond du Lac County. The wildlife area is located 15 miles east of Fond du Lac, and 10 miles west of Plymouth on Hwy 23. Travel south of Hwy. 23 on County Trunk G for one mile to the northeast corner of the wildlife area. This is where Mullet Creek flows under County Trunk G. Mullet Creek State Wildlife Area consists of a rich array of wetland, forest, grassland and farmland. Mullet Creek flows

through the entire property, eventually becoming the Mullet River and joining the Sheboygan River. The central portion of this property consists of shallow open water with submergent vegetation and cattail wetland totaling over 700 acres. Sedge, reed canary grass, willow, dogwood, swamp conifers and swamp hardwoods occur in the lowland areas. Oak, aspen and grass fields occur on the upland sites.

Hybrid cattail, reed canary grass, garlic mustard, dame’s rocket, spotted knapweed, phragmites, and black locust present challenges to preserving the integrity of the natural communities found here.

Mullet Creek State Wildlife Area is located in the Middle to North Kettle Moraine Priority Conservation Opportunity Area - a terrestrial opportunity area of continental significance within the Southeast Glacial Plain Ecological Landscape.

For more information, see http://dnr.wi.gov/org/land/wildlife/wildlife_areas/mullet.htm.

There are eight small unnamed tributaries that discharge to the Mullet River within this sub-watershed. Four of these small streams are intermittent, which means they may dry up because of low precipitation, mainly during the summer months. Very little is known about these streams and additional monitoring should be considered. These streams are summarized in Appendix C. In addition, there are at least 17 unnamed lakes and ponds in this sub-watershed. Very little is known about these water bodies.

Waterway Condition

Little or no monitoring has been done on the streams or lakes in this watershed. There is some macroinvertebrate biological data from 1980 that rates the Mullet River as fair to fairly poor. These two samples were collected upstream of County Highway U. Additional sampling in this sub-watershed is needed to assess its condition. The overall water quality of lakes and streams within this sub-watershed is perceived to be good.

Figure 7. Mullet Creek Subwatershed Water Condition

Stream	WBIC	Size	Condition	Biological Use	Attainable Use	Supporting Attainable Use	Management Issue	Proposed Actions
Mullet Lake	56200	200 acres	Good/Fair	WWSF	WWSF	Unknown	Land Use NPS runoff	Additional monitoring
Mullet River	53400	7.9 miles	Good/Fair	WWSF	WWSF	Yes	Land use NPS runoff	Additional monitoring

Issues

The following issues are in addition to the watershed-wide issues listed in this plan:

- State lands comprise a considerable amount of the land base in this sub-watershed and state lands management activities may have a significant impact on water quality.
- The large wetland complexes in this sub-watershed could be over-run with invasive species if not monitored and managed.
- Although dams were installed to restore wetlands at the Mullet Creek State Wildlife Area, they create fish passage barriers during most of the year.
- State Hwy 23 is scheduled for expansion to four-lanes beginning in 2013.

Management Opportunities and Recommendations

In addition to the watershed-wide recommendations listed in this plan, the following recommendations address issues specific to this sub-watershed.

Include watershed goals in public lands management

- Ensure that issues and recommendations from this plan are considered during master planning and annual property planning for the Mullet Lake State Natural Area and Mullet Creek State Wildlife Area.
- Ensure that public property managers are aware of and have access to water quality and biological assessment data that exist for this watershed.

- Support land acquisitions from willing landowners for the proposed Mullet Lake State Natural Area, so that the area can be designated as a State Natural Area and managed to control invasive species.
- Increase invasive species monitoring and control at the Mullet Creek State Wildlife Area.
- Consider methods to improve fish passage at Mullet Creek State Wildlife Area, and if deemed desirable, secure funding for fish passage restoration

Highway 23 Expansion

- Promote WDNR and Wisconsin Department of Transportation wetland compensation mitigation goals to increase restoration of wetland acreage and functions in Fond du Lac and Sheboygan counties.

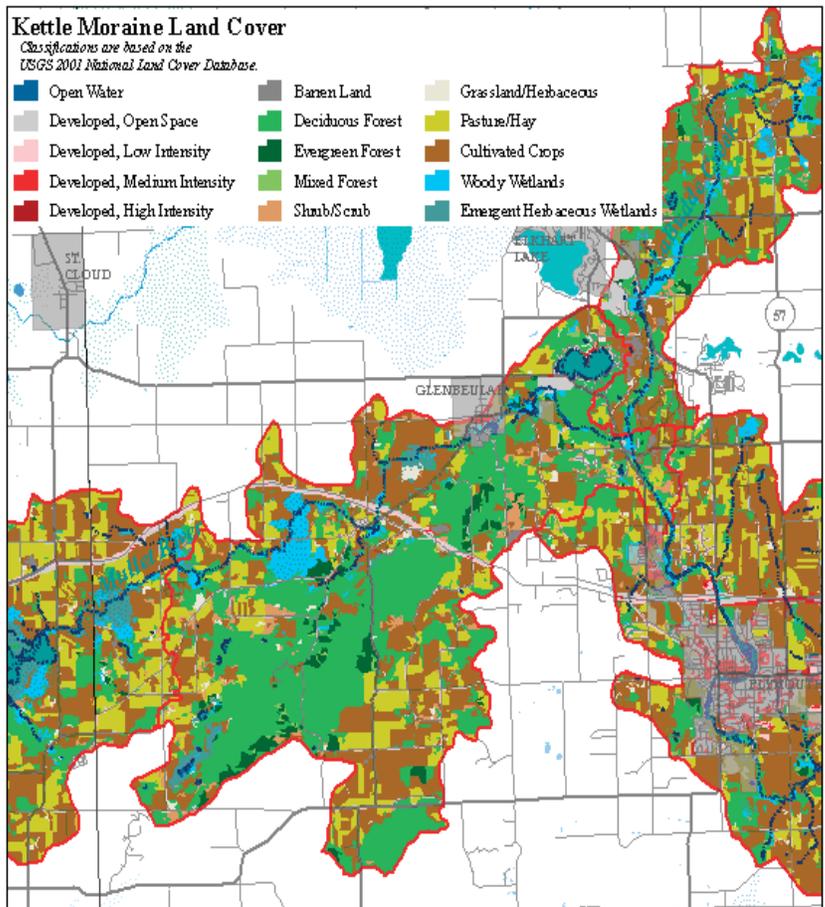
Kettle Moraine Subwatershed

The Kettle moraine sub-watershed encompasses 28.3% of the Mullet River watershed. It includes that portion of the Mullet River watershed below the Mullet Creek sub-watershed and above RM 19.2. This sub-watershed is dominated by forest and agricultural land cover. The uplands comparatively steep relief (elevation differences) associated with glacial end moraine deposits. Approximately 37% of this sub-watershed is held in public ownership. Soil associations include the Hochheim-Theresa and Casco-Fox-Rodman associations.

This sub-watershed includes the Villages of Greenbush and Glenbeulah, which have populations of 2,581 and 449, respectively (as of July 2008, www.city-data.com). A sawmill and pond were constructed in 2001 for the Wade House Historic Site. Even though a dam was constructed for operation of the sawmill, the river is free flowing through this area and the dam does not impound the Mullet River. The Wade House historic site has a permit from DNR to utilize river water for sawmill operation during periods of higher flow.

Mullet River - warm water segment (RM 30.8 – 22.5)

This segment starts below the confluence with an unnamed tributary (WBIC 5027191) at river mile 30.8 and ends at the confluence with Otter Pond near Glenbeulah. The segment runs through the Kettle Moraine State Forest Northern Unit and Old Wade House State Park.



Map 10: Land Cover in the Kettle Moraine Subwatershed

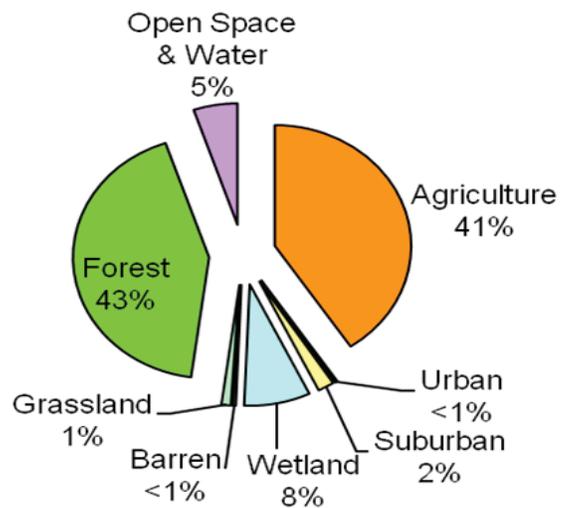


Figure 8. Kettle Moraine Subwatershed Land Use

Water quality conditions are good and there are a few springs within this reach that discharge to the river. Problems in this segment include old stream channelization, one impoundment, nonpoint source runoff, and sedimentation. Because of these limiting factors, the fishery continues as warm water sport fishery.

Glenbeulah Millpond (WBIC 55600)
T15N R20E Sec. 1, Surface Acres = 7,
Maximum Depth = 11 feet

Glenbeulah Millpond is an impoundment of the Mullet River in Glenbeulah at the site of an old sawmill formed by a 12-foot head dam. The water quality problems identified in the 1968 Water Resources of Sheboygan report (WDNR 1968) likely exist today; nutrient enrichment, sedimentation, and abundant carp are consistent with impounded rivers. Thermal increases associated with this impoundment and the Camp Evelyn impoundment warm the trout water portion of the Mullet River, which is a short distance downstream. No recent water quality data are available for this impoundment. The fishery does support a warm water sport fish population that includes bluegill, pumpkinseed, northern pike, and largemouth bass.

Mullet River - cold water segment (RM 22.4 – 19.2)

The trout water reach of the Mullet River extends from Otter Pond, which is downstream of the Village of Glenbeulah, downstream to State Highway 67, which is located in the Municipal Plymouth Sub-Watershed. This section of the Mullet River is the most heavily fished trout stream in Sheboygan County. Some agricultural pollution occurs within this segment, but is not considered limiting.

Water quality within this segment is rated as generally good, but is limited by a dam located at the Camp Evelyn Girl Scout facility. This impoundment alters the natural water temperature regime. The Northern Moraine Utility Commission wastewater treatment plant discharges treated effluent to the groundwater of the Mullet River watershed. It is believed that after some additional treatment by the soil, the effluent mixes with the groundwater, which discharges directly to the Mullet River during part or all of the year.

The fishery is represented by a good diversity of intolerant species, including brook and brown trout. This section of stream is a Class II stream for brown trout and the diversity and number of individuals indicates a good fishery. The macroinvertebrate community is represented by a wide diversity of both intolerant and tolerant genera. The high water temperatures and sedimentation in the Camp Evelyn impoundment does impair the trout habitat.

WDNR personnel surveyed the Mullet River downstream of the Crystal Lake Golf Course in August 1999. The fish community rated poor, possibly due to the lack of fish cover. Stream habitat analysis showed excellent buffer area and shading; moderate streambank erosion; bottom substrate with a mixture of rock, gravel, and sand; and moderate fish cover. Benthic macroinvertebrate ratings for this location were good to very good.

WDNR personnel surveyed a portion of the stream, upstream of County HWY CJ in July 2000 and 2009. Land use in the area is heavily wooded with wetland areas in the riparian corridor. The fish community rated fair to poor, due to the low number of cold water species at this site. Stream habitat analysis showed excellent buffer areas and shading, rocky substrate, and very little streambank erosion. Fish cover was limited due to shallow water depths. The benthic macroinvertebrate community rated excellent.

Glenbeulah Springs (WBIC 55400)

T15N R21E Sec.6, surface acres = 1.1, maximum depth = unknown

Glenbeulah Springs is a small, natural, spring-fed pond that has supported a trout population in the past. Little is known about this pond, however, and additional monitoring needs to be done.

Otter Pond (WBIC 55300)

T15N R21E Sec. 6, surface acres = 6.1, maximum depth = 10 feet

Otter Pond is a small natural lake with a maximum depth of 10 feet. The bottom is primarily muck and peat, with marl in the spring areas. The shoreline is bog marsh, with points of rock and gravel at various places around the pond. There is abundant aquatic plant growth in some areas of the pond. Otter Pond receives some of its water budget from Glenbeu-

lah Springs, but the majority comes from its own springs. The major springs are located in the south side of the pond, near the railroad grade. The current water quality and biological community is unknown.

Camp Evelyn Impoundment (WBIC 55000)

T15N R21E Sec. 6, surface acres = 1.8, maximum depth = 6 feet

This is a small impoundment in the trout water section of the Mullet River. The dam at the Camp Evelyn Girl Scout facility creates a fish barrier and increases water temperatures which are detrimental to trout and other cold water species. No recent water quality data have been collected in this impoundment.

Crystal Lake (WBIC 45200)

T16N R21E Sec. 31, surface acres = 152, S.D.F. = 1.87, maximum depth = 61 feet

At 152 acres, Crystal Lake is a moderately fertile, natural lake, heavily used for fishing and boating. The lake's shoreline is intensively developed with residential dwellings. Many property owners have reinforced the shoreline with seawalls that have detracted from the aesthetic quality as well as the fisheries value. In the autumn of 1966, a sanitary district was organized and sewers were installed in the late 1970s. Due to lake level fluctuations, the sanitary district has been conducting groundwater and lake water balance studies. Information on these studies and other lake information can be found at their website, www.sanitarydistrict.com (Wakeman, 1998).

Crystal Lake is currently on the State of Wisconsin's impaired waters (303(d)) list, due to elevated mercury levels found in fish tissue. The source of the mercury is atmospheric deposition from industrial pollution. There is no way to remove the lake from the impaired waters list at this time. However, there is a fish consumption advisory in place for Crystal Lake to reduce the risk of human health exposure to mercury.

The lake's fishery has undergone several major changes over the past 45 years due to shifts in management philosophy. Over time it has been managed for walleye and northern pike, then trout and panfish, then largemouth bass and panfish. It is currently being managed for the native fish community: largemouth bass, panfish and with limited walleye due to stocking by private organizations. The existing bass and panfish community is improving due in part to the new bass size limit restrictions.

Historically, the lake was chemically treated to control aquatic plants and algae. In 1989, the DNR conducted a Sensitive Area Survey of the lake and as a result prohibited the use of aquatic herbicides and algicides in an attempt to protect the fish habitat and the water quality.

Since 1986, the water quality, aquatic plant community, and phyto- and zooplankton have been surveyed to obtain baseline water quality data and to assess trends. The results from this survey indicate that the water quality is excellent. The lake boasts some of the clearest water found in southeastern Wisconsin. A significant amount of Eurasian water milfoil is present in Crystal Lake. The DNR, in cooperation with the Crystal Lake Property Owners Association, attempted to displace the Eurasian water milfoil with a native species, Large Leaf Pondweed during the summer of 1994. The control program was effective for only a few years. By 1997 Eurasian water milfoil had again moved into the area displacing the newly planted native species (Wakeman 1998).

A public boat launch with adequate parking is available in the southwest bay. A unique boating ordinance on the lake prohibits the use of motors on Sundays. This is strongly supported by residents on the lake.

Other waters

In addition, there are at least 23 lakes and ponds and four small tributaries in this sub-watershed that are not described above. Besides Little Round Lake and 4 Bear Lakes, most of them are unnamed. Very little is known about these water bodies.

Waterway Condition

Figure 9. Kettle Moraine sub-watershed waterway condition summary.

Stream	WBIC	Size	Condition	Biological Use	Attainable Use	Supporting Attainable Use	Management Issue	Proposed Actions
Crystal Lake	45200	152 acres	Impaired	WWSF	WWSF	Yes	Mercury in Fish Tissue	Future Advisories
Mullet River	53400	16.7 miles	Good/Fair	WWSF	WWSF	Yes	Land use NPS runoff	Additional monitoring
Mullet River	53400	3.2 miles	Good/Fair	COLD Class II	COLD Class II	Yes	Land use NPS runoff	Additional monitoring

Issues

The issues listed below are in addition to the watershed-wide issues listed in this plan.

- Degradation of shoreland habitat along Crystal Lake impacts water quality and fish populations in the lake.
- Residents on Crystal Lake are concerned about decreases in water levels.
- Glenbeulah and Camp Evelyn dams reduce water quality conditions in the Mullet River.
- Glenbeulah and Camp Evelyn dams contribute to fish passage problems in the Mullet River.
- State Hwy 23 is scheduled to be reconstructed .
- Fish habitat improvements are needed in the cold-water segments of the waterways.
- Thermal impacts are suspected in the cold-water segments of the waterways.
- Master plan updates will be made to the Northern Unit - Kettle Moraine State Forest in 2011.

Management Opportunities and Recommendations

The recommendations listed below are in addition to the watershed-wide opportunities and recommendations in this plan.

In-stream and riparian corridor habitat assessment and restoration

- Work in cooperation with landowners to improve straightened portions of the Mullet River and restore wetlands in the area between Greenbush and Glenbeulah.
- Promote shoreland restoration practices among Crystal Lake shoreland owners to improve water quality and fish habitat.
- Identify and assess thermal impacts in the cold-water segments of the river.
- Secure resources to implement DNR fisheries management projects to improve habitat conditions in the cold water sections of the Mullet River.
- Promote WDNR and WisDOT wetland compensation mitigation goals to increase restoration of wetland acreage and functions in Fond du Lac and Sheboygan counties for Hwy 23.

Restore fish passage

- Work with the owners of the Glenbeulah and Camp Evelyn dams to consider fish passage restoration, secure funding and implement the projects.

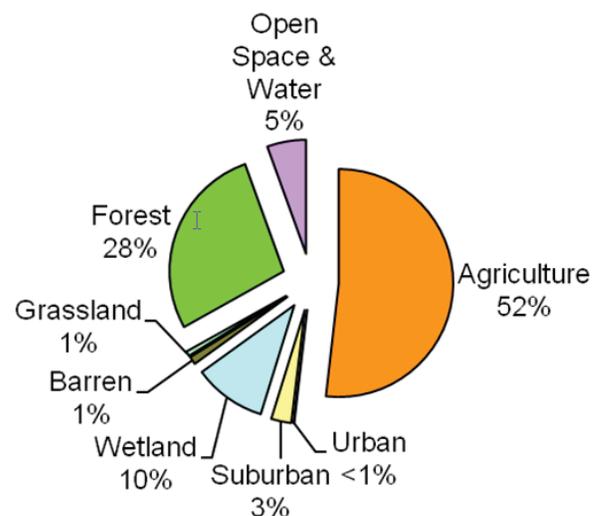


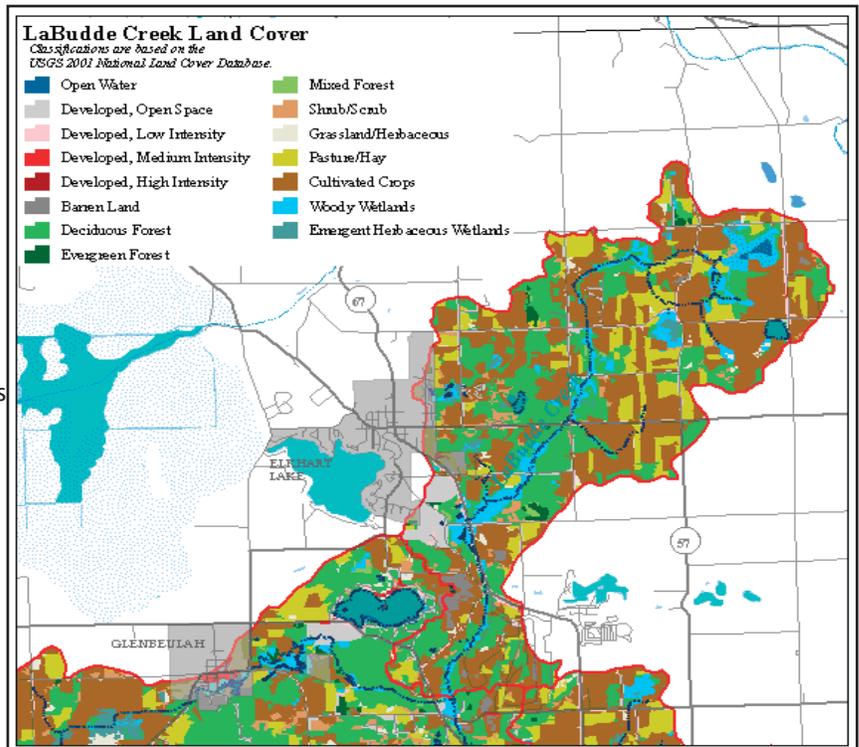
Figure 10. La Budde Creek subwatershed Land Use

Include watershed goals in public lands management

- Ensure that issues and recommendations from this plan are considered during master planning and annual property planning for the Kettle Moraine State Forest –Northern Unit.
- Ensure that public property managers are aware of and have access to water quality and biological assessment data that exist for this watershed.

Monitor and protect groundwater resources

- Continue to support the Crystal Lake water level studies.
- Identify and protect groundwater recharge areas for coldwater segments of the river.



Map 11. Land cover in the La Budde Creek sub-watershed

La Budde Creek Subwatershed

The La Budde Creek sub-watershed comprises 11% of the Mullet River watershed and is dominated by cool/cold water resources. It includes the total area drained by La Budde Creek, which flows directly into the Mullet River. La Budde Creek is one of three streams in Sheboygan County where significant amounts of naturally reproduced trout are found. The stream obtains the majority of its flow from several seepage springs along its upper mile. The stream averages 8-feet in width, 10-inches in depth, and has a relatively low gradient of 5.6-feet of drop per mile. Management on the fishery area is aimed specifically at brook trout, which have a fair amount of natural reproduction in the headwaters of the stream. The native brook trout are supplemented with hatchery fish to provide additional recreational opportunities. The La Budde Creek State Fisheries area is 426 acres in size and contains lowland brush and swamp hardwoods adjacent to the stream. Northern hardwoods, upland brush, and grassland are present in the upland areas of the property. This area is a transition between glacial moraine and clay till plain. Soil associations include the Hochheim-Theresa and Casco-Fox-Rodman associations.

La Budde Creek

T15N R21E Sec. 5 Stream Length = 7.0 miles

Class I Trout Reach (RM 7.0-3.1)

This reach of La Budde Creek originates as a series of small springs southwest of Rhine Center and ends at Badger Road. The 3.9-mile segment is Class I trout stream and has good water quality for the entire reach. Stream improvements have upgraded the trout habitat and encouraged natural brook trout reproduction. A fish community survey in 2009 rated fair. Low gradient and sedimentation may be limiting the fish population here.

Class II Trout Reach (RM 3.1-0)

This reach of the creek is classified as a Class II trout stream, and extends from its confluence with the Mullet River up to Badger Road. Water quality is rated as good. The low gradient of the stream and some sedimentation from upstream agricultural runoff limit fish and aquatic life habitat. Fish community surveys within this reach were done in 2002 and 2009, and rated fair and poor, respectively. Again, sedimentation may be having an im-

pact on the fish community. The benthic macroinvertebrate community rated good, as did the stream habitat.

Other waters

In addition, there are at least 15 unnamed lakes and ponds and three tributaries in this sub-watershed. Very little is known about these water bodies.

Waterway Condition

Figure 11. La Budde Creek waterway condition summary.

Stream	WBIC	Size	Condition	Biological Use	Attainable Use	Supporting Attainable Use	Management Issue	Proposed Actions
La Budde Creek	54800	3.9	Fair	COLD Class I	COLD Class I	Yes	Mercury in Fish Tissue	Additional monitoring
La Budde Creek	54800	3.1	Good/Fair	COLD Class II	COLD Class II	Yes	Land use NPS runoff	Additional monitoring

Issues

In addition to the watershed-wide issues listed in this plan, runoff from agricultural lands especially limits the fish community in the trout stream (cold water) sections of La Budde Creek. According to a GIS analysis of the 2001 National Land Cover Data, 33% of the riparian corridor, or 57 acres of land within that 50’ corridor, is not protected by buffers.

The master plan for La Budde Creek Fishery Area will be updated in 2010/2011. This presents an opportunity to take follow-up steps to implement recommendations suggested in this plan regarding property management.

Management Opportunities and Recommendations

In addition to the watershed-wide opportunities and recommendation listed in this plan, the following recommendations address runoff issues specific to this sub-watershed.

Protect surface water and groundwater quality

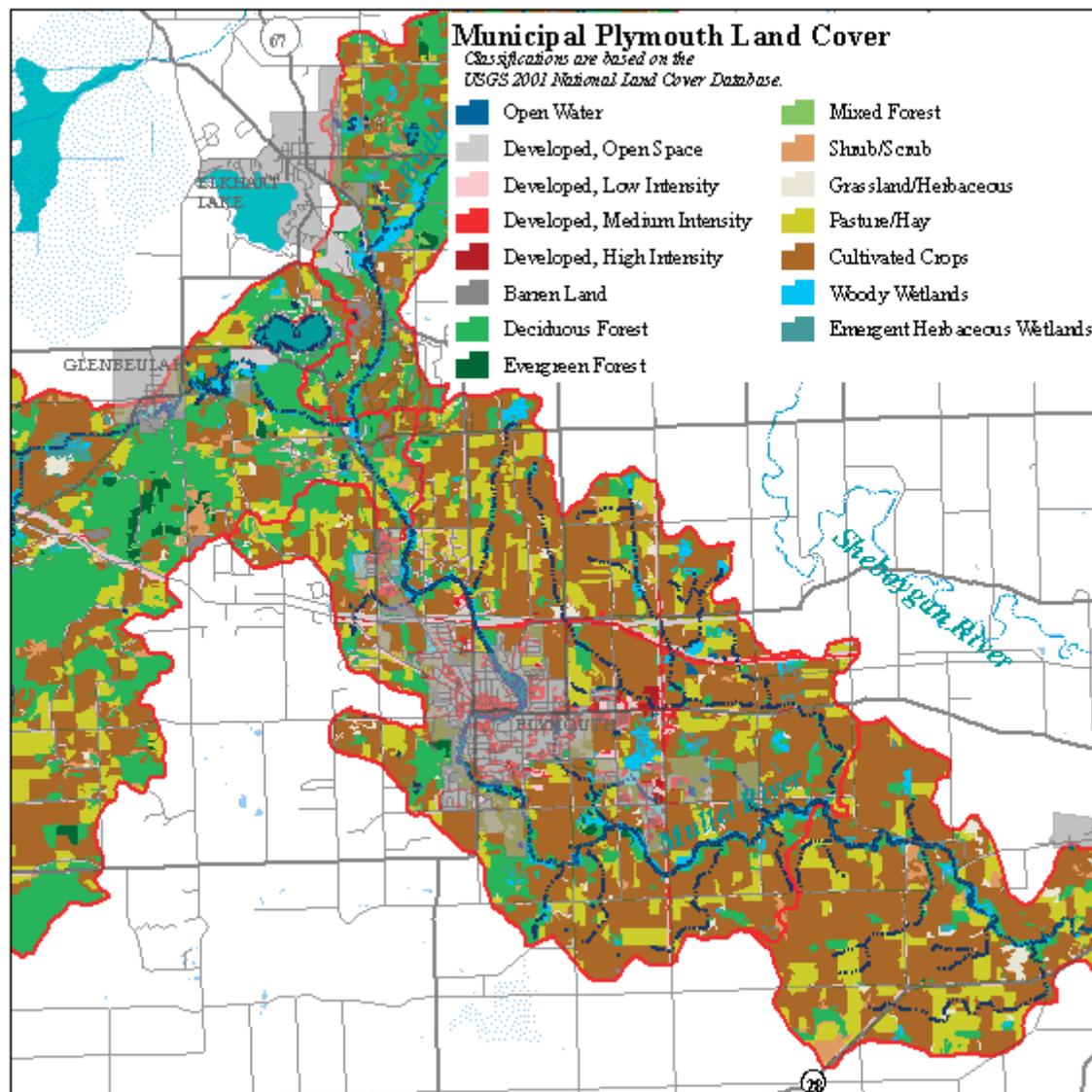
- Work to restore wetlands and riparian buffers and establish permanent vegetative cover or best management practices on agricultural lands in the headwater areas of La Budde Creek.
- Identify and protect groundwater recharge areas for cold water segments.

Include watershed goals in public lands management

- Ensure that issues and recommendations from this plan are considered during master planning and annual property planning for the La Budde Creek Fisheries Property.
- Ensure that public property managers are aware of and have access to water quality and biological assessment data that exist Secure resources to implement WDNR fisheries management activities to improve habitat in the cold water sections of La Budde Creek.

Municipal Plymouth Subwatershed

The Municipal Plymouth sub-watershed, which composes 25.1% of the Mullet River watershed, includes that portion of the watershed between the Kettle Moraine sub-watershed and the Lower Mullet sub-watershed (RM 19.2 – RM 8.4). This sub-watershed represents the most urban portion of the Mullet River watershed. The City of Plymouth, with a population of 8,241 as of July 2008 (www.city-data.com) lies on the transition between end moraine glacial deposits on the west side of the city and the



Map 12: Land cover in the Municipal Plymouth Subwatershed

plain on the east side of the city. This portion of the watershed includes significant impervious surfaces, storm sewer discharges, runoff from streets and highways including STH 23 and STH 57.

The City of Plymouth constitutes approximately 16% of this sub-watershed. Portions of this sub-watershed remain in row crop production and primary city growth has been to the north and west along the two state highways. The City of Plymouth is not currently required to have a municipal stormwater permit under NR216 because of its population size. Two WPDES permitted discharges occur in this subwatershed (Sartori Foods and Plymouth WWTP). Soil associations include the Kewaunee-Waymor-Manawa, Hochheim-Theresa, and Casco-Fox-Rodman associations.

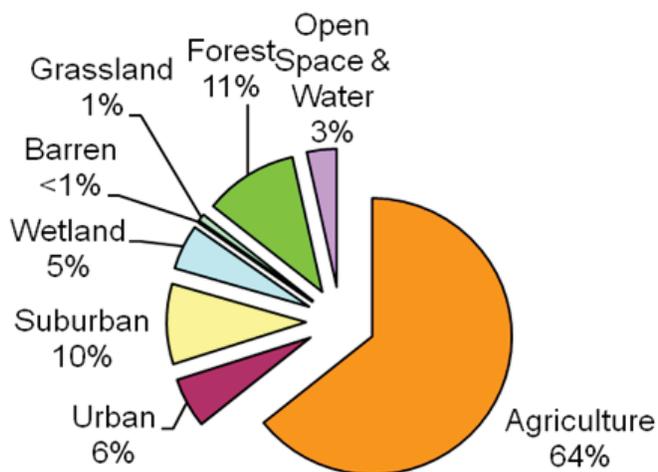


Figure 12. Land use percentages in the Municipal Plymouth

Mullet River - cold water segment (RM 19.2 – 17.8)

The trout water reach of the Mullet River includes the highest point of this sub-watershed down to the Highway 67 crossing. This section of the Mullet River is a commonly fished trout stream in Sheboygan County. Some agricultural pollution occurs within this segment, but is it not considered to be a limiting factor for the fishery.

The fishery is represented by a good diversity of intolerant species, including brook and brown trout. This section of stream is a Class II stream for brown trout and the diversity and number of individuals indicates a fair fishery. The macroinvertebrate community is represented by a wide diversity of both intolerant and tolerant genera and is rated as good to excellent.

Mullet River - warm water segment (RM 17.8 – 8.4)

This reach extends from the Highway 67 crossing down to and including the confluence with an unnamed creek (WBIC 53600) at RM 8.4. This reach of the Mullet River is classified as a warmwater sport fish community stream. Water quality in this segment of the Mullet River is fair. Water chemistry data from 2008 showed elevated levels of fecal coliform and E. coli bacteria that exceeded Wisconsin's water quality standards. Point source dischargers as well as stormwater runoff, and cropland runoff result in increased nutrients, sedimentation, and bacteria to the stream. Fish barriers and water quality impacts from the Plymouth and New Paris dams also impact the biological integrity of the Mullet River in this reach. Fish community surveys conducted in 2001 and 2008 rated fair. Numerous smallmouth bass are found in this stream reach. Benthic macroinvertebrate and stream habitat rated fair to good within the same time periods. A special project was conducted 2008 to determine the impacts of urban runoff on the Mullet River and will be completed in the near future.

Jackson Creek (WBIC 54700)

T15N R21E Sec. 16, stream length = 1.8 miles

Jackson Creek originates from a spring area in the northeast quarter of section 20. The stream flows northeasterly, crossing Highway 23, through a small marsh, and eventually draining into the Mullet River.

In 1978 the stream was downgraded from a Class I trout stream to a Class II for its entire length. Increased silt entering the stream and the resulting impacts were responsible for the classification change.

The silt comes from poor erosion control practices related to the construction of a housing subdivision and an industrial park northwest of the city of Plymouth. There is also concern that two abandoned gravel pits located in sections 17 and 20 of the town of Plymouth may be contributing to the pollutant load of the creek. The DNR owns 20 acres of land bordering a tributary to Jackson Creek in the town of Plymouth, section 17. Fish and stream habitat surveys in 2001 rated good, and the benthic macroinvertebrate community rated excellent.

Unnamed tributary (Sumac Creek) to Mullet River (WBIC 54100)

T15N R21E Sec. 34 NE SE, stream length = .84 miles, RM 13.3

This cold water stream originates from two, small, spring-fed ponds and flows to the north before discharging to the Mullet River. Land use in the area is primarily agriculture, however the stream is well buffered by woods and a significant wetland. WDNR personnel surveyed the site upstream of Sumac Road in July 2000. Fish community was limited to five creek chubs and four darter species. Habitat analysis showed an excellent buffer area of woods and wetlands with good shading; mixed bottom substrate of rocks, gravel, sand, and silt; moderate streambank erosion; very shallow water depths and very little fish cover. The shallow water depths limit the amount of fish cover available and account

for the low fish abundance and diversity. The benthic macroinvertebrate community rated excellent.

Unnamed tributary to Mullet River, (WBIC = 53600)

T15N R22E Sec. 31 NW NE, stream length = 6.65 miles, RM 8.6

This stream originates in the Town of Plymouth and flows to the southeast before its confluence with the Mullet River. Land use for the watershed is primarily agriculture; however, the stream corridor contains numerous wooded and wetland areas. WDNR personnel surveyed the site upstream of County Highway PP in August 1999. The fish community rated poor. Stream habitat rated good with excellent habitat types of riffles, pools, and runs; excellent buffer areas;

bottom substrates primarily comprised of rock, gravel, and sand; and minimal stream bank erosion. Fish cover in the habitat analysis rated poor due to relatively shallow water depths and lack of physical cover. The benthic macroinvertebrate community rated fair. Water quality may be limited due to low dissolved oxygen levels and nonpoint source pollution from agricultural runoff.

Plymouth Mill Pond (WBIC 54600)

T15N R21E Sec. 22, surface acres = 27.6, maximum depth = 6 feet

Plymouth Millpond is a moderately sized impoundment within the city of Plymouth on the Mullet River. The impoundment is very shallow with a soft mud bottom and very little rooted aquatic plant life. Periphytic blue-green algae are a problem as is high turbidity during months when carp activity is high.

Carp have dominated the fish community and carp numbers are currently very high (pers. comm. John Nelson).

Up to 1,000 Canada Geese roost on the pond causing some nuisances to riparian landowners and providing some hunting opportunities during feeding flights. Several broods of geese are produced on the pond each year (pers. comm. Steve Klock).

Public access is available by several city streets, navigable water from the upper end of the pond, approximately two acres of city property at the dam site, and by approximately 1,000 feet of shoreline on city school property. A comprehensive management plan was developed for the mill pond in 2008.

A sediment quality assessment was conducted by WDNR on June 29, 1999 on the Plymouth Millpond. Samples were collected at two sites in the soft sediment that has accumulated behind the dam. The first site was 15m upstream from the dam and consisted of two cores. The top halves of all the core samples were composited for a single sample and the bottoms of all of the cores were composited for a second sample. This enabled us to look at sediment quality that represents different time periods. The sediment that is buried to the greatest depth represents deposition that would have settled at an earlier date. A third sample was collected 100m upstream in the mid-channel of the impoundment. Two cores were collected and composited to make a single sample. Pollutant concentrations in the two sample locations showed low to moderate levels of heavy metals, polycyclic aromatic hydrocarbons, and phosphorus. This is typical with waterbodies receiving urban stormwater runoff.

In 2005, the City of Plymouth formed a mill pond committee to evaluate alternatives and measures that could be taken to improve the water quality and aesthetics of the Plymouth Mill Pond. A consultant was retained to collect information and provide recommendations which were provided to the City in a report dated January, 2008. In 2009, a summer drawdown was implemented as part of a low cost alternative measure that was identified in the report. The results of this drawdown were not formally reported although cursory observations by DNR staff indicate very little improvement in impoundment water depths was attained. The drawdown temporarily decreased water quality conditions downstream as some sediment was transported downstream by temporary erosion of the pond bottom.

New Paris Impoundment (WBIC 54400)

T15N R21E Sec. 27, surface acres = 6.9, maximum depth = unknown

This is an old dam on the Mullet River located within a historic settlement area within the City of Plymouth. The dam has partially failed and much of the river flow is within the historic millrace. No water quality data is available for this impoundment.

Other waters

In addition, there are at least 35 unnamed lakes and ponds and six tributaries in this sub-watershed. Very little is known about these water bodies.

Waterway Condition

Nonpoint source discharges and excess pollutant loading can have an impact on the water quality and biological integrity of streams. Water chemistry, fish and benthic macroinvertebrate communities, and stream habitat were assessed upstream and downstream of the City of Plymouth on the Mullet River in 2008. Bacteria and turbidity were significantly higher downstream of the city limits when compared to upstream concentrations. Bacteria concentrations did exceed water quality criteria standards. The other water quality pollutants did not exceed water quality criteria or did not have

standards for comparison. The fish and macroinvertebrate community, and stream habitat was slightly degraded within the city limits. Study results show that nonpoint source runoff from the City of Plymouth does impact the Mullet River.

Figure 13. Municipal Plymouth sub-watershed waterway condition summary.

Stream	WBIC	Size	Condition	Biological Use	Attainable Use	Supporting Attainable Use	Management Issue	Proposed Actions
Mullet River	53400	1.4	Fair	COLD Class II	COLD Class II	Partially	Land use NPS runoff	Additional monitoring
Mullet River	53400	9.4	Fair	WWSF	WWSF	Partially	Land use NPS runoff	Additional monitoring
Jackson Creek	54700	1.8	Good	COLD Class II	COLD Class II	Yes	Land use NPS runoff	Additional monitoring
Unnamed Tributary	54100	0.84	Fair	Unknown	Unknown	Unknown	Land use NPS runoff	Additional monitoring
Unnamed Tributary	53600	6.7	Fair/Poor	Unknown	Unknown	Unknown	Land use NPS runoff	Additional monitoring

Issues

The following issues are in addition to the watershed-wide issues listed in this plan.

- Snow disposal practices in the City of Plymouth are unacceptable to citizens, some of whom have called in complaints to the WDNR in 2009 and 2010.
- The eastern-most unnamed tributary to the Mullet River in this sub-watershed has water quality problems stemming from excess nutrients and sedimentation.
- Water quality storm event monitoring upstream and downstream of the City of Plymouth indicates that bacteria and suspended solids measurements within the Mullet River increase significantly within and downstream of the city during rain events.
- The Plymouth Mill Pond dam and New Paris dam affect water quality and impede fish passage.
- The Plymouth Mill Pond suffers from poor water quality and is over-run with carp and Canada geese.
- Fish habitat improvements are needed in the cold-water segments of the waterways.
- Thermal impacts are suspected in the cold-water segments of the waterways.

Management Opportunities and Recommendations

The following recommendations are in addition to the watershed-wide recommendations listed in this plan.

Fish passage restoration

- Work with the owners of the Plymouth Mill Pond dam and the New Paris dam to consider removing the dams, or if dams must remain, encourage fish passage restoration, secure funding and implement projects.
- WDNR staff should follow through with the routine inspection of the New Paris dam.

Fish habitat restoration

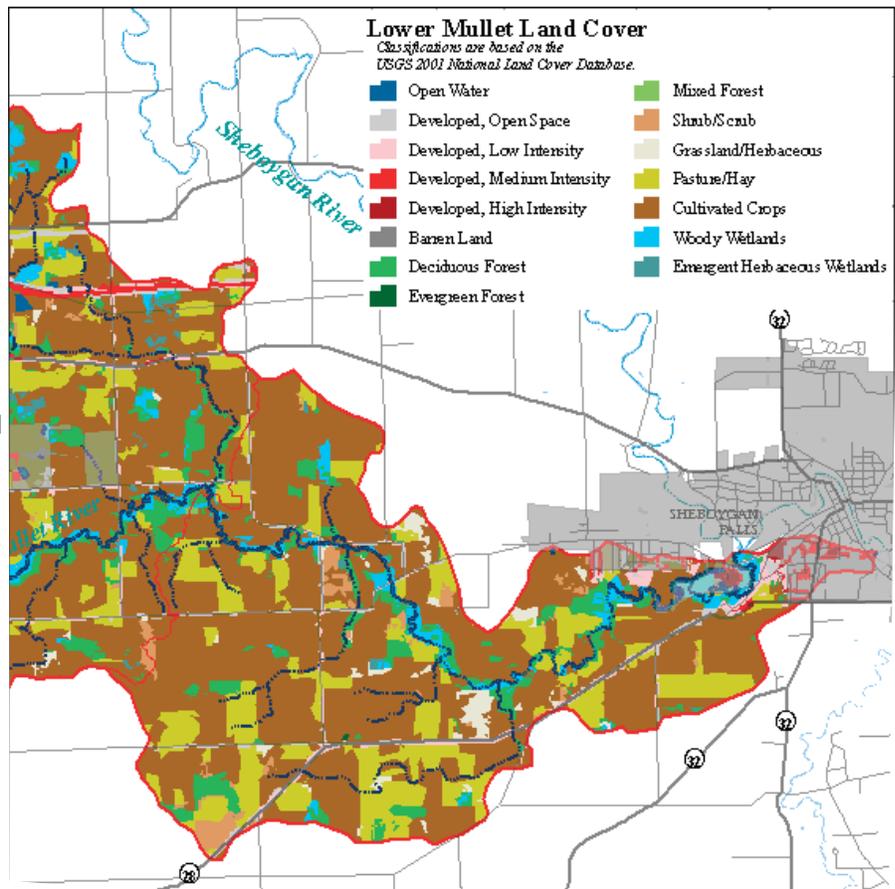
- Secure resources to implement WDNR fisheries management activities to improve habitat in the cold water sections of the river.

Minimize urban stormwater runoff

- Work with City of Plymouth on improving snow disposal practices and other aspects of stormwater management.
- Solicit volunteers for storm sewer stenciling or outfall monitoring
- Encourage the city to adopt and utilize low impact development stormwater standards for new urban development.
- Although the City of Plymouth conducts some street sweeping and storm sewer catch basin cleaning, encourage additional best practices in stormwater management and construction site erosion control to improve water quality.
- Educate Plymouth residents on yard care, yard waste disposal and other stormwater management practices.

Increase water quality monitoring and assessment

- Increase monitoring and assessment of Plymouth east tributary relative to impaired water status.
- Determine whether the Mullet River below STH 67 should be added to the impaired waters list.
- A Plymouth mill pond committee was formed and the City obtained a DNR grant to study options to improve the impoundment. Continue to work with the City on management of the Plymouth mill pond.
- Complete analysis of the WDNR 2008-2009 Plymouth storm event water quality monitoring project.
- Identify and protect groundwater recharge areas for cold water segments.



Map 13. Land Cover in the Kettle Moraine Subwatershed

Lower Mullet Subwatershed

The Lower Mullet sub-watershed, which comprises approximately 11% of the Mullet River Watershed, includes the remainder of the watershed below the confluence with an unnamed creek (WBIC 53600) at RM 8.4. This sub-watershed is dominated by agricultural row crop land uses. It is characterized by clay soils. The soil association in this sub-watershed is the Kewaunee-Waymor-Manawa association.

Mullet River - warm water segment (WBIC 53400) (RM 8.4-0)

This reach extends from the confluence with the unnamed creek (WBIC 53600) at RM 8.4 down to the confluence of the Mullet River with the Sheboygan River.

The reach is classified as a warm-water sport fish community stream. Water quality in this segment of the Mullet River is fair to good. Water chemistry and macroinvertebrate samples collected during 1994 indicate an increase in nutrients and

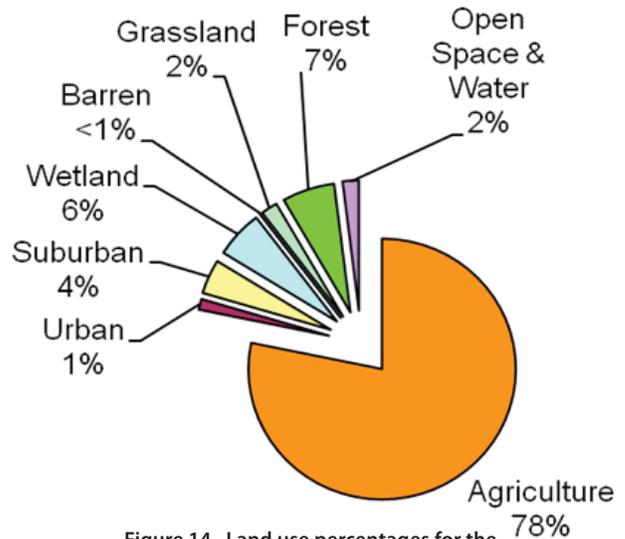


Figure 14. Land use percentages for the lower Mullet sub-watershed.

solids from upstream to downstream but overall are not limiting the stream’s biological potential. A survey was done in 2003 and the fish community rated fair.

Benthic macroinvertebrate and stream habitat rated good. Point source dischargers as well as stormwater runoff, and cropland runoff result in increased nutrients, sedimentation, and bacteria to the stream.

Richardson Brothers Impoundment (WBIC 53400 = Mullet River) T15N R22E Sec. 35, surface acres = 8, maximum depth = 7 feet

The Richardson Brothers Impoundment is located within the City of Sheboygan Falls. The privately-owned dam was constructed in 1935. Little is known about the water quality in the impoundment, and further study is needed.

Other waters

In addition, there are at least three unnamed lakes and ponds and five tributaries in this sub-watershed. Very little is known about these water bodies.

Waterway Condition

Figure 15. Lower Mullet sub-watershed waterway condition summary.

Stream	WBIC	Size	Condition	Biological Use	Attainable Use	Supporting Attainable Use	Management Issue	Proposed Actions
Mullet River	53400	8.4	Good/Fair	WWSF	WWSF	Partially	Land use NPS runoff	Additional monitoring

Issues

This sub-watershed is impacted dramatically by the conversion of wetlands, riparian corridors and woodlands to agricultural use. There is a great need to increase riparian buffers to keep sediment and pollutants from entering the river.

Fish passage is known to be impeded by the Richardson dam.

Management Opportunities and Recommendations

In addition to the watershed-wide opportunities and recommendations listed in this plan, this sub-watershed should be analyzed to determine how and where funding and effort could be prioritized and used most effectively and efficiently to reduce sediment and nutrient loads.

Conclusions

This plan provides a starting point for focused planning to further identify watershed priorities, build partnerships, seek funding, and implement projects. It is clear that an important next step is to convene ad hoc or standing committees to serve as implementation teams. The implementation teams would include key stakeholders for an issue or recommendation. For instance, one could see value in convening an implementation team for most of the recommendations:

- Inventory, monitoring and assessment team
- Agricultural areas polluted runoff team
- Developed areas polluted runoff and stream hydrology team
- Wetlands, woodlands, shorelands, and riparian buffers team
- Non-native exotic species control team
- Fish passage improvement team
- Watershed education and participation team

Additionally, one could envision instances where sub-watershed teams may be more appropriate for focusing on certain issues or recommendations specific to certain sub-watersheds.

Finally, this is an important document for developing educational materials and programs to help citizens, businesses, organizations and agencies consider, understand and connect to the watershed perspective on a scale that is meaningful. It identifies issues and recommendations that provide focal points around which stakeholders may rally.

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Mullet River