Cedar, Pigeon, Ulao, and Mole Creeks Watershed Restoration Plan

Southeastern Wisconsin Watersheds Trust, Inc.
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Cedar, Pigeon, Ulao, and Mole Creeks Watershed Restoration Plan

Prepared By:

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Executive Summary

The Cedar, Pigeon, Ulao, Mole Creeks Plan (the Plan) covers each of six contiguous HUC 12 (Hydrologic Unit Code) sub-watersheds in the geographic center of the Milwaukee River watershed (Figure 1). These sub-watersheds are on the state's impaired waters 303(d) list because they do not meet their designated uses. The impairments are due to contaminants such as phosphorus, total suspended solids, bacteria, chlorides, mercury, and legacy pollutants like PCBs. To address some of these causes, Total Maximum Daily Loads (TMDLs) were developed for total phosphorus (TP), total suspended solids (TSS), and bacteria (expressed as fecal coliform). The Plan follows the nine key elements recommended by the United States Environmental Protection Agency for watershed restoration plans.

The Plan was developed for MMSD and WDNR through grants to the Southeastern Wisconsin Watershed Trust, Inc. (aka 'Sweet Water'). The purpose of the Plan is to provide guidance in project planning, prioritization, and identification of investment opportunities among diverse watershed stakeholders working toward achieving improved water quality. This plan will serve as a non-point source implementation plan for specified subwatersheds to make progress in meeting the allocations in the TMDL and to address other pollutants found in the waters, such as chlorides, and to ultimately delist the impaired waters from the 303(d) list.

Representatives from Washington and Ozaukee Counties land and water departments have been closely involved in the development of the Plan. The Plan will be made publicly available for use by any entity that seeks resources to install, maintain, or improve practices or otherwise engage in activities to improve water quality within the planning area. Once the Plan is approved by the United States Environmental Protection Agency as a Nine Key Element Plan, the Plan may facilitate access to an expanded range of funding sources and options for watershed initiatives. The Plan is intended to provide guidance on watershed restoration during the period of 2020 – 2030 and can serve as a resource for the agricultural community including producers, agencies, and producer-led groups, as well as environmental NGOs, municipalities, quasi-public organizations, academia, and citizens of the watersheds.

Acronyms and Definitions

ACPF	Agricultural Conservation Planning Framework
AM	Adaptive Management
BMP	Best Management Practice
CAFO	Concentrated Animal Feeding Operation
CFU	Colony Forming Unit
CLU	Common Land Unit
CSO	Combined Sewer Overflow
CWA	Clean Water Act
EPA	United States Environmental Protection Agency
EVAAL	Erosion Vulnerability Assessment for Agricultural Lands
EQIP	Environmental Quality Incentives Program
FAL	Fish and Aquatic Life
FC	Fecal Coliform
DATCP	Wisconsin Department of Agriculture, Trade, and Consumer Protection
GLRI	Great Lakes Restoration Initiative
GIS	Geographic Information System
HSG	Hydrologic Soil Group
HUC	Hydrologic Unit Code
IBI	Index of Biotic Integrity
LCD	Land Conservation Department
LWCD	Land and Water Conservation Department
MDV	Multi- Discharger Variance
MMSD	Milwaukee Metropolitan Sewerage District
MS4	Municipal Separate Storm Sewer System
NGO	Non-Governmental Organization
NRCS	Natural Resource Conservation Service
PCB	Polychlorinated Biphenyls
PI	Phosphorus Index
RCPP	Regional Conservation Partnership Program
SEWRPC	Southeastern Wisconsin Regional Planning Commission
SnapPlus	Soil Nutrient Application Planner
STEPL	Spreadsheet Tool for the Estimation of Pollutant Load
SWMP	Stormwater Management Plan
TMDL	Total Maximum Daily Load
TP	Total Phosphorus
TSS	Total Suspended Solids
UWEX	University of Wisconsin Extension
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UWM	University of Wisconsin-Milwaukee
WDNR	Wisconsin Department of Natural Resources
WLA	Waste Load Allocation
WPDES	Wisconsin Pollutant Discharge Elimination System
WQT	Water Quality Trading
WWTF	Waste Water Treatment Facility

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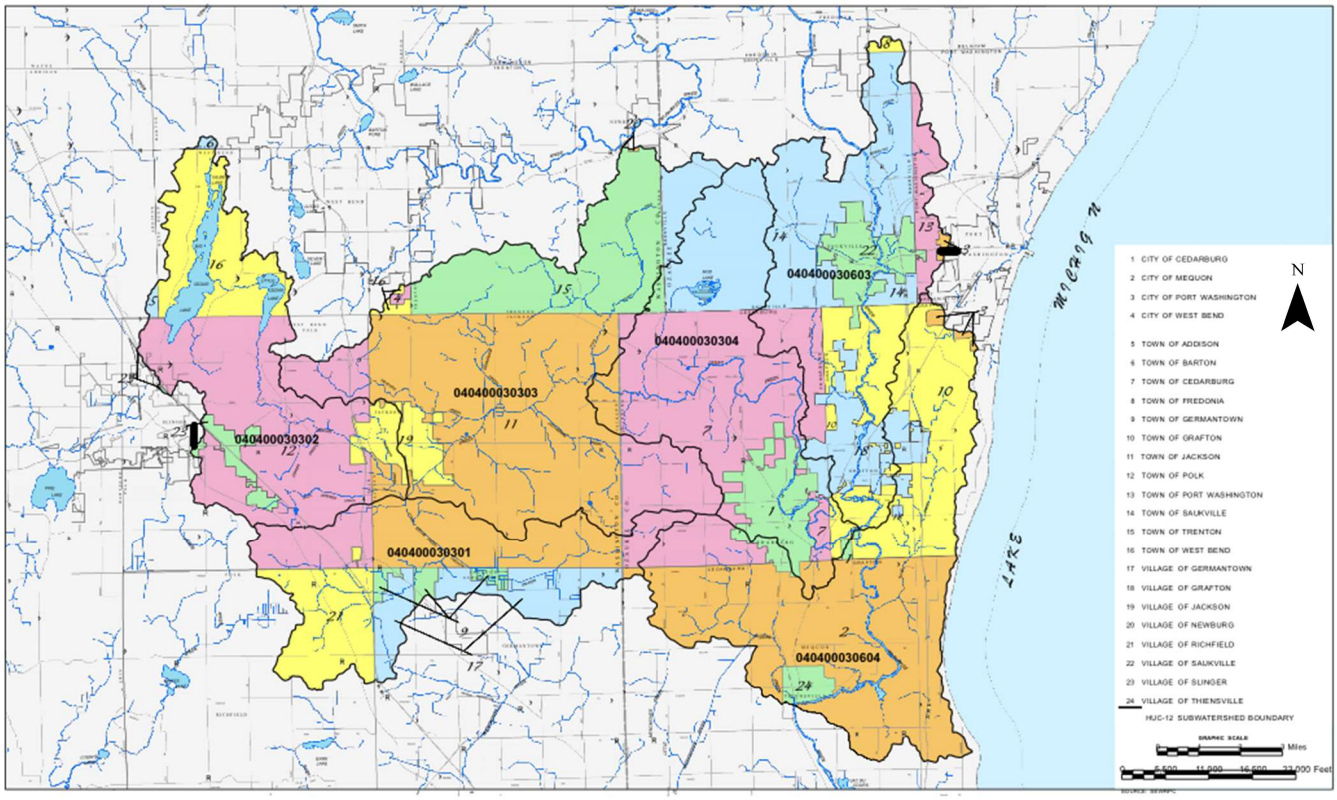
1.0 Background

1.1 Planning area

The Cedar, Pigeon, Ulao, Mole Creek Plan covers each of six contiguous HUC 12 (Hydrologic Unit Code) sub-watersheds in the geographic center of the Milwaukee River watershed (Figure 1). Cedar Creek occupies four HUC12s, and Pigeon, Ulao, and Mole Creeks fall within two adjoining HUC12s. These are two separate river systems that converge approximately two miles east of downtown Cedarburg. Together, these six HUC12s cover much of Washington and Ozaukee Counties. Part One of this plan provides overview information that is common or overlapping for the six HUC12s. Part Two contains six subsections analyzing each of the six HUC12s separately.

FIGURE 1 – MAP OF POLITICAL JURISDICTIONS WITHIN THE PLANNING AREA



1.2 Purpose of this plan

This plan will serve as a non-point source implementation plan for specified subwatersheds to make progress in meeting the allocations in the Total Maximum Daily Loads (TMDLs) determined for the Milwaukee River Basin, and to ultimately delist the impaired waters from the 303(d) list. Further detail on the TMDLs and how this plan can help to meet TMDL targets is elaborated throughout the Plan. While the TMDLs are a primary focus, measures recommended in the Plan can also help to address other pollutants found in the waters, such as chlorides.

This Plan builds upon prior watershed planning for the planning area by, among other things, ensuring that the plan satisfies the nine key elements recommended by the United States Environmental Protection Agency (USEPA) and provides reasonable assurance that the recommended management measures will help to achieve plan goals toward improved water quality and impaired stream delisting. An approved

Nine Key Element Plan may facilitate access to an expanded range of funding sources and options for watershed initiatives.

The purpose of the Plan is to provide guidance in project planning, prioritization, and identification of investment opportunities among diverse watershed stakeholders working toward achieving improved water quality over years 2020 - 2030. The Plan can serve as a resource for the agricultural community including producers, agencies, and producer-led groups, as well as environmental NGOs, municipalities, quasi-public organizations, academia, and citizens of the watersheds.

1.3 Plan preparation and context

The Plan draws in part from the most recent Washington County and Ozaukee County land and water plans, including updates, and the Total Maximum Daily Loads for Total Phosphorus, Total Suspended Solids, and Fecal Coliform, Milwaukee River Basin, Wisconsin, approved on March 9, 2018.

In turn, these plans are informed by A Regional Water Quality Management Plan Update for the Greater Milwaukee Watersheds (RWQMPU) by the Southeastern Wisconsin Regional Planning Commission (SEWRPC) - reports PR-50 and TR-39.

Various studies have been completed in the Milwaukee River watershed describing and analyzing conditions in the area. In addition, significant planning efforts in the region date back to the contemporary era (at least 1970), when SEWRPC released a Comprehensive Plan for the Milwaukee River Watershed, Volumes 1 & 2 (PR-13). In 1999, Wisconsin's comprehensive planning program, also known as the Smart Growth initiative, directed municipalities to develop comprehensive plans. These plans were to address water quality issues, either directly or tangentially, through efforts such as farmland preservation programs or other land use planning tools. In addition to municipal comprehensive plans, several other plans, projects, and initiatives have been developed over the intervening years to address issues in the watersheds, as listed below.

1.3.1 Washington County Plans

Washington County Farmland Preservation Plan (adopted by Board of Supervisors 12/10/2013) inventoried Washington County's current agricultural resources and made recommendations for farmland preservation. This plan examined the county's population, housing, and employment trends and projections in order to identify and recommend Farmland Preservation Areas.

Purchase of Development Rights (Washington County Task Force, February, 2006) determined that a countywide Purchase of Development Rights Program offers the most potential for preserving prime farmland in Washington County.

Washington County Riparian Buffer Project Plan suggests that phosphorus and TSS can be reduced significantly through buffer implementation.

Washington County Land & Water Resource Management Plan, which covers the period 2011-2020 and was last revised in 2010, aims to protect and enhance the productivity and sustainability of all cropland and reduce sediment delivery into streams, lakes, and wetlands. The plan's goals:

1. Identify local resources, concerns and priorities
2. Integrate existing resource management programs, plans, and funding sources
3. Establish partnerships between agencies, municipalities, and other organizations
4. Incorporate an information and education strategy for each plan objective

5. Identify a method to evaluate and monitor progress

1.3.2 Ozaukee County Plans

Farmland Preservation Plan for Ozaukee County: 2035 (adopted by County Board of Supervisors 7/3/2013). This plan provides recommendations for the public, county, and local officials for decision making about future development and agricultural land preservation in Ozaukee County.

Ozaukee County Land and Water Resource Management Plan was developed in 2011 and covered the period through 2015. A supplemental update covers planned implementation activities through 2018. The plan's goals include: Improved Land and Water Resources, Regional Leadership, Education, and Collaboration; Enhanced Governmental Role in Environmental Protection; and Effective Planning and Design.

1.3.3 Plans Covering Planning Area

Total Maximum Daily Loads for Total Phosphorus, Total Suspended Solids, and Fecal Coliform Milwaukee River Basin, Wisconsin addresses the pollutants that have led to low dissolved oxygen concentrations, degraded habitat, excessive algal growth, turbidity, and recreational impairments in the region's waterways. As a result of these impairments, impairments to beneficial uses within the Basin, such as preservation and enhancement of fish and other aquatic life and recreational use, have occurred. The Total Maximum Daily Load report was approved on March 9, 2018.

Regional Water Quality Management Plan Updated for the Greater Milwaukee Watershed P-R 50 (SEWRPC, 12/2007, updated 2013) serves as a master plan and data source for many of the water quality and aquatic ecosystem plans and initiatives mentioned here, including the county land and water plans below.

Nonpoint Source Control Plan for the Cedar Creek Priority Watershed Project (WDNR, DATCP, Ozaukee and Washington LCDs, 1993; web-link unavailable). The plan assesses nonpoint sources in the Cedar Creek watershed and sets forth a strategy for reducing their effects on surface waters.

Ozaukee County, Milwaukee River TMDL Watershed Based Solutions (GRAEF, 2018, technical plan; web-link unavailable). The plan researches, locates, and determines the feasibility of opportunities for watershed-based solutions to reduce phosphorous and TSS from stormwater runoff in the Milwaukee River watershed in Ozaukee, Washington, and the southern parts of Fond du Lac Counties.

1.4 US EPA Nine Key Element Watershed Plan Requirements

The Plan considers the nine key elements recommended by the US EPA for watershed restoration plans. The 1987 amendments to the Clean Water Act (CWA) established the US EPA's Section 319 Nonpoint Source Management Program. Under Section 319, states, territories, and tribes receive grant money that supports a wide variety of activities including technical assistance, financial assistance, education, training, technology transfer, demonstration projects, and monitoring to assess the success of specific nonpoint source implementation projects (USEPA 2017). Eligibility for Section 319 funding, and increasingly, other sources of funding, depends on providing "reasonable assurance" that management measures will achieve plan goals. Generally, this assurance is demonstrated through achieving EPA approval for a nine-key element watershed plan. The intent of this Plan is to satisfy the nine key elements recommended by USEPA and provide reasonable assurance that the recommended management measures will help to achieve plan goals toward improved water quality and impaired delisting.

The nine-key elements recommended by the USEPA are as follows:

1. Identification of causes of impairment and pollutant sources or groups of similar sources that need to be controlled to achieve needed load reductions, and any other goals identified in the watershed plan. Sources that need to be controlled should be identified at the significant subcategory level, along with estimates of the extent to which they are present in the watershed.
2. An estimate of the load reductions expected from management measures.
3. A description of the nonpoint source management measures that will need to be implemented to achieve load reductions in element 2, and a description of the critical areas in which those measures will be needed to implement this plan.
4. Estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon to implement this plan.
5. An information and education component used to enhance public understanding of the plan and encourage their early and continued participation in selecting, designing, and implementing the nonpoint source management measures that will be implemented.
6. Schedule for implementing the nonpoint source management measures identified in this plan that is reasonably expeditious.
7. A description of interim measurable milestones for determining whether nonpoint source management measures or other control actions are being implemented.
8. A set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made toward attaining water quality standards.
9. A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established under element 8.

2.0 Watershed Jurisdictions

Natural resources in the United States are protected to some extent under federal, state, and local law. The Clean Water Act is the strongest regulating tool at the national level. In Wisconsin, the WDNR has the authority to administer the provisions of the Clean Water Act. The U.S. Fish and Wildlife Service and U.S. Army Corps of Engineers work with the WDNR to protect natural areas, wetlands, and threatened and endangered species. The Safe Drinking Water Act also protects surface and groundwater resources. Counties and other local municipalities in the watershed area have already established ordinances regulating land development and protecting surface waters. All municipalities have ordinances relating to Shoreland and Wetland Zoning, Erosion Control, and Stormwater. Municipalities must meet the minimum requirements of County ordinances; however, they have the ability to adopt higher levels of protection (Outagamie County 2017). Described later in detail, some municipalities in the planning area are required to comply with a Municipal Separate Stormwater Sewer Systems (MS4s) permit and all municipalities in the planning area will be allocated effluent limits consistent with the Milwaukee River Basin TMDL requirements.

The planning area contains 24 municipalities (City of Cedarburg, City of Mequon, City of Port Washington, City of West Bend, Town of Addison, Town of Barton, Town of Cedarburg, Town of Fredonia, Town of Germantown, Town of Grafton, Town of Jackson, Town of Polk, Town of Port Washington, Town of Saukville, Town of Trenton, Town of West Bend, Village of Germantown, Village of Grafton, Town of

Jackson, Village of Newburg, Village of Richfield, Village of Saukville, Village of Slinger, Village of Thiensville) either entirely or partially. Figure 1 shown previously is a map showing the locations of each jurisdiction.

3.0 Watershed Overview

The broader Milwaukee River watershed is home to approximately 1.3 million people and encompasses all or portions of 13 cities, 32 towns, 24 villages. The southern quarter of the basin is the most densely populated area in the state, holding 90 percent of the basin's population. The basin is divided into six watersheds. Three of the watersheds (Milwaukee River North, Milwaukee River East-West and Milwaukee River South) contain the Milwaukee River from start to finish and collectively occupy two-thirds of the basin area (584 square miles). The other three watersheds (Cedar Creek, Menomonee River and Kinnickinnic River) are named after the major rivers they contain. Collectively the six watersheds contain about 500 miles of perennial streams, over 400 miles of intermittent streams, 35 miles of Lake Michigan shoreline, 57 named lakes, and many small lakes and ponds. Wetlands encompass over 68,000 acres, or 12 percent of the basin land area (WDNR 2016).

The Natural Heritage Inventory has documented 16 endangered, 26 threatened and 65 special concern plant and animal species, and 30 rare aquatic and terrestrial communities within the basin. The Southeastern Wisconsin Regional Planning Commission (SEWRPC) identified over 18,000 acres of high-quality natural communities and critical species habitats remaining in the basin. About 18 percent of the land area of the basin is covered by urban uses, while the remainder is considered rural. Agriculture is still dominant in the northern half of the basin (WDNR 2016).

3.1 Plan Coverage in the Milwaukee River Watershed

The Cedar Creek HUC 10 includes the entire Cedar Creek watershed and four HUC 12 sub-watersheds - 040400030301, 040400030302, 040400030303, 040400030304. Cedar Creek originates in the central portions of Washington County and flows in a generally easterly direction to its confluence with the Milwaukee River in the central part of Ozaukee County. The Cedar Creek portion of the watershed encompasses approximately 91 square miles, or about 20 percent of the total land area of Washington County.

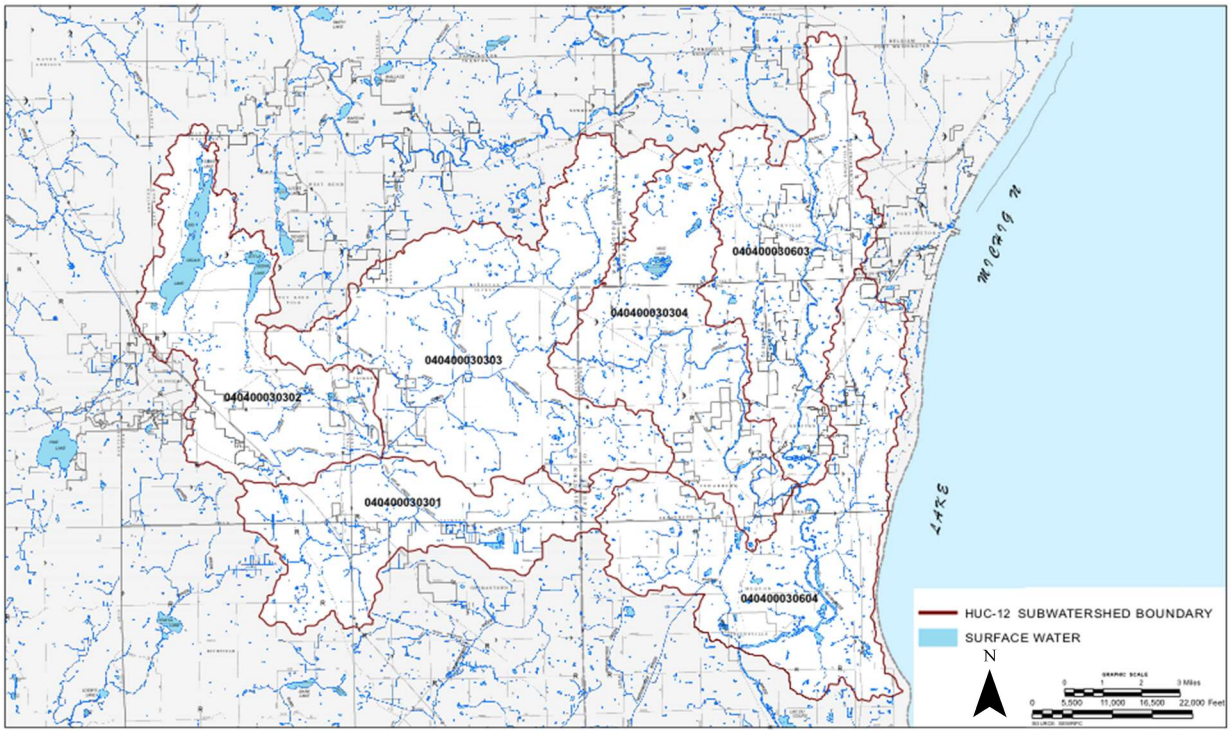
Two major wetland complexes, the Jackson Marsh State Wildlife Area and Cedarburg Bog State Natural Area, are located within the Cedar Creek Watershed, providing important habitat for fish and wildlife. Portions of the Villages of Germantown and Slinger, the City of Cedarburg, and the entire Village of Jackson are the incorporated municipalities in the watershed (Ozaukee County 2011).

The Milwaukee River-Lake Michigan Frontal HUC 10 includes two HUC 12 sub-watersheds in the Milwaukee River South Branch - 040400030603, 040400030604. Ulao Creek begins at the Ulao Swamp just south of Port Washington in Ozaukee County. The creek flows south through Grafton, Cedarburg, and Mequon where it joins the Milwaukee River just north of Thiensville. The Ulao Swamp is a wetland comprising 490 acres of the 16 square-mile Ulao Creek watershed. Mole Creek flows south/southeast for 7 miles from its headwaters in the Town of Saukville before discharging to the Milwaukee River in the Village of Grafton. Pigeon Creek flows 3.8 miles, including a significant portion in the Town of Thiensville.

TABLE 1 - SUBWATERSHEDS COVERED UNDER THIS PLAN

HUC 12 Sub-watershed Number	HUC 12 Sub-watershed Name: HUC 10 Watershed Name
040400030301	Town of Richfield: Cedar Creek
040400030302	Cedar Lake: Cedar Creek
040400030303	Jackson Marsh State Wildlife Area: Cedar Creek
040400030304	Cedar Creek: Cedar Creek
040400030603	Mole Creek: Milwaukee River-Lake Michigan Frontal
040400030604	Pigeon Creek, Ulao Creek: Milwaukee River-Lake Michigan Frontal

FIGURE 2 – MAP OF SUBWATERSHEDS COVERED IN PLAN



4.0 Human Geography of the Watershed

4.1 Watershed History: Human Settlement and Impacts on Land Use

The Milwaukee River Basin has seen major changes in land use and human settlement over the past 200 years. Historical settlements of four Native American groups—the Fox, Mascouten, Potawatomi and Menominee—were documented along the Milwaukee River, and remained in the area for a short time after their lands were ceded to the United States around 1833. Some of these groups became involved in the fur trade with French explorers during the 1700s and 1800s. Pere Jacques Marquette was the first European explorer known to have visited what is now Milwaukee. He and the other explorers who followed found an area rich with upland forests of maple, beech and basswood, and lowland areas

dominated by tamarack, cedar, and ash. In addition to the forests, the basin was rich in clean waterbodies and extensive wetlands. The abundant resources of the forests, rivers, and lakes were catalysts for the first settlers' attempts at economic development in the basin (WDNR 2016). As for many North American cities, rapid urbanization drastically altered the landscape.

Rivers were dammed, channelized, and used as sewers. Forests were cleared and wetlands were filled to create farms. Pollution from canneries have caused numerous fish kills in the past. (WDNR 2018) Early efforts to restore the watershed included the control of much of the pollution – which mainly came from point sources, like sewage treatment facilities and industrial plants. Today, the recovery process is more complex. Increased urbanization has brought rapidly growing populations, increasing the demands for more resources that are more energy-, land-, water- and fossil fuel-intensive. Agriculture and infrastructure have met the stressed demands, but at a cost to the environment (NCBI 2010). Agricultural and urban runoff is now a leading concern of non-point source water pollution, which is being exacerbated by climate change by bringing extreme heat, heavy downpours, and times of drought. Dotted across the landscape are numerous efforts protecting the watersheds. Farmers are learning new practices that increase yields while protecting the water and wetlands. Cities are learning innovative ways of building streets that minimize runoff to nearby waterways and areas are being naturalized helping to protect waters against flash flows and polluted runoff.

4.2 Demographics

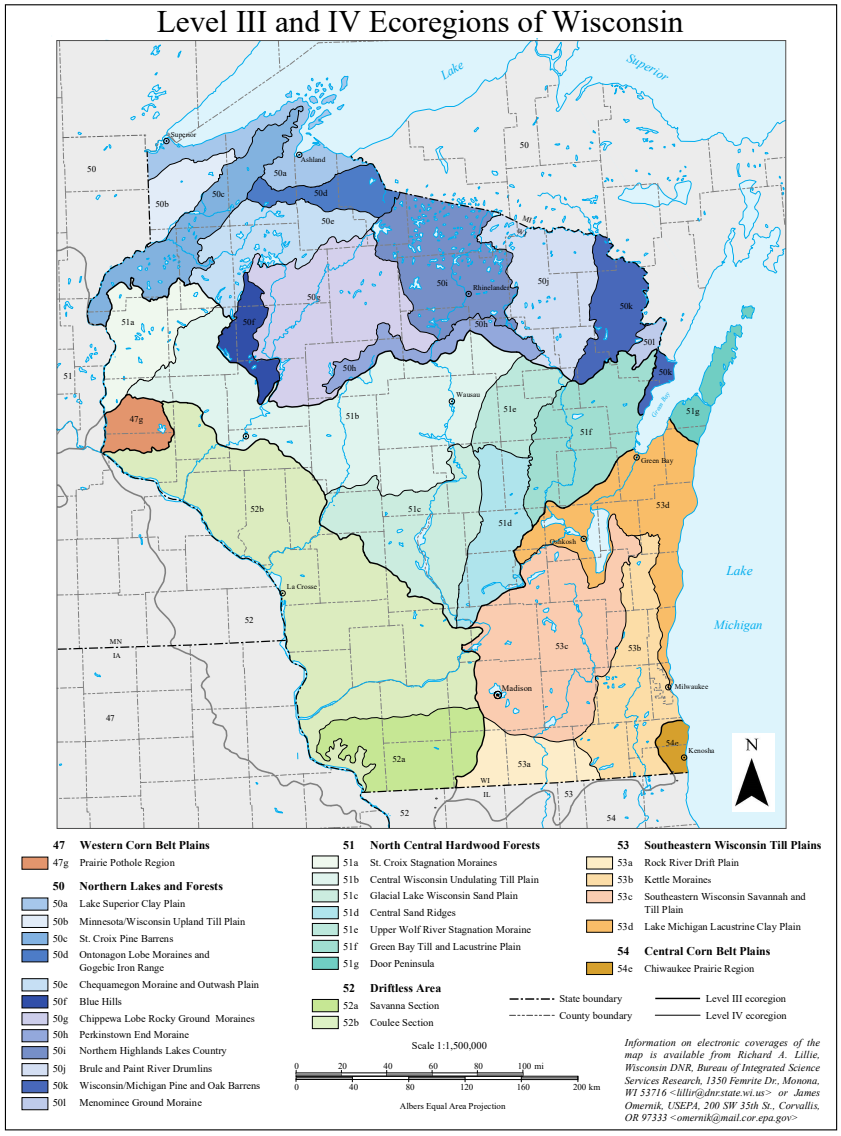
SEWRPC estimates that Washington County's population will grow 10 percent from 2016 through 2025, reaching 150,000. The Town of Jackson, in the Cedar Creek sub-watershed, is the fastest growing community in the county, and is projected to grow significantly, from 5,489 in 2000 to 9,886 in 2035. According to the recent transect surveys, Ozaukee County's natural resources (particularly Natural Area, Critical Species Habitats, and Environmental Corridors) are also under pressure from increased population and households in the form of new development (Ozaukee County 2011). The sub-watersheds in the planning area are in a strategic portion of the larger watershed, where agricultural land use is giving way to residential development as the counties grow in population. This land use change is a continuing trend and is projected to affect greater portions of the watershed in the future.

5.0 Physical Geography of the Watershed

5.1 Physical Setting Ecoregion

Ecoregions are based on biotic and abiotic factors such as climate, geology, vegetation, wildlife, and hydrology. The mapping of ecoregions is beneficial for the management of ecosystems. As illustrated in Figure 3, the east-west band geographic center of the Milwaukee River watershed is in the Southeastern Wisconsin Till Plains ecoregion -Key Code 53 (USEPA 2018).

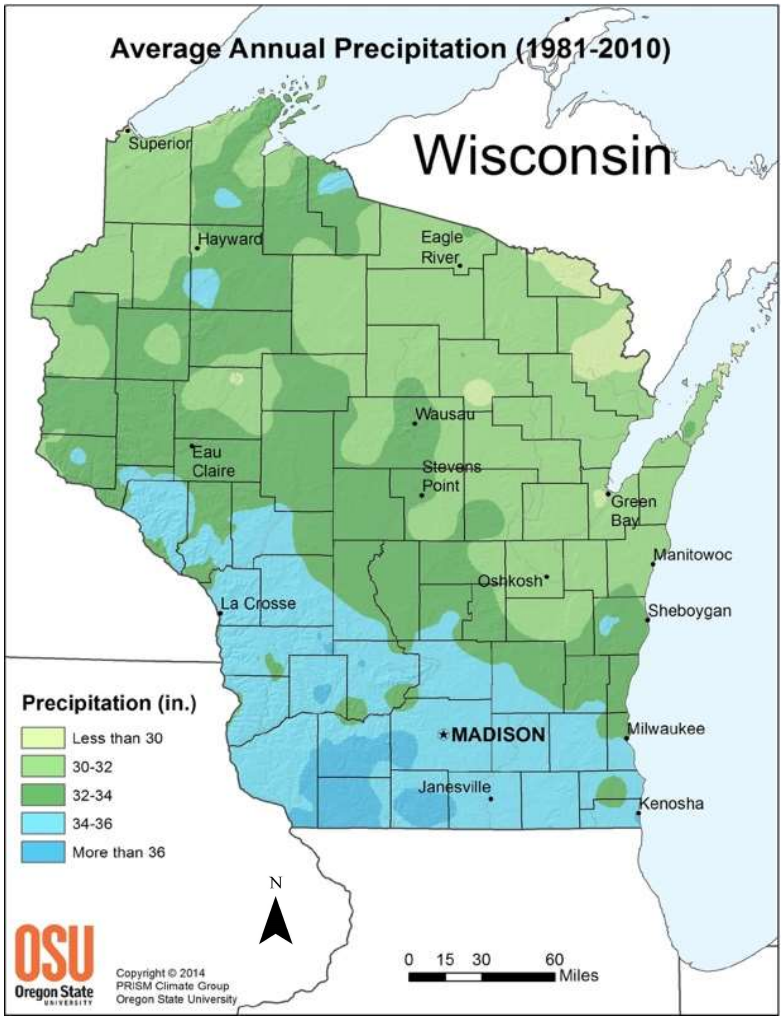
FIGURE 3 – ECOREGIONS IN THE PLANNING AREA.
SOURCE: FTP://NEWFTP.EPA.GOV/EPADATACOMMONS/ORD/ECOREGIONS/WI/WI_ECO_PG.PDF



5.2 Climate and Precipitation

Wisconsin has a continental climate that is affected by Lake Michigan and Lake Superior. Wisconsin typically has cold, snowy winters and warm summers. The average annual temperature ranges from 39°F in the north to about 50°F in the south. Temperatures can reach minus 30°F or colder in the winter and above 90°F in the summer. As depicted in Figure 4, average annual precipitation in the area is estimated between 32 and 34 inches a year in the watershed area. It is normally adequate for vegetation, although drought is occasionally reported. This climate is favorable for dairy farming; the primary crops are corn, small grains, hay, and vegetables. The rapid succession of storms moving from west to east or southwest to northeast account for the stimulating climate (UWM 2003).

FIGURE 4 - WISCONSIN PRECIPITATION. SOURCE COPYRIGHT © 2018, PRISM CLIMATE GROUP



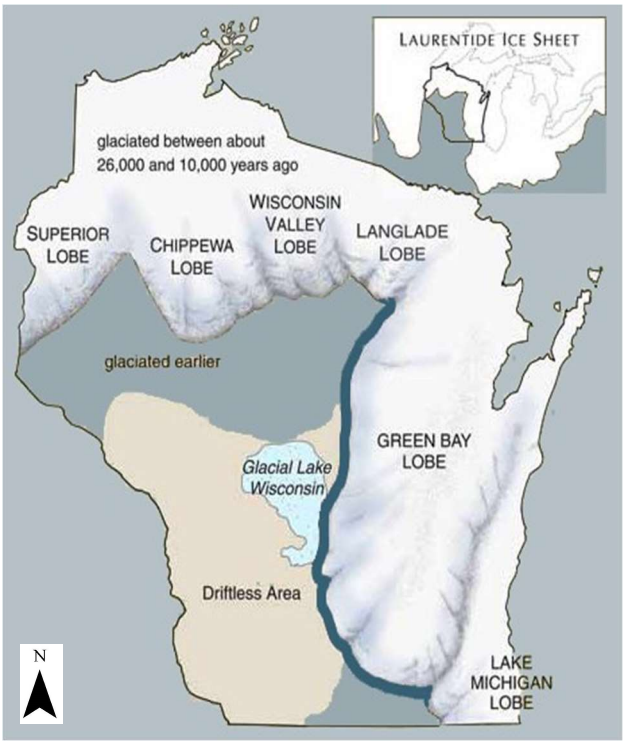
5.3 Topography and Drainage

The topography of the basin was formed by glacial deposits superimposed on underlying bedrock, and ranges from a high of 1360 feet above sea level in the Northern Unit of the Kettle Moraine State Forest to 580 feet at the Milwaukee Harbor (Figure 5). The surface slopes downward from the north and west to the south and east. The physiography is typical of rolling ground moraine, although surface drainage networks are generally well connected, leaving relatively few areas of the watershed that are internally drained (WDNR 2016).

5.4 Soil Characteristics

Soil and its characteristics are important for planning management practices in a watershed. Due to the innumerous soil types in the region, a map delineating each soil types would serve little purpose. However, a map delineating soil association - depicting significant change in the soil- is beneficial as it relates to underlying landform such as a floodplain. Other factors such as hydrological soil group, slope, and erodibility should be evaluated when planning management practices in a watershed (USDA and NRCS 2011).

FIGURE 5 - ICE AGE GEOLOGY OF WISCONSIN.
SOURCE: MOUNTAIN PRESS©, 2004



5.4.1 Soil Associations

As shown on Figures 6 and 7, soils in the Cedar Creek watershed are predominantly of the Casco-Hochheim- Sisson and Hochheim- Theresa associations, while soils in the Milwaukee-River Lake Michigan Frontal watersheds are primarily of the Kewaunee- Manawa association (SEWRPC 2018).

The Casco-Hochheim-Sisson association contains well-drained soils that have a subsoil of loam to clay loam over lake-laid silt and fine sand in gravel and sand outwash, or in sandy loam glacial till on uplands. This association is in the eastern part of the County in the townships of Farmington, Trenton, and Jackson, encompassing about 10 percent of the County. The portion of the Village of Newburg in Ozaukee County, about 53 acres, is also within this soil association (Washington County 2010).

The Hochheim-Theresa association contains well-drained soils that have a subsoil of clay loam, formed in loess with underlying sandy loam to loam glacial till on uplands. This is the predominant soil association, encompassing about 44 percent of the County. Much of the central and western parts of the County are in this soil association (Washington County 2010).

The Kewaunee-Manawa association contains well-drained to somewhat poorly drained soils that have a subsoil of clay to silty clay loam formed in thin loess and silty clay loam glacial till on uplands. Most of this association is cultivated. Erosion control and tile drainage are the main concerns in managing these soils (Ozaukee County 2011).

FIGURE 6 – SOIL ASSOCIATIONS IN WASHINGTON COUNTY. SOURCE: NRCS

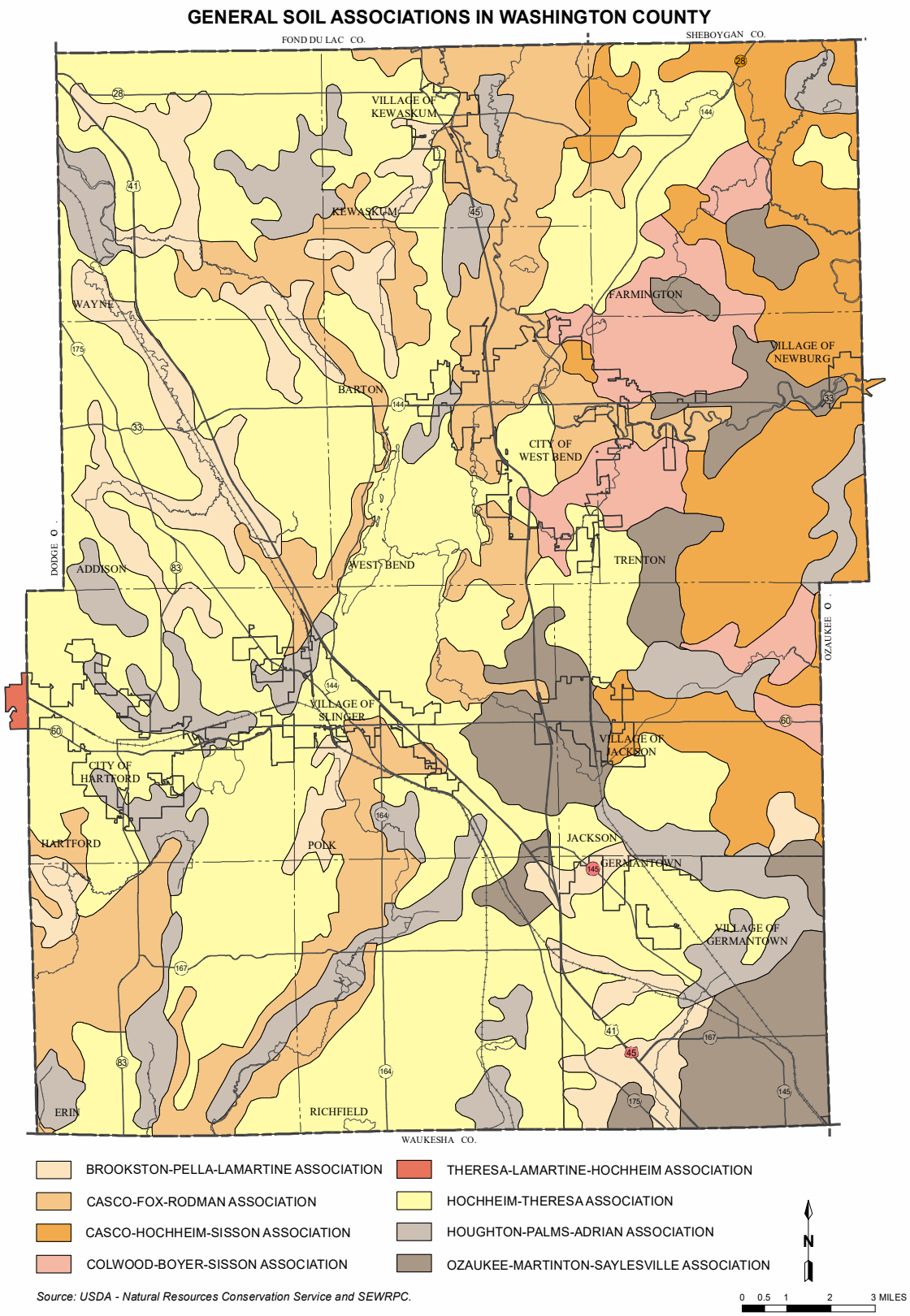
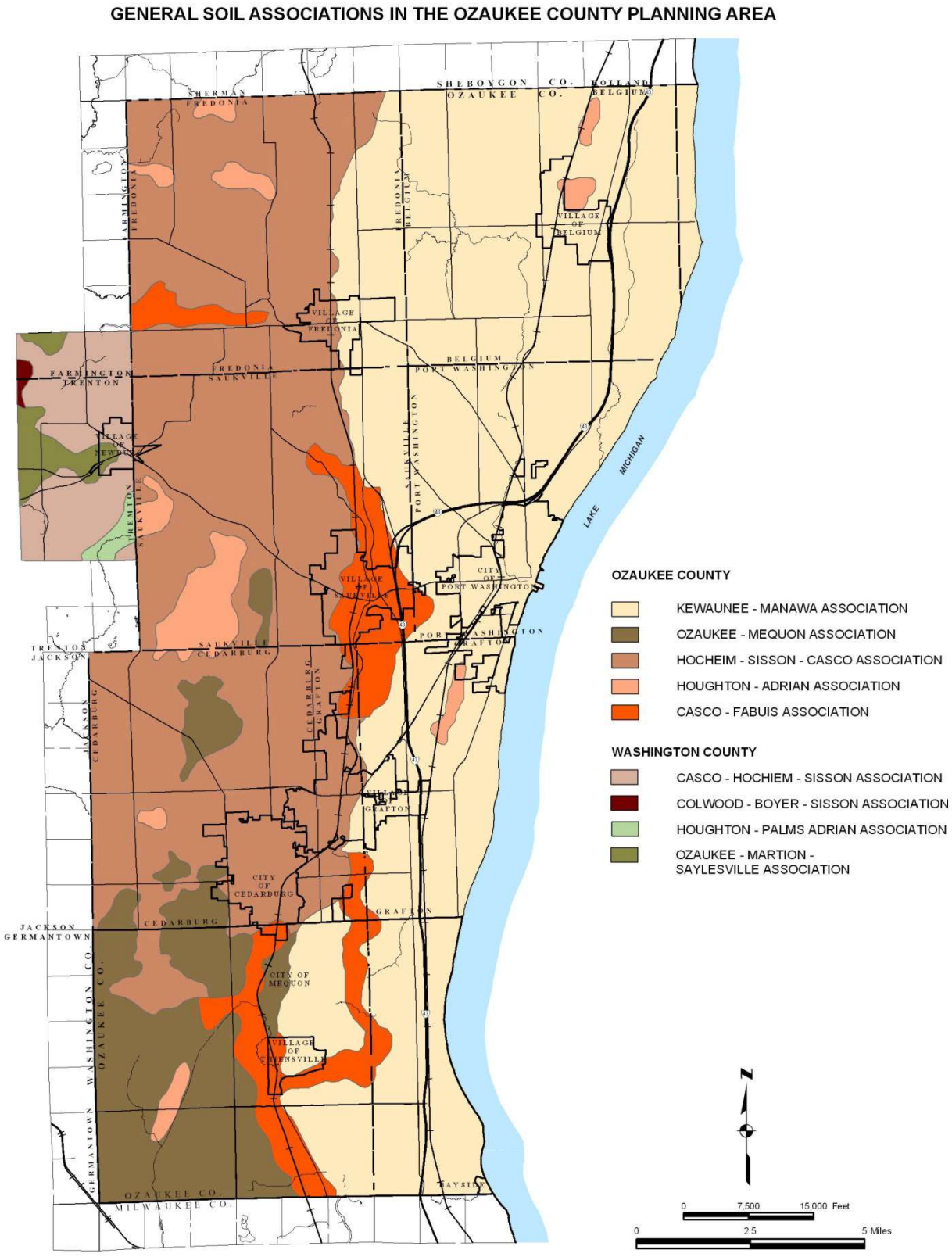


FIGURE 7 – OZAUKEE COUNTY SOIL CLASSIFICATION. Source NRCS and SEWRPC



Source: Natural Resources Conservation Service and SEWRPC.

5.4.2 Hydrologic Soil Group

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes (NRCS 2017).

The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high-water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Though soil types and soil associations varied throughout the watersheds, all soils in the planning area are classified under the hydrologic soil group C according to STEPL (Spreadsheet Tool for the Estimation of Pollutant Load) modeling.

5.4.3 Soil Erodibility and Slope

The susceptibility of a soil to wind and water erosion depends on soil type and slope. Slope steepness affects the velocity and, accordingly, the erosive potential of runoff. As a result, steep slopes place moderate to severe limitations on urban development and agricultural activities, especially in areas with highly erodible soil types. Steeply sloped agricultural land may make the operation of agricultural equipment difficult or even hazardous. Development or cultivation of steeply sloped lands is also likely to negatively impact surface water quality through related erosion and sedimentation (Outagamie County 2017).

Course textured soils, such as sand, are more susceptible to erosion than fine textured soils such as clay. The soil erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. It is one of the six factors used in the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons/acre/year. Values of K range from 0.02 to 0.55 (Outagamie County 2017). Soil erodibility factors for Cedar Creek and Milwaukee River- Lake Michigan Frontal are shown in Figure 8 and 10, soils with high erodibility are indicated by orange and red.

FIGURE 8 – SOIL ERODIBILITY MAP FOR CEDAR CREEK WATERSHEDS

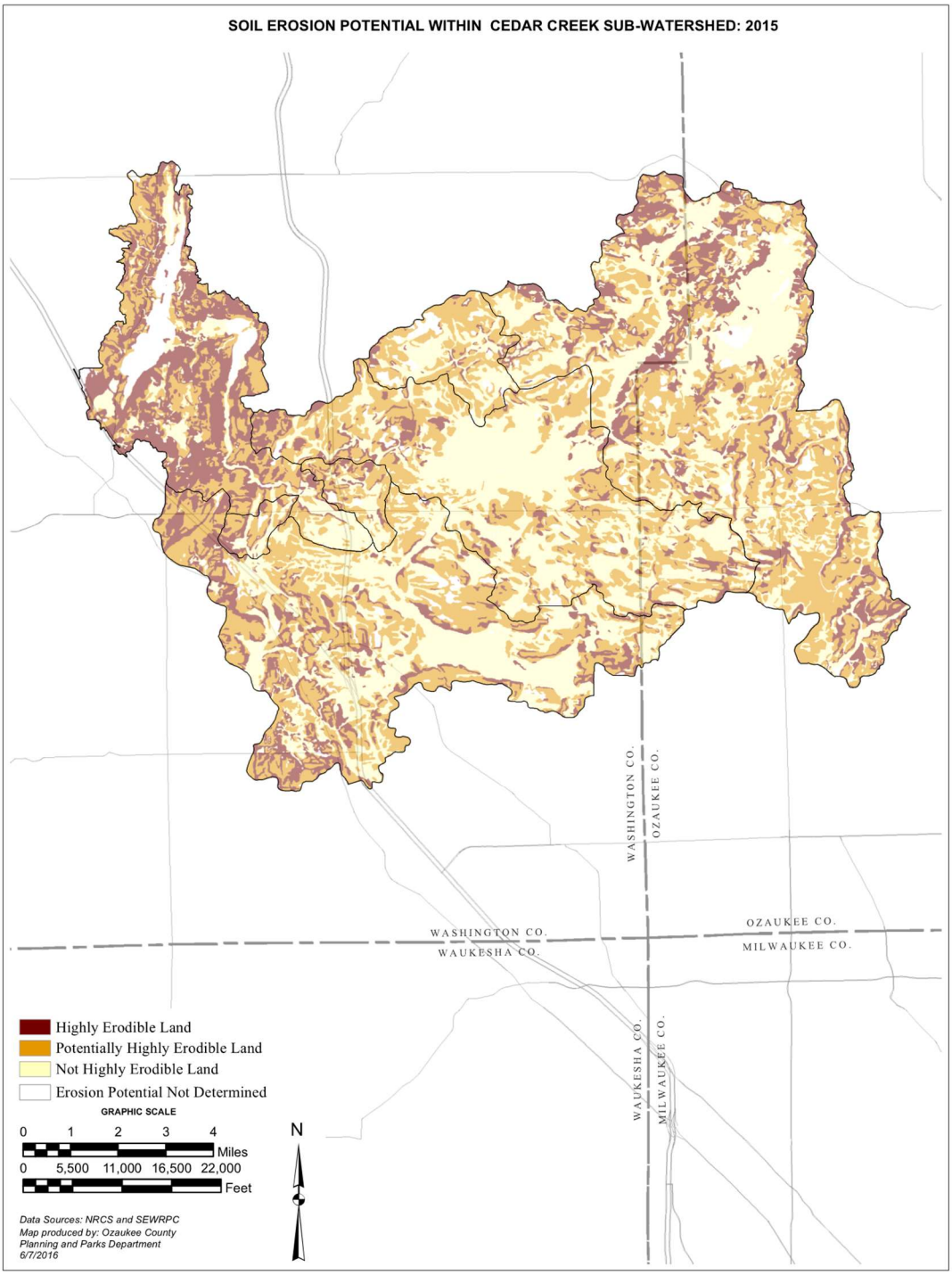


FIGURE 9 – SOIL ERODIBILITY MAP WITH CANOPY COVER FOR CEDAR CREEK WATERSHEDS

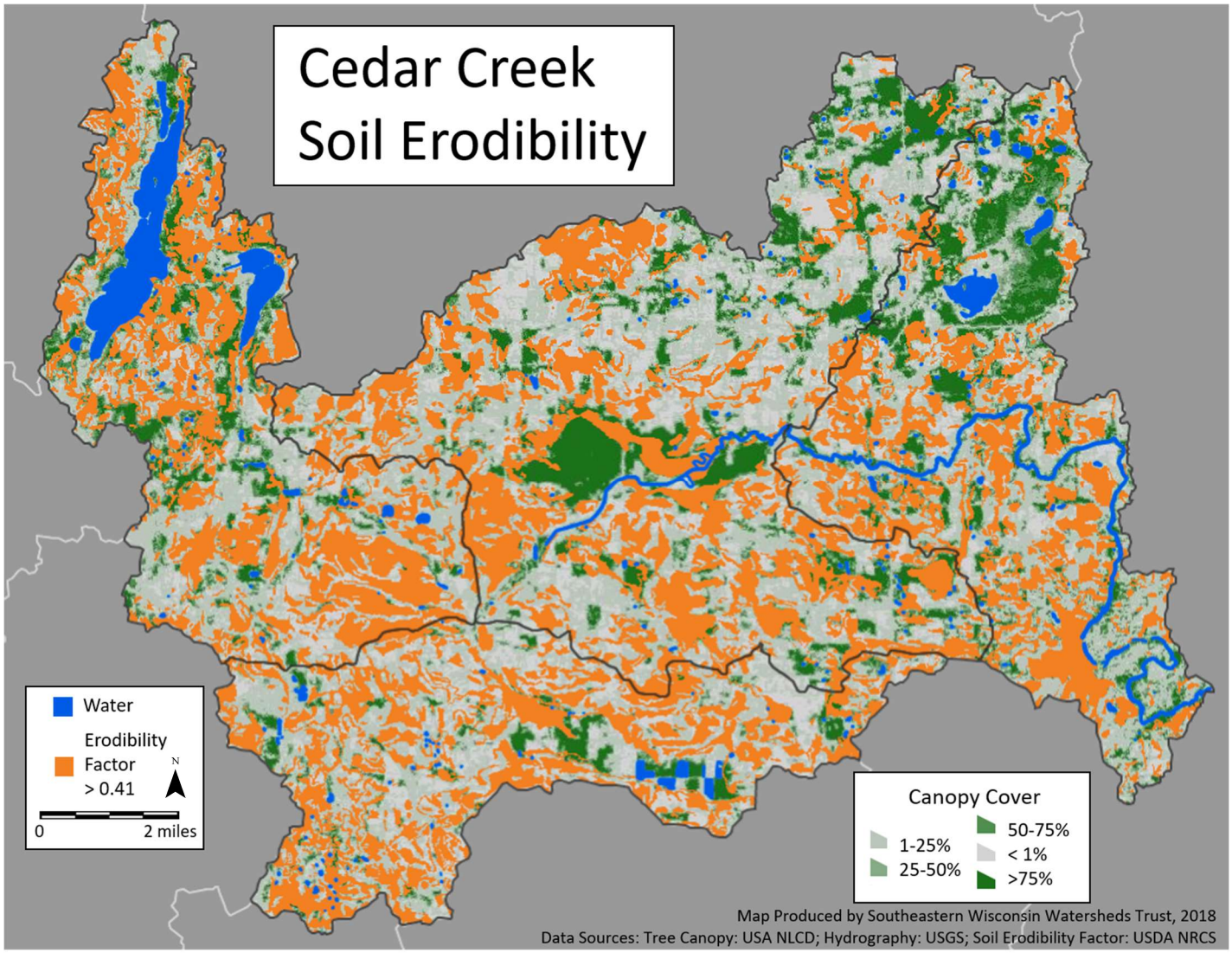
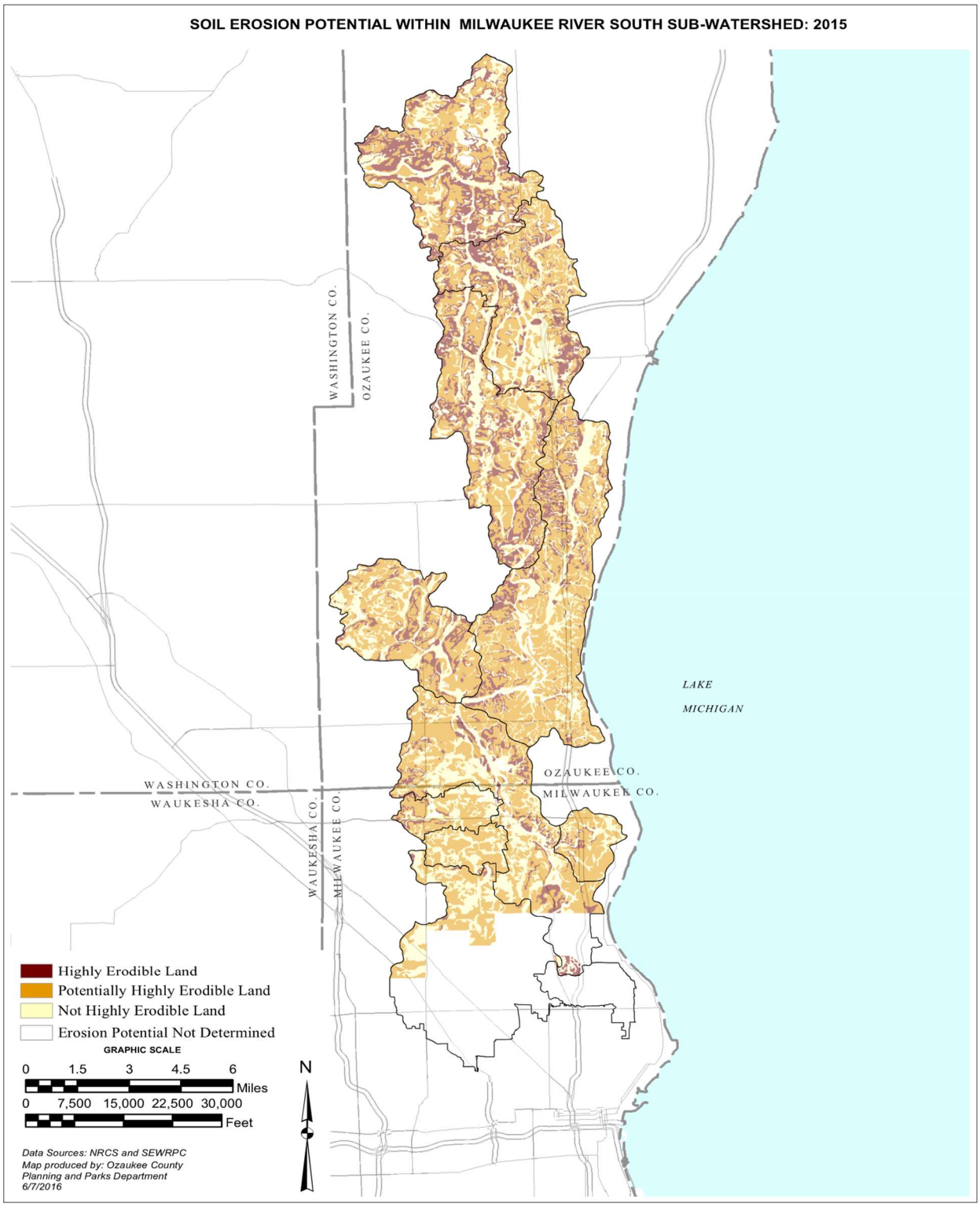


FIGURE 10 – SOIL ERODIBILITY MAP FOR MILWAUKEE-RIVER LAKE MICHIGAN FRONTAL WATERSHED.

Source NRCS and SEWRPC

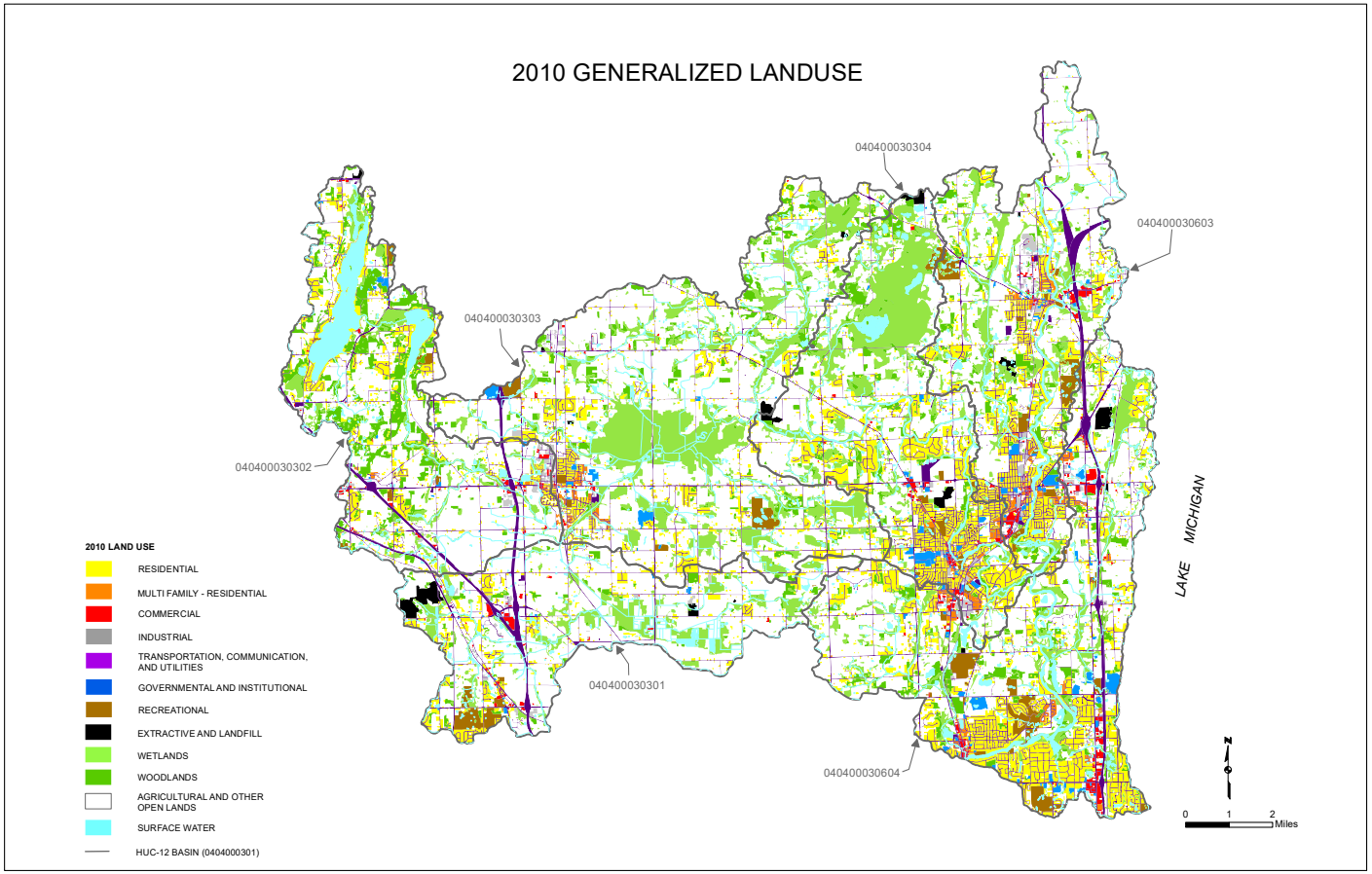


6.0 Planning Area Uses

6.1 Land Use

Figure 11 conveys land use within the planning area as of 2010. Section 2.1.3 of the 2018 Milwaukee River TMDL report also describes land use and applicable point and non-point sources of pollution occurring within the planning area.

FIGURE 11 – LAND USE IN PLANNING AREA SOURCE: SEWRPC



6.2 Sewerage Districts

Figure 12 shows the existing and planned sanitary sewer service areas in the planning area. The map also shows clusters of urban development inside and outside of the planned sewer service areas that are not currently served by public sanitary sewerage systems. Urban development in areas that are not served by sanitary sewerage systems is served by private onsite wastewater treatment systems, such as septic tank systems or mound systems. Failing or malfunctioning onsite systems can contribute pollutants (e.g., nitrogen, phosphorus and bacteria) to surface water and groundwater. Thus, the distribution of the urban enclaves shown may be a consideration in determining locations for conducting water quality monitoring (SEWRPC 2018).

Furthermore, the expansion of sewerage districts should be encouraged to the extent possible. Areas covered by sewer systems discharge less pollutants per capita than those that are covered by private onsite wastewater treatment systems.

FIGURE 12 – MAP OF PLANNNED SEWERAGE DISTRICTS IN THE PLANNING AREA

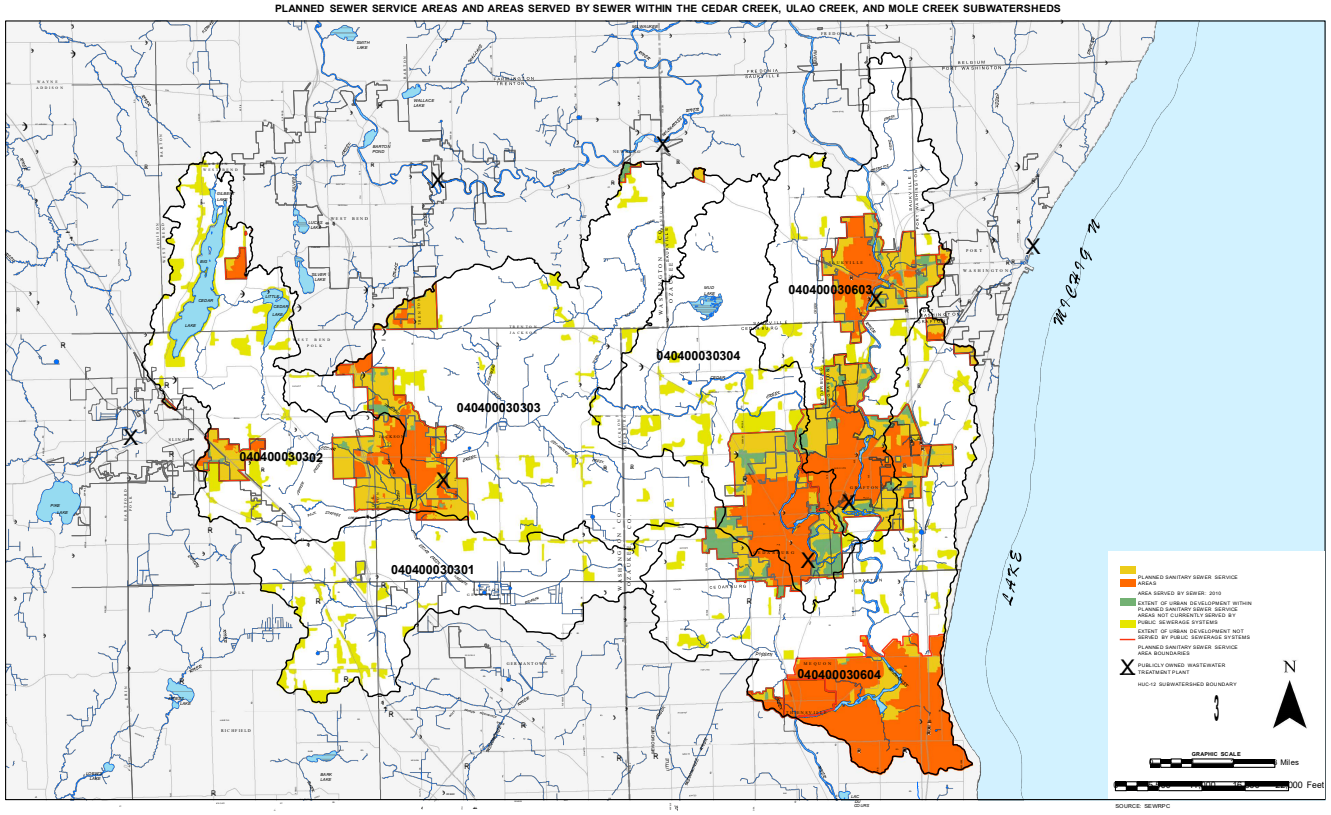
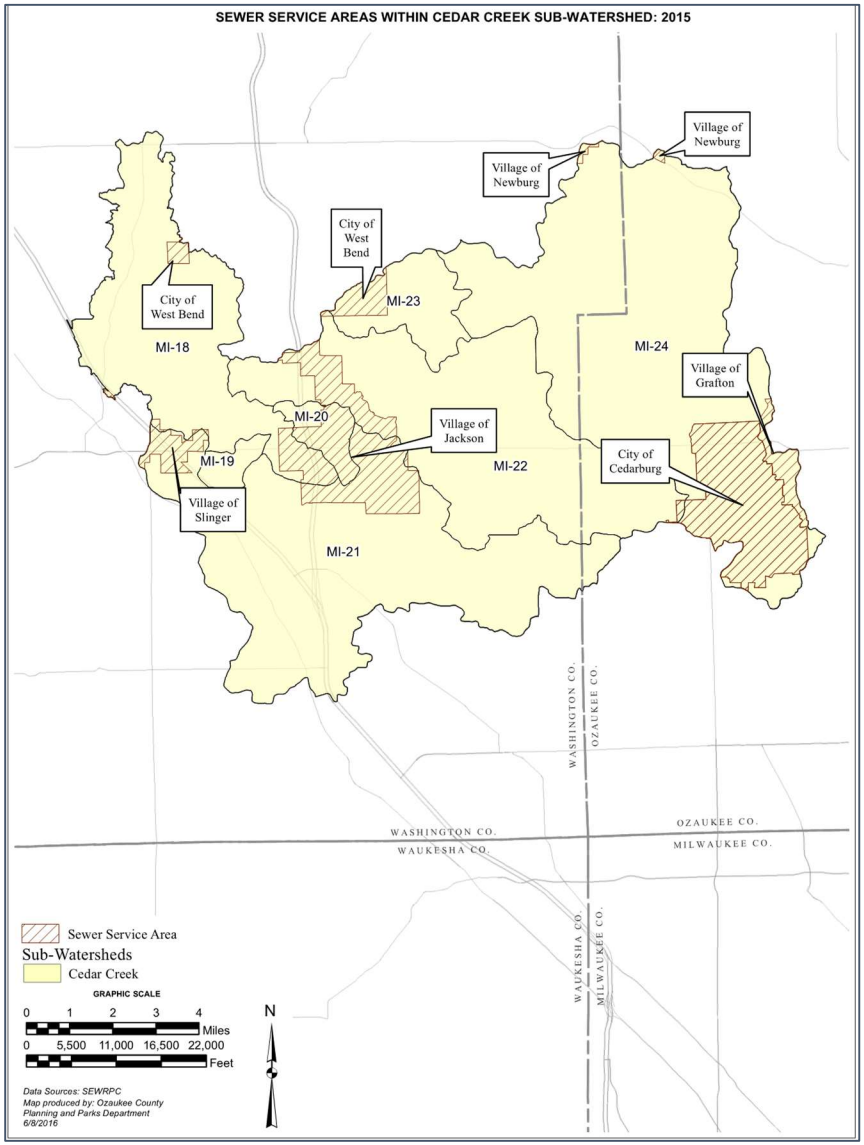
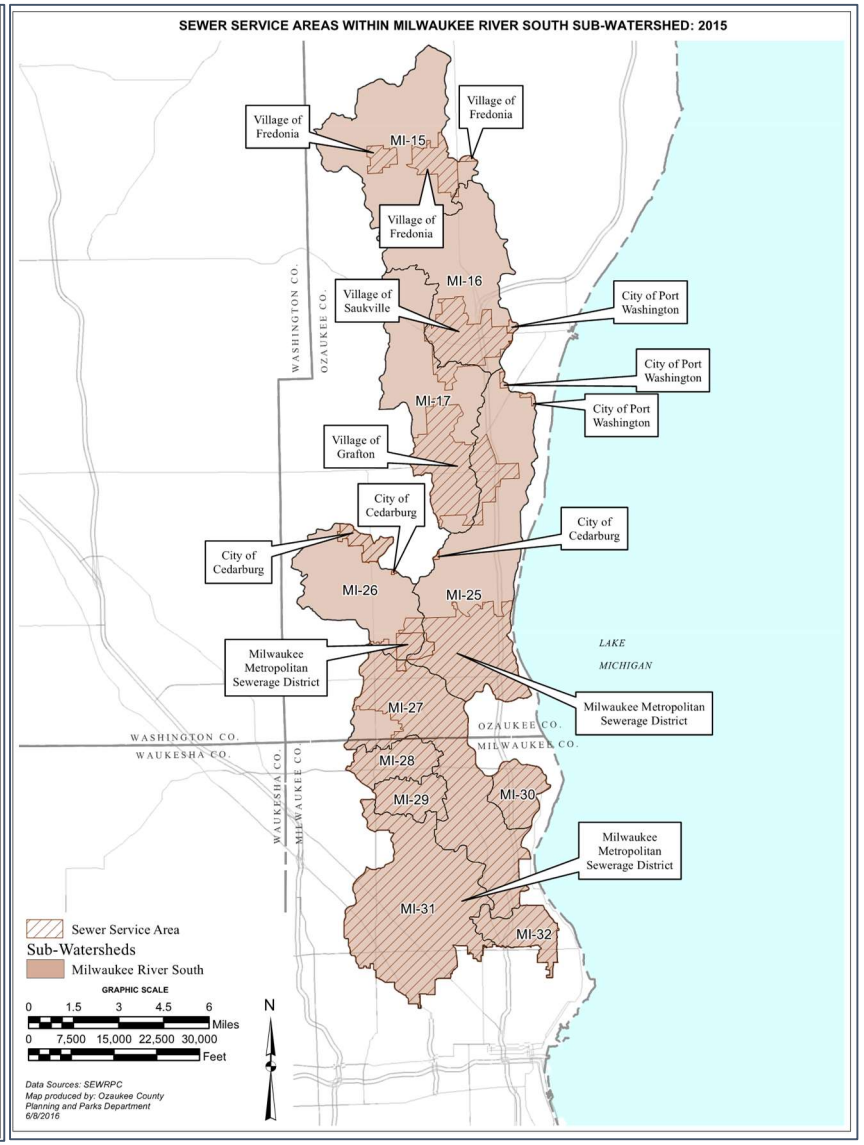


FIGURE 13 – MAPS OF CURRENT SEWERAGE COVERAGE IN PLANNING AREA





6.3 MS4 Permits

Under Wisconsin Administrative Code NR 216 some of the municipalities in the planning area are required to comply with a Municipal Separate Stormwater Sewer Systems (MS4s) permit. The permits require municipalities to reduce polluted stormwater runoff by implementing storm water management programs (SWMPs) with best management practices (BMPs). Municipalities that require an MS4 permit in the planning area are listed in Figure 14. Table 2 provides web-links to each municipality's stormwater management plan.

FIGURE 14 - MUNICIPALITIES WITH MS4 PERMITS IN THE PLANNING AREA

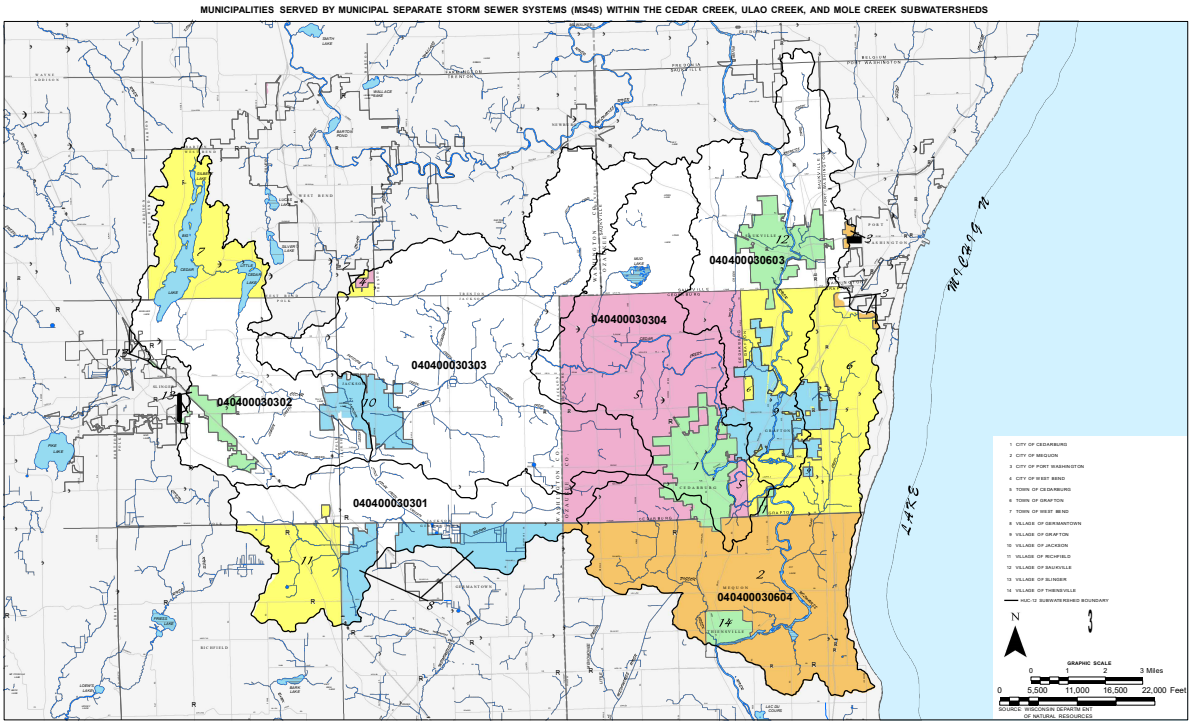


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TABLE 2 - LINKS TO STORMWATER MANAGEMENT PLANS

Municipality	Link to Stormwater Management Information/Plan
City of Cedarburg	http://www.ci.cedarburg.wi.us/city-government/city-departments/engineering/stormwater-management/
City of Mequon	https://www.ci.mequon.wi.us/publicworks/page/engineering-resources
City of Port Washington	http://cityofportwashington.com/publicworks.html
City of West Bend	http://www.ci.west-bend.wi.us/Public-Works/
Town of Cedarburg	http://www.town.cedarburg.wi.us/cedarburg-government.cfm?id=31
Town of Grafton	http://townofgrafton.org/ms4-permit-and-stormwater
Town of West Bend	http://www.townofwestbend.com/
Village of Germantown	https://www.village.germantown.wi.us/180/Stormwater

Village of Grafton	https://www.village.grafton.wi.us/115/Public-Works-Engineering
Village of Jackson	http://www.villageofjackson.com/index.asp?Type=B_BASIC&SEC={6A324B44-8C1E-4977-80FB-70C32BC219A3}
Village of Richfield	http://www.richfieldwi.gov/index.aspx?nid=140
Village of Saukville	http://www.village.saukville.wi.us/154/Public-Works-Department
Village of Slinger	http://www.vi.slinger.wi.gov/index.asp?keyword=stormwater&SEC=%7B02FC6AC7-E729-4B31-9DF5-E5D51F36EFFA%7D&Type=SEARCH
Village Thiensville	See Mequon

7.0 Water bodies, designated uses, and impairments

7.1 Designated Uses

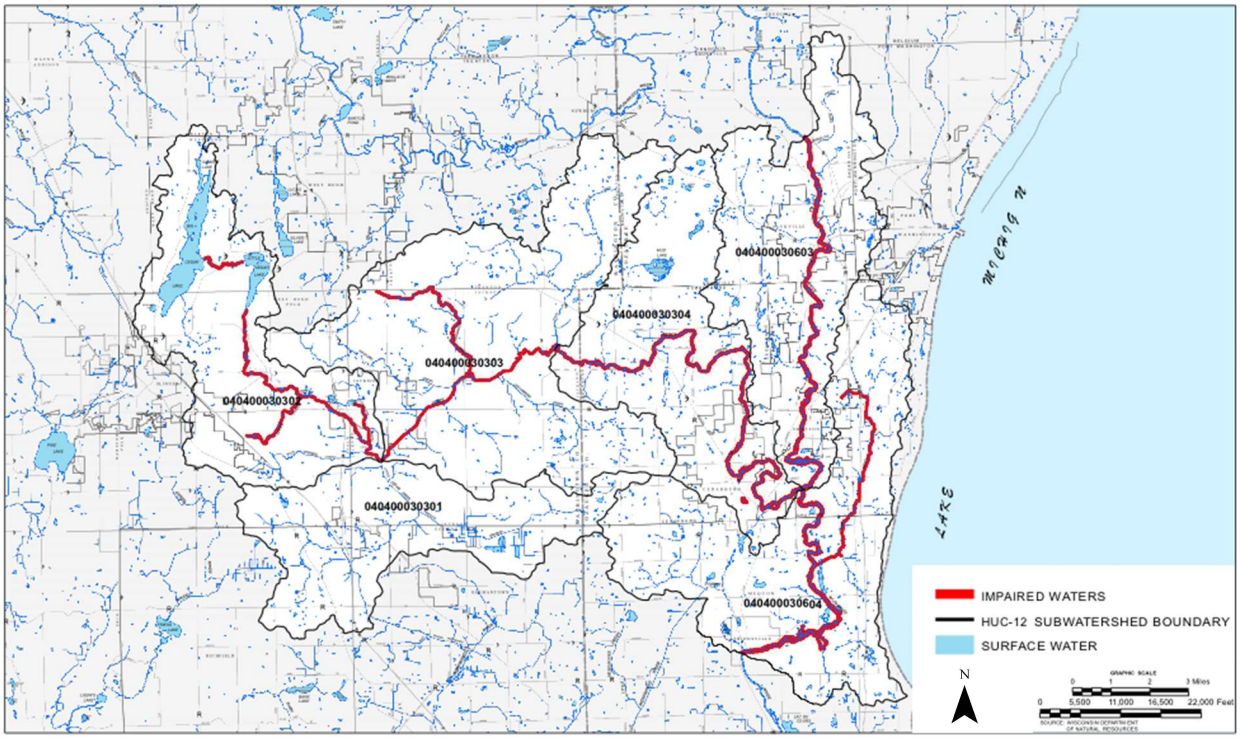
Under the Clean Water Act, Wisconsin waters are each assigned four "uses" that carry with them a set of goals: Fish and Aquatic Life, Recreation, Public Health and Welfare, Wildlife. The Fish and Aquatic Life (FAL) use is further divided into several subcategories for Streams/Rivers and Lakes. Assigning the appropriate uses—for instance, determining which Fish and Aquatic Life subcategory is appropriate—is one of the first steps in managing water quality. The use designation process involves evaluation of the resource and its natural characteristics to determine the water's highest 'attainable' use according to its potential. Table 3 lists the impaired waterbodies, along with the impairment type(s), FAL subcategory, and pollutant(s) for each waterbody (WDNR 2014) and Table 15 conveys the location of impaired waters within the planning area.

TABLE 3- IMPAIRED WATERBODIES IN PLANNING AREA

Waterbody Stream Miles	Designated Use	Impairment	FAL Attainable use	Pollutant	303(d) ID	Listing Date
Cedar Creek 0.00 –5.00	Fish Consumption	Contaminated Fish Tissue	Warm water sports fishery	PCBs	35378-69	4/1/1998
Cedar Creek 5.01 – 32.71	Fish and Aquatic Life	Unknown, PCBs, contaminated fish tissue	Warm water sports fishery	PCBs, Total Phosphorus	2014-15	4/1/2014
Cedarburg Pond 121 15 Acre Pond	Fish Consumption	Contaminated Fish Tissue	Warm water sports fishery	PCBs	2012-1234	4/1/2012
Cedarburg Stone Quarry 5.43 Acre Pond	Fish Consumption	Contaminated Fish Tissue	Warm water sports fishery	PCBs, Mercury	551	4/1/2012, 4/1/1998
Evergreen Creek 0.00 - 5.21	Fish and Aquatic Life	Degraded Habitat	Warm water sports fishery	Sediment/Total Suspended Solids	133	4/1/1998
Jackson Creek 0.00 – 1.25	Fish and Aquatic Life	Degraded Habitat	Warm water sports fishery	Sediment/Total Suspended Solids	500	4/1/1998

Milwaukee River 2.90-19.35	Fish and Aquatic Life	Elevated Water Temperature, Total Phosphorus	Warm water sports fishery	Unknown Unknown	2016-006 2014-4	4/1/2016 4/1/2014
Ulao 0-8.6	Fish Consumption	Contaminated Fish Tissue	Warm water sports fishery	PCBs	291	4/1/1998

FIGURE 15 – MAP OF IMPAIRED WATERBODIES IN PLANNING AREA

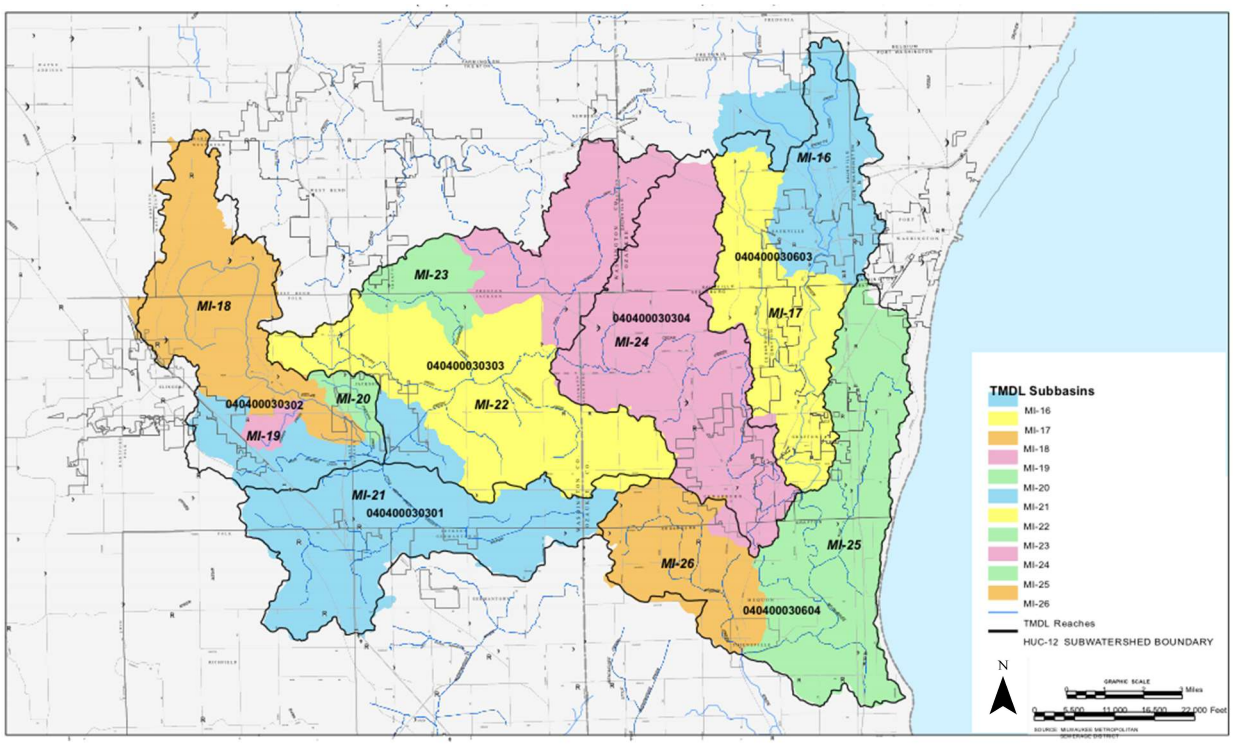


7.2 Milwaukee River TMDL and MS4 Permits

The Milwaukee River Total Maximum Daily Load (TMDL) report was created as a requirement of Section 303(d) of the Federal Clean Water Act for impaired water bodies. The TMDL determines the maximum amount of pollutants that a water body is capable of assimilating while continuing to meet the existing water quality standards. After this maximum load was established for the Milwaukee River Basin as a whole, mass loads were established for both point and nonpoint sources in the watershed (CDM Smith, 2018).

The approved TMDL for Milwaukee River Basin divides the entire Milwaukee River watershed into reaches and establishes baselines and future allocations for TP, TSS, and bacteria for the entire Milwaukee River watershed. Figure 16 shows the TMDL reaches within the planning area.

FIGURE 16 – MAP OF TMDL REACHES IN PLANNING AREA



Section 1.1 of the Milwaukee River TMDL report describes the causes/sources of TP, TSS and bacteria within the planning area and the corresponding impacts to water quality. The TMDL report's baseline loadings also provide estimates on the locations, types, and sources of pollutants (e.g., agriculture, non-permitted urban, and MS4) that are causing or contributing to water quality impairment within the planning area. The TMDL contains reach specific TP and TSS targets, allowable loads, and average percent reduction targets for both Agriculture and Non-Permitted Urban Sources and MS4 permits within the planning area (Table 4).

As MS4 permits expire and are reissued within the planning area, the permits will reflect 2018 Milwaukee River TMDL report MS4 waste load allocations per the steps 1, 2 and 3 described within DNR's 2014 TMDL Guidance for MS4 Permits and addendums A and B to this guidance:
http://dnr.wi.gov/topic/stormwater/standards/ms4_modeling.html
DNR's TMDL MS4 guidance describes the process for how MS4 permits will, over one or more permit terms, be used to achieve the TMDL-based pollutant load reductions within MS4 areas. Below is a summary of how MS4 permits will help implement the TMDL and this plan's urban reductions:

- Include TMDL reach specific waste load allocations for phosphorus, sediment and bacteria within each MS4 permit
- Provisions for revising or creating a Storm Water Management Plan (SWMP) with a TMDL implementation analysis that demonstrates that the discharge of pollutants to the MS4 system, over time, is progressing toward the percent reductions needed to meet the TMDL waste load allocations
- Establish benchmarks within the SWMP to reflect what pollutant reduction practices will be employed and over what time frame the practices will be implemented to meet reductions consistent with TMDL waste load allocations
- Track implementation of stormwater management practices by TMDL reach

- Estimate pollutant load reductions from implemented practices on a percentage basis using WINSLAMM or equivalent models/methods
- Compare load reductions achieved on a percentage basis, to TMDL pollutant reduction goals
- Report on TMDL implementation in the MS4 annual reports to WDNR and including a description of practices and pollutant load reductions achieved

TABLE 4 - TMDL PERCENT REDUCTIONS FOR MS4 TP AND TSS BY TMDL REACH AND MUNICIPALITY WITHIN THE PLANNING AREA
SOURCE: MILWAUKEE RIVER BASIN TMDL, TABLE A.28

Reach	TP Target (mg/L)	Annual Allowable TP Load for Reach	TSS Target (mg/L)	Annual Allowable TSS Load for Reach (lbs/year)	Municipality	MS4 Area (acres)	Average TP Percent Reduction for MS4	Average TSS Percent Reduction for MS4
MI-16	0.075	1697	12	271,547		**2,058**	**75%**	**69%**
					Grafton (T)	5	75%	69%
					Port Washington (C)	92	75%	69%
					Saukville (V)	1,961	75%	69%
MI-17	0.075	1759	12	281,517		**7,356**	**81%**	**70%**
					Cedarburg (T)	1,617	81%	70%
					Grafton (T)	3,397	81%	70%
					Grafton (V)	2,029	81%	70%
					Saukville (V)	312	81%	70%
MI-18	0.075	1184	12	189,496		**5,299**	**68%**	**71%**
					Jackson (V)	142	68%	71%
					Slinger (V)	64	68%	71%
					West Bend (T)	5,093	68%	71%
MI-19	0.075	55	12	8,844		**4**	**56%**	**72%**
					Slinger (V)	4	56%	72%
MI-20	0.075	109	12	17,362		**710**	**75%**	**76%**
					Jackson (V)	710	75%	76%
MI-21	0.075	2746	12	439,332		**8,938**	**75%**	**76%**
					Cedarburg (T)	425	75%	76%
					Germantown (V)	3,279	75%	76%
					Jackson (V)	846	75%	76%
					Mequon (C)	41	75%	76%
					Richfield (V)	3,638	75%	76%
					Slinger (V)	710	75%	76%
MI-22	0.075	1273	12	203,673		**3,012**	**49%**	**71%**
					Cedarburg (T)	2,753	49%	71%
					Jackson (V)	241	49%	71%
					West Bend (T)	17	49%	71%
MI-23	0.075	229	12	36,630		**254**	**47%**	**74%**
					West Bend (C)	90	47%	74%
					West Bend (T)	164	47%	74%
MI-24	0.075	3196	12	511, 431		**13,646**	**77%**	**67%**
					Cedarburg (C)	2,849	77%	67%
					Cedarburg (T)	9,548	77%	67%
					Grafton (T)	312	77%	67%
					Grafton (V)	413	77%	67%
					Mequon (C)	524	77%	67%

MI-25	0.1	9382	12	336,698		**15,968**	**36%**	**77%**
					Cedarburg (C)	74	36%	77%
					Grafton (T)	5,975	36%	77%
					Grafton (V)	797	36%	77%
					Mequon (C)	8,821	36%	77%
					Port Washington (C)	105	36%	77%
					Thiensville (V)	196	36%	77%
MI-26	0.075	822	12	131,510		**7,536**	**87%**	**88%**
					Cedarburg (C)	195	87%	88%
					Cedarburg (T)	1,596	87%	88%
					Mequon (C)	5,328	87%	88%
					Thiensville (V)	417	87%	88%

Note: % reduction is calculated as the average of the monthly % load reductions from baseline. Baseline MS4 loads reflect 20% TSS reduction from no controls (and associated reduction of TP).

7.3 Agriculture and Non-Permitted Urban Sources

Table 5 shows the TMDL percent reductions for TP and TSS for Agricultural and non-permitted urban areas by TMDL reach and corresponding HUC 12 watershed within the planning area. Agricultural and non-permitted urban area non-point sources of pollutants are generally eligible for grants using Federal Section 319 funding.

TABLE 5 – AGRICULTURE AND NON-PERMITTED URBAN TP AND TSS OVERALL PERCENT REDUCTION BY REACH SOURCE: ADAPTED FROM DRAFT TMDL TABLES 1

TMDL Reach and Corresponding HUC 12[1]		TP Reduction		TSS Reduction[2]	
		Agricultural	Non-Permitted Urban	Agricultural	Non-Permitted Urban
MI-16	040400030603	53%	76%	65%	70%
MI-17	040400030603	57%	82%	61%	71%
MI-18	040400030302	40%	69%	63%	72%
MI-19	040400030302	40%	57%	68%	73%
MI-20	040400030302,03	49%	76%	68%	76%
MI-21	040400030301,03	51%	76%	70%	76%
MI-22	040400030303	37%	50%	68%	72%
MI-23	040400030303	38%	49%	72%	75%
MI-24	040400030303, 04	52%	78%	60%	68%
MI-25	040400030604	23%	38%	62%	78%
MI-26	040400030604	65%	-	75%	-

1. There is no exact correspondence between TMDL reach boundaries and individual HUC 12 boundaries in the Cedar Creek watershed. Together, reaches MI-18 through MI-24 correspond with the HUC 10 area and boundaries.
2. Percent reduction is calculated as the average of the monthly percent load reductions from baseline.

7.4 Water Quality Monitoring

Since 1964, several agencies and organizations have collected surface water quality monitoring data within the Milwaukee River watershed to assess whether the streams and rivers are meeting state water quality standards (WQS). Much of the past and recent sampling has occurred within the MMSD planning area where samples have been collected from more than 352 sampling sites. With the approval of the Milwaukee River watershed TMDL, the WDNR, USGS, SEWRPC, MMSD, and Milwaukee Riverkeeper share water quality monitoring data, tools, strategic plans, and assessments to streamline efforts (SEWRPC 2018). This joint effort will be used over time, to verify and track progress in maintaining WQS within the District planning area's TMDL reaches and/or HUC 12 watersheds.

Some agencies that collect water quality data make those data publicly available through internet databases. Examples of such databases include the WDNR's Surface Water Integrated Monitoring System (SWIMS) database, which contains data collected by the WDNR and through the joint WDNR/University of Wisconsin- Extension (UWEX) Water Action Volunteers (WAV) citizen-based monitoring program, and the U.S. Geological Survey's (USGS) National Water Information System (NWIS) Database, which contains data collected by the USGS and the WDNR's SWIMS database (SEWRPC 2018).

MMSD's data collected for long term monitoring is publicly available through USEPA's STORET database or via MMSD Records Request (https://www.mmsd.com/about-us/contact-us/records-request). MMSD coordinates with DNR to upload MMSD data into SWIMS.

7.4.1 Supplemental Water Quality Data Collection

Under a 2017 contract with MMSD, SEWRPC produced a strategy memorandum entitled Milwaukee River Watershed Monitoring Strategy Phase 1: Cedar Creek, Mole Creek, Pigeon Creek, and Ulao Creek (M03029P40). The purpose of the water quality monitoring strategy memo was to provide guidance for assessing the average state of water quality in streams for water quality constituents related to the pollutants and impairments of concern in the Milwaukee River Basin TMDL. The strategy provided water quality monitoring site selection criteria, considerations for sampling methodology, and a list of 30 sample site recommendations within six HUC12 watersheds (SEWRPC 2017). As noted by SEWRPC in their memo, it is recommended to follow the Wisconsin Consolidated Assessment and Listing Methodology (WisCALM) for Clean Water Act Section 305(b), 314, and 303(d) Integrated Reporting standards for sample collection and handling, to assure investments of time and resources in monitoring can support the impaired streams delisting objective.

Following the guidance outlined in the 2017 SEWRPC memo, MMSD in 2017 initiated Phase 1 Baseline Water Quality Sampling (P-2721) at 25 sites in the Pigeon, Ulao, Mole and Cedar Creek watersheds, to establish baseline trends in 2018 and 2019 for areas where little water quality data existed. The selected monitoring sites are listed in Appendix G, Figure 60A. The Phase One baseline water quality monitoring supports the collection of 560 samples at 25 sites over a 28-month period September 2017-November 2019. Collected samples were processed at the District's state certified lab. Sample results have been reviewed for quality assurance and control and will be uploaded in 2020 into the DNR SWIMS Database for public access. The final report is available on MMSD's website under What We Do/Water Quality/ Reports and Research: Baseline Water Quality Monitoring Upper Milwaukee River Watershed Phase 1 Report 2018-2019. An MMSD generated ArcGIS Story Map interface can also be accessed to share project information among watershed participants.

Phase 1 Baseline Monitoring site locations are available in Appendix G, as tables and maps. In 2020 interested individuals and organizations will determine staff resources and volunteer recruitment needs to prioritize monitoring resources across baseline sites and DNR stream assessment units to continue to fill gaps in information and eliminate redundancy where possible. DNR also has resources that will be allocated to biological monitoring at select locations where there is existing chemical data collected, where sites are safe and accessible to sample at under varying seasonal and weather conditions, and where there is a need for additional information.

Based on the 2018-2019 sampling results from the Baseline Water Quality Monitoring Phase 1 study it was confirmed that all of the watersheds in this plan are exceeding water quality criterion for at least two of four measured pollutant parameters. Table 47 (Appendix I) summarizes the findings within each watershed. The red-shaded cells represent median concentration rates exceeding TMDL allocations and water quality criterion.

Median monthly sample concentration data for HUCs 301, 303, 603 and 604 shows these watersheds have high TP and bacteria concentrations, and therefore are a high priority for plan implementation. HUC 302 median monthly sample data shows the Cedar Lake Cedar Creek watershed does not have high TP nutrient concentrations or TSS, but does have high bacteria loading in many sites, and therefore is a high priority for addressing sources of bacteria. HUC 304, Cedar Creek East median monthly sample data trends high in TP, and therefore should focus on TP reducing practices as a high priority. There are two sampling sites that have median concentrations below water quality criterion for TP, TSS, and bacteria. However, these sites are downstream from other sites that have exceeding concentration trends and lie within watershed stream networks that need address in specific critical areas.

- HUC 301 Town of Richfield-Cedar Creek sites LCC01 and KRB01b have TP concentrations greater than 0.075 mg/L criteria. LCC01 has TSS concentrations greater than 12 mg/L. Priority sites identified upstream will be evaluated for erosion and runoff management. All three monitoring sites in this watershed have high bacteria concentrations.
- HUC 302 data shows all stations are below TP criteria but have high bacteria. HUC 302, however, may be a priority for soil health practice implementation as four of the five stations are consistently above bacteria criteria. Vulnerable fields identified upstream from monitoring site LEC01b and JKC01 will be evaluated for erosion and runoff management. The sub-area between CDC 03 and JKC 01 may be critical area for TP reduction practices to prevent exceeding TP median target values. For example, streambank erosion along Polk Springs is being addressed as a 2020 project upstream from monitoring site PSC_01, within HUC 302.
- HUC 303 watershed, Jackson Marsh State Wildlife Area -Cedar Creek reveals all monitoring sites are above 0.075 mg/L TP criteria. Because all monitoring sites are above TP criteria outreach, promotion, and implementation off soil health practices is a high priority for land owners and managers operating in this area. Within HUC 303, there is an increase in TP and TSS concentrations between CDC 04 and CDC 05 sites. The sub-area between these two stations may be a critical area for soil health practices.
- HUC 603 Village of Grafton-Milwaukee River, RCD01 may be a critical area for soil health practices to address TP as well as bacteria.

HUC 604 priority sites of greatest concern should seek to address the high TP and bacteria loading along the Ulao Creek. Both ULC01 and ULC02 sites exceed stream criteria for TP and bacteria, as consistently found in prior sampling conducted by other project partners in recent years.

The results of the baseline monitoring, combined with erosion vulnerability modeling (EVAAL), serves as a preliminary planning tool to further evaluate highly erodible, steep sloping lands, or critical areas. Appendix J provides maps of each HUC12 watershed, with modeled estimates of where productive land use and erosion vulnerability may be contributing to area runoff. These critical areas and prioritized sites from the EVAAL and STEPL modeling may help identify sources contributing to high pollutant concentrations in surface waters. However model outputs need to be field-verified. These estimates are mere forecasts of where watershed partners can focus technical assistance and design efforts to prioritize investments and implementation for focused impact. The watershed implementation team will evaluate site conditions, to survey for signs of erosion and runoff.

Milestone: County Land and water Conservation Staff in year one of the plan implementation will review and confirm noticeable resource management concerns/pollution sources at sites identified as most vulnerable priority sites determined from the EVAAL and STEPL analysis. Then, focused outreach and allocation of county staff resources and technical assistance will be provided to landowners/operators of the priority sites – that promote practices described in this plan. In year 3 and 6 of plan implementation, County land and water staff will revisit the priority sites, and assess practice implementation/maintenance, and then identify if existing or additional practices are necessary. Water quality monitoring will be prioritized to occur downstream from priority sites that meet and maintain the practice milestones listed in this plan, or at existing monitoring sites to document incremental change in water quality data within each HUC 12 sub-basin. Priority sites or sections of a HUC 12 sub-basin that do not meet this plan's practice milestones will be low priority for water quality monitoring.

7.4.2 Citizen Volunteer Monitoring

Milwaukee Riverkeeper has managed a community-based water quality monitoring program since 2006. As of 2019, Riverkeeper manages over 90 volunteers testing over 110 sites throughout the Milwaukee River Basin. Each year, Riverkeeper creates a water quality report card that summarizes data from Milwaukee Riverkeeper volunteers and staff, as well as data from the WDNR, MMSD, Ozaukee County, and other watershed stakeholders that either provide data or upload it into the DNR database. Historic report cards can be accessed at the Milwaukee Riverkeeper website at: https://www.milwaukeeriverkeeper.org/category/report-cards/. The Report cards represent one of several methods that will be used to evaluate water quality and aquatic habitat conditions within the six HUC 12 sub-basins described in this plan. Close coordination with WDNR is necessary to accurately evaluate water quality monitoring results, over time. Such coordination will be critical to determine if stream monitoring results reflect trends or just typical variation in stream TP, TSS and bacteria concentrations.

Milwaukee Riverkeeper collected data at 4 sites within the Pigeon Creek subwatershed, 2 sites within the Ulao Creek subwatershed, 1 site within the Mole Creek subwatershed, 10 sites within the Cedar Creek subwatershed, and 5 sites on the mainstem of the Milwaukee River within or adjacent to these subwatersheds monthly from May through October per WDNR WisCALM guidance. Ozaukee County monitors 6 sites in the Mole Creek subwatershed, and 9 sites in the Ulao Creek subwatershed monthly.

Pigeon, Mole, and Ulao Creeks are part of the larger Milwaukee River South Branch subwatershed. The location of the Riverkeeper and Ozaukee County sampling sites are shown in Appendix G, Figures 60B, 70, and 71.

You can find results of Milwaukee Riverkeeper's 2018 Milwaukee River Basin Report Card Volunteer WQ monitoring online at their website: https://www.milwaukeeriverkeeper.org/2018-milwaukee-river-basin-report-card/.

High levels of turbidity and sediment are a problem for all creeks, but especially for Ulao Creek downstream from the I43 crossing. Overall, bacteria concentrations are higher for 3 South Branch Creeks (Ulao, Pigeon, and Mole) than Cedar Creek. Temperatures in Pigeon Creek are very close to meeting criteria for "cold water creeks" or trout streams in Wisconsin. Ulao and Mole Creeks also have great potential for fisheries, and Ozaukee County and WDNR have been investing significant resources to re-meandering and restoring parts of Ulao and Mole Creeks, which are already showing benefit.

Algae is a problem in the Cedar Creek Watershed, especially upstream of impoundments created by Big and Little Cedar Lakes, as well as impoundments upstream of 4 existing dams in the City of Cedarburg. In-stream algae concentration is highest during warmer summer months from July through September, often reaching nuisance levels. According to Milwaukee Riverkeeper survey data, the Cedar Creek subwatershed upstream of the downtown dams may have the best freshwater mussel populations in the entire Milwaukee River Basin, with 4 sites surveyed with living mussels, 3 additional sites with shells found (but no living mussels) and 2 sites surveyed with no mussels found. Overall 44% of sites surveyed in the Cedar Creek Watershed had living mussels compared to 24% of all sites surveyed, which was the Basin average (based on 37 surveys). Additional information on algae and muscles, and muscle monitoring maps are available through Milwaukee d: https://www.milwaukeeriverkeeper.org/mussels/

In 2017, Milwaukee Riverkeeper surveyed 16 different sites in the Milwaukee River Basin on 5 different occasions, during "low flow", and tested 1 site on each of the Creeks of concern: Cedar Creek at Covered Bridge, Mole Creek at Maple Road, Ulao Creek at Bonniwell Road, and Pigeon Creek at Highland Road. These samples were analyzed by Dr. Ryan Newton at UWM-Milwaukee School of Freshwater Sciences using sequence-based DNA technologies (e.g., Ilumina Myseq) to assess dozens of human sewage associated bacteria taxa at one time, as well as to identify other sources of bacteria from livestock, naturally occurring river bacteria, etc. This analysis provides robust signals for presence and degree of human sewage water contamination at the time of testing See Appendix K for a map and results.

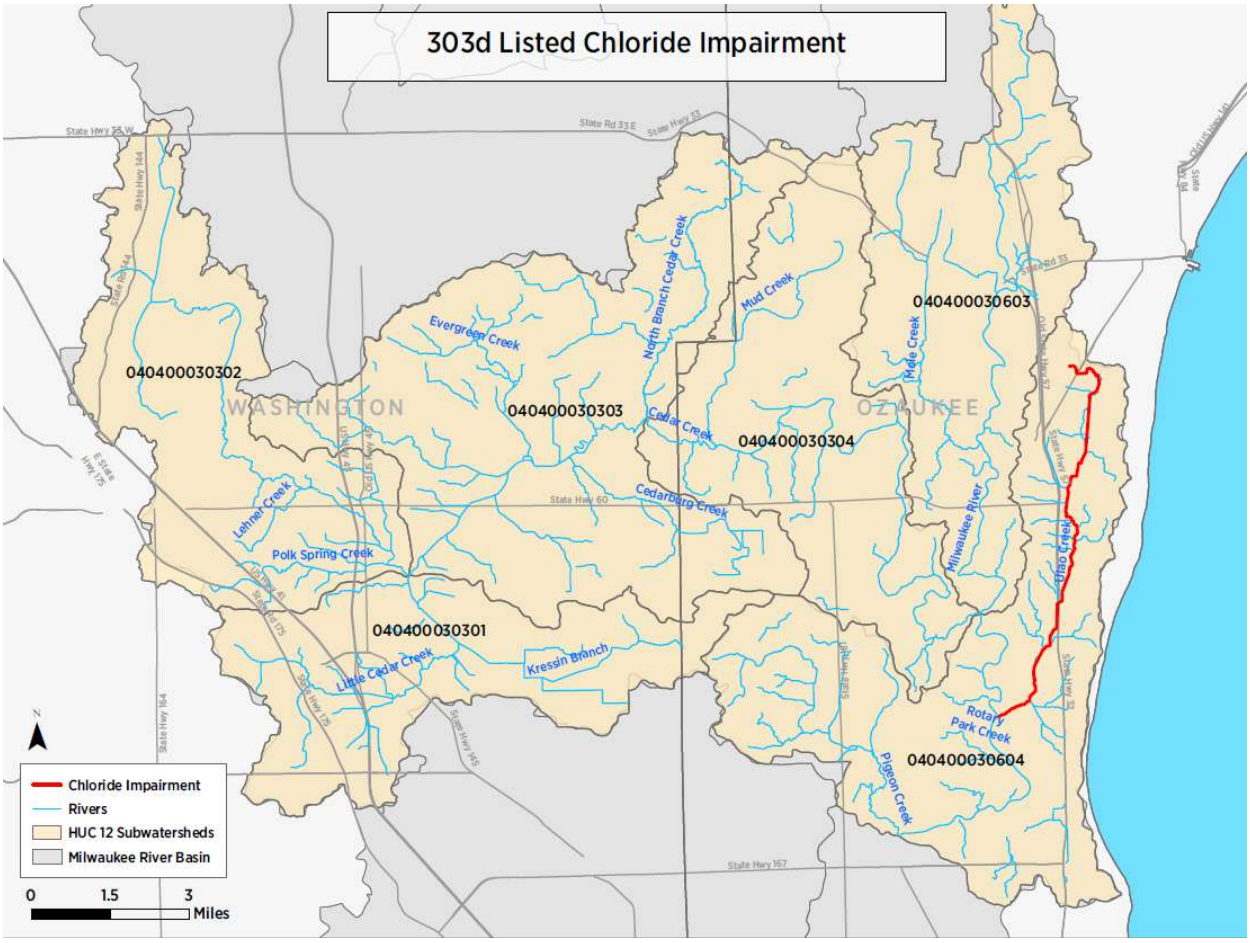
Bacteria that is typical of sanitary sewer water contamination is not naturally found in rivers or lakes. Of the sites of interest to this plan (detailed above), Riverkeeper assigned letter grades for degree of bacterial contamination: Cedar Creek received an A grade, Mole Creek an A- grade, Ulao Creek a B grade, and Pigeon Creek a C+ grade. There is more information on this project in Milwaukee Riverkeeper's Milwaukee River Basin 2017 Report Card: https://www.milwaukeeriverkeeper.org/2017-milwaukee-river-basin-report-card/. This genetic data can be used to help identify sources of bacteria, and could be helpful in prioritizing areas for more illicit discharge detection and elimination work and best management practices for addressing bacteria as part of implementation of the Milwaukee River TMDL.

7.5 Chlorides

Milwaukee Riverkeeper has been conducting winter road salt monitoring, looking at chloride levels and conductivity since 2010. Riverkeeper conducts its monitoring according to Wisconsin WisCALM standards to ensure correct procedures are followed to establish trend data on acute and chronic toxicity levels that qualify as impairment. Large segments of Cedar Creek and Ulao Creek have been listed as impaired for chloride (as pictured below, Figure 16.B). In general, smaller creeks in the Milwaukee River Basin are much more susceptible to chloride toxicity than larger rivers. Riverkeeper has also been holding training sessions for public and private road salt contractors to minimize their salt use and incorporate best practices to minimize salt application. More information on Riverkeeper chloride monitoring program can be found online:
https://www.milwaukeeriverkeeper.org/road-salt/chloride.
Additional results can be found in this story map (excluding data from winter 2018/2019):
https://www.arcgis.com/apps/Cascade/index.html?appid=e8f260325eb04a409489537f3ce4ec06

FIGURE 16B. 303(D) IMPAIRED RIVERS AND STREAMS – LISTED CHLORIDE IMPAIRMENT

SOURCE: WDNR OPEN DATA SOURCE: 303(D) IMPAIRED RIVERS AND STREAMS – LISTED



As an additional note, approximately 5.1 miles of the downstream portion of Cedar Creek are a federal Superfund Site due to PCB contamination from boat manufacturer Mercury Marine Some assessment and cleanup occurred in the early 2000s. Mercury Marine removed PCBs from contaminated culverts from

the Ruck Pond dam to Mill Street, and between the upper and lower sections of the Ruck Pond Raceway in 2016. In 2017-2018, they continued to remove PCB contaminated sediments from the Columbia and Wire and Nail Ponds. Mercury Marine conducted feasibility studies for the downstream portions of Cedar Creek. After EPA reviews that information, they will propose a plan to clean up the rest of the creek from the Wire and Nail Dam to the Milwaukee River. That plan is expected to be available for public review and comment in 2019. Removal of sediments is likely to have some positive impacts on total suspended solids, phosphorus levels, and potentially other water quality parameters, as well as will have benefits to fisheries over the next few decades.

The area where Cedar Creek joins the Milwaukee River has been identified as a fish and wildlife population project that is a priority for delisting the Milwaukee River Estuary Area of Concern for fish and wildlife population "beneficial use impairment". This site has also been identified as a potential site for a future wastewater treatment plant by the City of Cedarburg.

7.6 Water Quality Indicators and Pollution Reduction Strategy

The 2018 Baseline Phase 1 monitoring results, and the water quality monitoring indicators for success in Tables 42-44 in Appendix F identify this plan's future milestones for stream pollutant concentrations. These milestones are proposed short-term targets and are contingent upon adoption of this plan's practice milestones within priority sites and remaining contributing areas upstream of a monitoring station. Given the characteristics of each stream and the contributing area land use further analysis of land use practices within each HUC 12 sub-watershed, over multiple years, will be necessary to determine what locations within the six HUC 12 sub-basins may be more likely to meet WQS for TP, TSS, and FC. The preliminary results from the Baseline Water Quality Monitoring Phase 1 Study: Cedar Creek, Pigeon Creek, Mole Creek, and Ulao Creek can be viewed in Appendix I.

Water quality standards for chloride in Wisconsin are set based on aquatic life toxicity. The water quality criteria for chloride in Wisconsin are 395 mg/L (chronic level) and 757 mg/L (acute level). Chronic toxicity levels are set at the point where chloride can cause an adverse effect to survival and viability of an organism if they are exposed for a prolonged period. This standard is based on showing exceedances of 395 mg/L over at least 4 consecutive days. Acute toxicity is the level of chloride that can cause mortality or adverse impacts from a single exposure. These subwatersheds should meet both chronic and acute water quality standards for chloride to protect fish and aquatic life.

In 2020 and 2021, watershed partners will convene to review trends in data and confirm outreach strategies to local government staff, community elected officials, and land and business owners where water quality conditions are of greatest concern. Whereas the MMSD baseline monitoring study is limited to 2 years, there will be an increased focus on grant fundraising and recruitment to build the Milwaukee Riverkeeper and DNR Wave volunteer citizen monitoring programs, particularly for continued monitoring at locations sampled during the baseline study within the six HUC 12 sub-watersheds. Specific sites will be prioritized, and resources will be allocated to continue monitoring at existing priority sampling sites and for adoption or pollutant reduction practices. Plan progress will be measured, in part, by water quality data and also adoption rates of new or additional practices. In time, as more resources and data become available, macroinvertebrate index of biotic integrity can also be used to determine improvements in water quality. DNR and watershed monitoring parties will plan in 2020-21 where DNR can initiate biological monitoring

in 2021-22 where chemical data and records exists and suggest how progress can be measured in future years.

A challenge that presents itself to improving water quality within wetland marsh areas and agricultural dominated watersheds is legacy phosphorus within cropland irrigation ditches and stream channels. In recent years, scientists and watershed managers are finding that water quality is not responding as well as expected to implemented conservation practices (Sharpley et al 2013). They are attributing this slower and smaller response to legacy phosphorus sources, primarily from cropland soils in a watershed. Legacy phosphorus is used to describe the accumulated phosphorus that can serve as a long-term source of P to surface waters. Legacy phosphorus in a soil occurs when phosphorus in soils builds up much more rapidly than the decline due to crop uptake. In stream channels, legacy phosphorus can result from upland sediment erosion followed by sediment deposition of particulate phosphorus, sorption of dissolved phosphorus onto riverbed sediments or suspended sediments, or by incorporation into the water column (Sharpley et al 2013). Therefore, water quality may not improve/respond to implementation of conservation practices in a watershed as quickly as expected due to remobilization of legacy phosphorus hot spots. Legacy phosphorus is a factor that will be considered when water quality monitoring is completed to assess plan implementation.

Established watershed groups, select farmers, and watershed agencies are experimenting with different soil health principles and practices that may help reduce sources of legacy phosphorus in harvestable cover crops, so that the vegetated cover can add value as a commodity and utility crop, as well as take up excess nutrients. Municipalities are also looking for cost affective projects where they can invest in restorations of stream and riparian habitat to reduce nutrient and sediment transport. Collectively across a watershed there are opportunities that will be prioritized for investments in a ten-year time frame to demonstrate progress in water quality improvement.

7.7. Biological Indicators of Water Quality

Biological data can be used alone or in conjunction with physical-chemical data to make an impairment assessment on a waterbody in Wisconsin. A Fish Index of Biotic Integrity (Fish IBI) is one method of assessing biological health and water quality through several attributes of fish communities found in streams. The WDNR uses biological data to determine water quality conditions of streams because fish and macroinvertebrates are relatively easy to sample/identify and reflect specific and predictable responses to human induced changes to the landscape, stream habitat, and water quality.

Indices have been developed that measure water quality using fish (fish Index of Biotic Integrity (fIBI)) and macroinvertebrates (Macroinvertebrate Index of Biological Integrity (M-IBI) and Family Biotic Indexing (FBI)). These indices are best applied prior to a project such as a stream restoration to obtain baseline data and again following restoration to measure the success of the project. Or, they can be conducted to simply assess resource quality in a stream reach.

7.7.1. Fish Indices of Biotic Integrity

The fIBI is designed to assess water quality and biological health directly through several attributes of fish communities in streams. After the fish have been collected using electrofishing equipment and identified, the data is used to evaluate 12 metrics and a rating is assigned to each metric based on whether it deviates

strongly from, somewhat from, or closely approximates the expected values found in high quality reference stream reaches. The sum of these ratings gives a total IBI score for the site. The best possible IBI score is 100. The WDNR has determined that a score less than 30 indicates a stream is not fully supporting for Warm Water Sport Fish.

7.7.2. Macroinvertebrate Indices of Biological Integrity (M-IBI) and Family Biotic Indexing (FBI)

The M-IBI is designed to rate water quality using aquatic macroinvertebrate samples. An M-IBI score of 0-2.5 is considered grounds for 303(d) listing a stream.

The FBI is performed by collecting macroinvertebrates samples and sorting specimens by taxonomic order and family. The number of organisms within each Family and their respective tolerance to organic pollution is used to determine the FBI score. Higher scores are indicative of a higher degree of organic pollution and poor water quality.

7.7.3. Habitat Considerations for Species of Local Conservation Interest

Many actions taken to address water quality and flood abatement can impact aquatic and riparian habitat. Often little time or attention is taken in the project planning process to assess the critical habitat requirements or restoration opportunities that can further support Species of Local Conservation Interest (SLCI), that serve as health indicators of environmental health. Project planning with consideration to SLCI habitat conditions requires project proponents to know what these critical habitat requirements are and to incorporate them into projects. In order to do no harm to SLCI, project planning requires thorough knowledge of the natural history of the SLCI selected as Focal Species for projects. It is therefore important to inform and involve wildlife biologists in project monitoring design to consider SLCI habitat characteristics. Inventorying and tracking the status of SLCI can provide qualitative biological indications of habitat integrity and project impacts.

SLCI are species that meet at least one of the following criteria:

a) listed as either state or federally Endangered, Threatened, or Special Concern;
b) listed as Species of Greatest Conservation Need in the State Wildlife Action Plan;
c) considered to be locally rare or declining; or
d) have social value to stakeholders and considered by the community to be desirable; *and*, the habitat has the potential to support viable populations of these species.

Water quality dependent SLCI in Ozaukee County: Spotted Salamander, River Otter, and Least Bittern.

Orange spotted Sunfish and Northern Pike are SLCI that can be overlooked in planning.

SLCI checklists were developed over the past decade through studies by the University of Wisconsin, Ozaukee Washington Land Trust, Wisconsin DNR, Ozaukee County Planning and Parks, Milwaukee County Parks, and Great Lakes Ecological Services. These studies informed watershed planning projects for the Milwaukee River Basin and Milwaukee Estuary Area of Concern. The studies identified impaired species through a local conservation assessment process. This process is detailed in Kline et al. (2006), Struck et al. (2015, 2016a, 2016b), and Casper and Robson (2017; see Chapters 1, 2, 4). These projects produced Checklists and distribution databases of impaired and recoverable species. They also addressed what is known of SLCI current distribution and critical habitat requirements.

Milestones: To further inventory SLCI in the watershed area the following milestones are proposed:

- Develop and share watershed area-specific SLCI checklists and data with monitoring agencies, as resources allow.
- Discuss with area monitoring agencies resources needed to fill SLCI data deficiencies.
- Fill fish and wildlife baseline data deficiencies.
- Set SLCI delisting goals and metrics for Focal Species
- Focal Species are a subset of SLCI that represent project and habitat goals, and have metrics developed for monitoring recovery or preservation. Integrate SLCI recovery goals with other indicators addressing water quality and flood abatement goals.

7.8. Social Indicators of Water Quality

Quantifying social indicators of success in a watershed planning initiative is difficult. Lending from the guidance provided by Applied Ecological Services, Inc. in their authored Fredonia Newburg Area Watershed Restoration Plan (2019), The Great Lakes Regional Water Program (GLRWP) provides widely recommended guidance, which is outlined in table 6. As a leading organization that addresses water quality research, education, and outreach in Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin, GLRWP defines social indicators as standards of comparison that describe the context, capacity, skills, knowledge, values, beliefs, and behaviors of individuals, households, organizations, and communities at various geographic scales. The GLRWP suggests that social indicators used in water quality management plans and outreach efforts are effective for several reasons including:

- Help watershed committees evaluate projects related to education and outreach;

- support improvement of water quality projects by identifying why certain groups install Management Measures;
- Measure changes that take place within grant and project timelines;
- Help watershed committees with information on policy, and other social factors that may impact water quality;
- Measure outcomes of water quality programs not currently examined.

GLRWP has developed a Social Indicators Data Management and Analysis Tool (SIDMA) to assist watershed stakeholders with consistent measures of social change by organizing, analyzing, and visualizing social indicators related to non-point source (NPS) management efforts. The SIDMA tool uses a seven-step process to measure social indicators. Detailed information about GLRWP's social indicator tool can be found at http://35.8.121.111/si/Home.aspx.

Several potential social indicators could be evaluated by the watershed implementation committee using different strategies to assess changes in water quality. For example, surveys, public meetings, and establishment of interest groups can give an indication of the public knowledge about the water quality in the watershed. It is important to involve the public in the water quality improvement process at an early stage through public meetings delineating the plans for improvement and how it is going to be monitored. Table 6 includes a list of potential social indicators and measures that can be used by the watershed committee to evaluate the social changes related to water quality issues.

Table 6- Social indicators related to understanding behavior toward water quality issues SOURCE: APPLIED ECOLOGICAL SERVICES, FREDONIA NEWBURG AREA WATERSHED RESTORATION PLAN, 2019

Social Indicator	Measure
1) Media Coverage	• # of radio broadcasts related to water quality protection • # of newspaper articles related to water quality protection
2) Citizen Awareness	• # of informational flyers distributed per given time period • % of citizens who are able to identify where pollution is originating from • % change in volunteer participation to protect water quality • % change in attendance at water quality workshops • # of requests to create public use areas with interpretive signage • % of stakeholders who are aware of watershed management information
3) Watershed Management Activities	• # of stream miles cleaned up per year • # of linear feet or miles of trails created or maintained each year • # of municipalities adopting watershed management plan • # of watershed groups implementing plan recommendations

Future Water Quality Monitoring Plan Implementation (sampling locations & frequency)

Generally, it is recommended that WDNR continues with their current monitoring programs, parameters and locations within the six HUC 12 sub-basins within this plan. Additionally, in order to track changes in water quality over time, watershed stakeholders, with WDNR and other capable entities, will coordinate water quality monitoring consistently across prioritized sites in all six sub-watersheds.

Physical, chemical, and microbial sampling should occur at least once annually at representative, prioritized sites and should include the following parameters: temperature, dissolved oxygen, total phosphorus, total nitrogen, total suspended solids, pH, chloride, and E. coli. Future water quality sampling at select watershed sites should be coordinated to occur on the same days and for the same parameters

consistently. With that said, monitoring sites that are verified to have adopted and maintained this plan's practice milestones - at priority sites and remaining contributing areas upstream - will be a priority for water quality monitoring. Sites that fail or that make minimal progress towards meeting practice milestones will be lower priority for monitoring.

Additionally, biological monitoring should occur at the same priority sites using WDNR's standard procedures and protocols, once every three to five years, preferably in May or June. Table 48 summarizes a recommended minimum plan for continued water quality monitoring, and the associated costs that the watershed implementation team will consider. Figures 62-69 show planned monitoring by DNR Assessment units for 2020 and beyond, and Figures 70 and 71 show past monitoring conducted by Counties and Milwaukee River Keeper. Coordination of resources and prioritization of information can help to substantiate the level of effort and resources needed for monitoring water quality, tracking plan implementation, and progress toward milestones.

TABLE 7- RECOMMENDED FUTURE WATER QUALITY MONITORING

Waterbody/ Location	Monitoring Entity	Monitoring Location	Monitoring Frequency	Parameters Tested	Cost to Implement
Existing Recommended Monitoring Programs					
Town of Richfield-Cedar Creek 040400030301	WDNR	1-3 sites: LCC_01 LCC_02 KRB_01	Annually (Biological every 3-5 years)	Physical; Chemical; Microbial; Biological	Physical, Chemical & Microbial: $1,250/yr Biological: $700/3-5 yrs. per site
Cedar Lake-Cedar Creek 040400030302	WDNR	1-5 sites: LEC_01, JKC_1, PSC_01, CDC_01b, CDC_03	Annually (Biological every 3-5 years)	Physical; Chemical; Microbial; Biological	$1,250-$2,000/yr per site
Jackson Marsh State Wildlife area-Cedar Creek 040400030303	WDNR	1-5 sites: CBC_01, EVC_01, NCC_01b, CDC_04b, CDC_05	Annually (Biological every 3-5 years)	Physical; Chemical; Microbial; Biological	$1,250-$2,000/yr per site
Cedar Creek-East 040400030304	WDNR	1-3 sites: MDC_01, CDC_07b, CDC_08c	Annually (Biological every 3-5 years)	Physical; Chemical; Microbial; Biological	$1,250-$2,000/yr per site
Village of Grafton-Milwaukee River 040400030603	WDNR	1-5 sites: MOC_02, RCD_01, MLR_01, MLR_02, MLR_03d	Annually (Biological every 3-5 years)	Physical; Chemical; Microbial; Biological	$1,250-$2,000/yr per site
Pigeon Creek-Milwaukee River 040400030604	WDNR	1-4 sites: PGC_01c, ULC_01, ULC_02, MRL_06b	Annually (Biological every 3-5 years)	Physical; Chemical; Microbial; Biological	$1,250-$2,000/yr per site
Targeted Watershed Assessments	WDNR	HUC12 scale 7-9 sites	One-time baseline	Chemical, Biological	$7,5000

Individual Management Measures	Owner, operator, in cooperation with NRCS, County, and/or Consultant	Varies: Specific to each measure	Pre and post project	Physical, Chemical, and Biological	varies for each measure
Additional Continuous stream flow gauge stations	USGS, WDNR	(2) TBD	Continuous, automated seasonal install	Physical, Chemical, Microbial	Equipment purchase: $50,000/ea. O&M: ~$250,000 ea.
Subtotal: Monitoring at 4 sites:					$8,000-11,000/yr
WDNR watershed assessments on 6 HUC12s (one-time additional cost)					$45,000
USGS Monitoring Stations 5-year investment					$500,000+

8.0 Subwatershed Analysis

8.1 Plan Detail for HUC 12 Sub-Watersheds

The following sections cover six sub-watersheds located in the planning area in greater detail, with specific information on baseline causes and sources, and reductions expected from management measures based on modeling (EVAAL, STEPL and the TMDL). This plan not only uses land use (in conjunction with water quality monitoring data) as a critical determinant of the causes and sources of pollutants in each sub-watershed, but also as the key consideration for developing and implementing management measures and determining the expected reductions from those measures.

The Erosion Vulnerability Assessment for Agricultural Lands (EVAAL) was developed by the Wisconsin Department of Natural Resources Bureau of Water Quality to identify and map areas vulnerable to water erosion and help prioritize soil conservation efforts to help improve water quality. It accounts for soil erosion and stream power, as well as internally drained areas which do not contribute to downstream pollutant loadings within a watershed. EVAAL map outputs (at the HUC 12 level) specify total acres of agricultural uses, including relevant crop rotations, and pasture/grassland, as well as the extent of non-agricultural land uses within the watershed. This land use data provides information needed to prioritize non-point BMPs within watershed areas where they will provide the most benefit EVAAL modeling for this plan was provided with assistance from WDNR and is based on land use and crop rotations averaged over the period 2013-2017. These data form the basis for the STEPL model land use inputs for each sub-watershed within the planning area. The non-agricultural land area from EVAAL is further split into urban and forest land categories based on the relative portions of urban and forest land use derived from the national STEPL Model Input Data Server, based on 2012 land use information.

The Spreadsheet Tool for Estimating Pollutant Loads (STEPL) is an EPA program that models a watershed's baseline pollutant loadings and the expected load reductions that can be achieved from management practices. It addresses nitrogen (N), phosphorus (P), biological oxygen demand (BOD), and sediment. STEPL is used in this plan to estimate pollution loading scenarios (both baseline and with practices installed) from cropland, pastureland, forest, feedlots, grassland, streambanks, and gullies (on cropland). STEPL does not model bacteria loading or load reductions, but this is planned for a future release by EPA

in 2020 or 2021. Once this new application of STEPL has been released, model results should be revised within 12 months with bacteria pollutant loads and reduction estimates for each sub-watershed in this plan. For each sub-watershed modeled, Ozaukee and Washington County Land and Water Departments provided some important STEPL inputs for agricultural animals, septic systems, and Universal Soil Loss Equation parameters for each sub-watershed, while the remainder of the inputs are defaults from the national STEPL Data Input Server.

The counties also provided detailed information for each sub-watershed regarding agricultural practices that were in place in January 2017 (to define baseline pollutant loads), as well as projected levels of agricultural BMPs to be installed over the 10-year initial span of the present plan. STEPL is an accepted tool for watershed-level planning, but it does not specify the locations for practices or the expected load reductions at the individual field level. EVAAL outputs and WQ monitoring data from the watershed can be used to help determine priority locations for BMPs in HUC 12 watersheds, while STEPL or SnapPlus models can be used to estimate load reductions from practices at the watershed or field level.

The *Total Maximum Daily Loads for Total Phosphorus, Total Suspended Solids, and Fecal Coliform, Milwaukee River Basin, Wisconsin* (TMDL) provides both load and wasteload allocations for these pollutants of concern. Wasteload allocations apply to point sources, such as wastewater treatment facilities, non-contact cooling water for power plants, industrial dischargers, concentrated animal feeding operations (CAFOs) and MS4s. Of these, only MS4s are relevant for the planning area (see discussion below). Load allocations within TMDLs apply to non-point sources, such as agriculture and non-permitted urban areas (urban areas not covered by an MS4 permit). The focus of this 9 Key Element planning is to reduce non-point sources of pollution that generate phosphorus, sediment or bacteria from agricultural and non-permit urban land and make progress towards meeting the Milwaukee River TMDL pollutant reductions.

As described earlier, the Milwaukee River TMDL divides the watershed into reaches based on impairments, water quality standards, point source locations, and hydrology, and assigns pollutant allocations and required percent reductions from baseline loadings to meet TMDL targets. Percent reductions in the TMDL specify, for each reach and each pollutant, the proportional reductions needed from each load and wasteload category. The TP and TSS percent reductions in this plan were calculated by comparing STEPL baseline loadings with STEPL loadings after implementation of planned BMPs over a ten-year time schedule. The types and amounts of planned BMPs were selected by Ozaukee and Washington County Land and Water Department staff and reflect practice adoption rates over the past 3 years (2017-2019). Reductions are compared to the non-point percent reductions specified in the TMDL for each TMDL reach. Since there is not typically a one-to-one correspondence between TMDL reaches and HUC 12 sub-watershed boundaries (Figure 16), approximate weighted averages of the TMDL-specified percent reductions are employed in this plan.

The estimated nonpoint reductions in this plan demonstrate some progress towards, but do not fully meet, the Milwaukee River TMDL reduction goals. It is estimated multiple ten-year planning cycles will be required to fully meet the TMDL reduction targets for TP and TSS in the planning area. A similar timeframe and reduction approach is expected in order to meet TMDL bacteria reduction targets and for reducing chloride sources in the six HUC 12 sub-watersheds within this plan.

As shown in Figure 14, many of the urban areas in the sub-watersheds in the present plan are covered by MS4 permits, so it is estimated that urban non-point sources and loads (i.e., bacteria, nutrient and

chlorides) will largely be addressed through the MS4 permit requirements. With that said, there are some non-permitted urban areas in the planning area; and where some urban BMPs can be identified to reduce these urban nonpoint sources within the breakout section for each HUC 12 sub-watershed.

The TMDL percent reductions for P and TSS specified for both MS4 and non-permitted urban areas are all nearly identical (within 1%) for each of the reaches covered in the present plan (listed in individual HUC 12 sections). This suggests that each municipality will likely address its permitted and non-permitted areas within their reaches in similar fashion, for example, by using similar BMPs and using SLAMM modeling to estimate pollutant reductions within the planning area. SLAMM (Source Loading and Management Model) is currently the standard for MS4 permitting and is optimized for urban land uses and urban BMPs. Modeling urban BMPs via STEPL requires modeling each urban BMP separately over each relevant category and area of non-permitted urban land use, most of which have not yet been determined at the municipal level. Obtaining the land use and BMP information needed to model non-permitted urban areas pollutant loads for each municipality using STEPL was not completed because of the estimated small pollutant loads contributed by the non-permitted areas. Nonetheless, since BMPs in non-permitted urban areas, along with BMPs that do not directly implement the terms of MS4 permits are potentially eligible for section 319 funding, determining the areas and land uses of non-permitted urban areas is set as a three-year milestone in the present plan. The appropriate modeling approach will be determined once the above information is made available. Practices in urban areas may have additional benefits beyond water quality improvements, such as providing education and outreach to urban residents about the importance and interconnectedness of watershed resources.

SEWRPC estimates that both counties' populations will grow significantly from 2016 through 2035 and beyond. As population growth occurs, agricultural land use will give way to residential development. The result will likely be lower pollutant loadings from agricultural, along with an expansion of MS4-permitted and non-permitted urban areas in the planning area. Given current loading patterns from these land uses, the result is likely to be lower P and sediment loads, and higher N and BOD loads compared to current conditions in the watershed. Changing land use is just one of the factors that makes regular monitoring and updates critical to plan success.

In 2018, Ozaukee County, in collaboration with Washington County and SWWT, commissioned a study to identify potential sites for P trading between agricultural producers and municipalities. The resulting report, covers 17 HUC 12 sub-watersheds in the counties, including the six addressed in the present plan. The August 2018 *Ozaukee County, Milwaukee River TMDL Watershed Based Solutions* report identifies and maps 265 mostly agricultural sites with potential for P trading. The report includes a STEPL modeled analysis of expected TP and TSS reductions from multiple combinations of cropland practices, trade ratio approximations, and cost ranges for the BMP(s) proposed for each site. This report presents data that may be useful for identifying critical agricultural areas (and limited urban) for adoption of BMPs within this plan's sub-watersheds whether they result in P trading or not. Accordingly, a milestone in the present plan is to review the report during in years 1-3 and years 4-6 of plan implementation - to help identify critical areas within each HUC 12 sub-watershed with nutrient or bacterial sources.

The Mid-Moraine Water Quality Collective (www.mmwqc.org) is a collaboration among a host of municipalities, Washington and Ozaukee Counties, SWWT, and engineering firms GRAEF and Ruekert & Mielke, Inc. MMWQC member communities have expressed interest in installing BMPs and engaging in P trading to meet the TMDL and improve water quality in their jurisdictions.

Although Nitrogen (N) and Biological Oxygen Demand (BOD) are not included in the TMDL, STEPL analysis includes these water quality constituents. The modeling presented in this plan shows reduction from BMPs for N and BOD, in addition to TP and TSS. Currently, STEPL does not model bacterial reductions, but this is planned for a future release by US EPA in 2020 or 2021. Addressing the bacterial component of the TMDL is a future milestone item for this plan; future modeling efforts as part of this plan will include bacteria as part of a future release of STEPL.

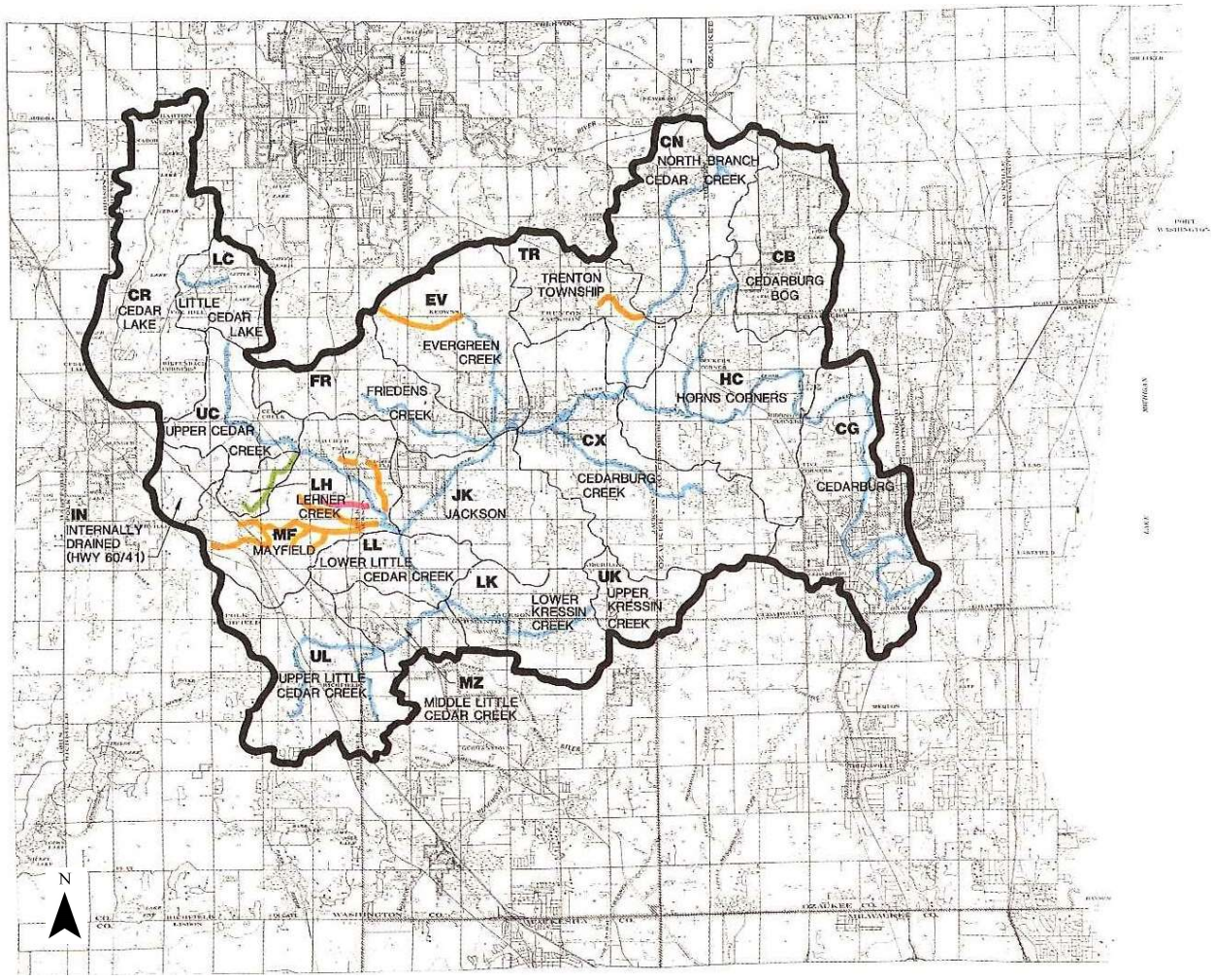
Chlorides, primarily from road salt used to control winter icing conditions, are another pollutant of concern in the planning area. Excessive chloride levels can affect aquatic and riparian species. Neither the TMDL nor STEPL addresses chloride levels or targets reductions. In 2017, SEWRPC began a study of chlorides in the Milwaukee River Basin, which includes the planning area. The first phase of the study is scheduled to be completed in 2021, so addressing chlorides is set as a 3-5-year milestone in the present plan.

8.2 Cedar Creek HUC 12 - 040400030301

The 040400030301 sub-watershed comprises most of the southern portion of the Cedar Creek watershed (Fig. 1 and 2). This area includes the 8.2 stream miles of the Little Cedar Creek and the 4.7-mile Kressin Creek. This sub-watershed is in a strategic portion of the planning area, where agricultural land use is giving way to residential development as the county grows in population. The Town of Jackson, which covers a significant portion of this sub-watershed, is the fastest growing community in Washington county, and is projected to grow significantly, from 5,489 in 2000 to 9,886 in 2035 (SEWRPC).

TMDL Reach MI-21 covers most of the sub-watershed area, except for a small section at the eastern tip covered by Reach MI-22 within the Town of Cedarburg (Fig. 1). These streams are capable of supporting warm water sport fish communities through their entire lengths, either year-round or seasonally (Figure 17). The lower section of Little Cedar Creek is large enough to support full-body contact recreation, while the remaining stream miles in the sub-watershed can support partial-body contact uses. The surface waters in this sub-watershed are not currently impaired, but land uses in the sub-watershed contribute pollutants that may impair waters in neighboring areas. The TMDL is also designed to be protective of non-impaired surface waters. Therefore, the TMDL specifies current pollutant loadings and needed reductions in this HUC 12. Please refer to sections 7.1, 7.4 and Appendices F-I of this plan for discussion of impaired waters and results of recent water quality monitoring within this sub-watershed.

FIGURE 17 – CEDAR CREEK AND TRIBUTARIES POTENTIAL BIOLOGICAL USES. SOURCE: SEWRPC



LEGEND

- FAL-A COLD WATER COMMUNITIES
- FAL-B WARM WATER SPORTFISH COMMUNITIES
- FAL-C WARM WATER FORAGE FISH COMMUNITIES
- LIMITED FORAGE FISH COMMUNITIES (INTERMEDIATE SURFACE WATERS)
- LIMITED AQUATIC LIFE (MARGINAL SURFACE WATERS)

This sub-watershed is vulnerable to erosion, and an analysis of this vulnerability was completed using WDNR's EVAAL tool. The results of this analysis are shown in Figure 18. There is also significant agricultural land use in this sub-watershed, and the land use/acreage information that is shown in Figure 19 in conjunction with Washington County and WDNR staff input was used to complete STEPL modeling of this sub-watershed.

FIGURE 18 – HUC 0301 EROSION VULNERABILITY ANAYLYSIS FOR AGRICULTURAL LANDS (EVAAL)

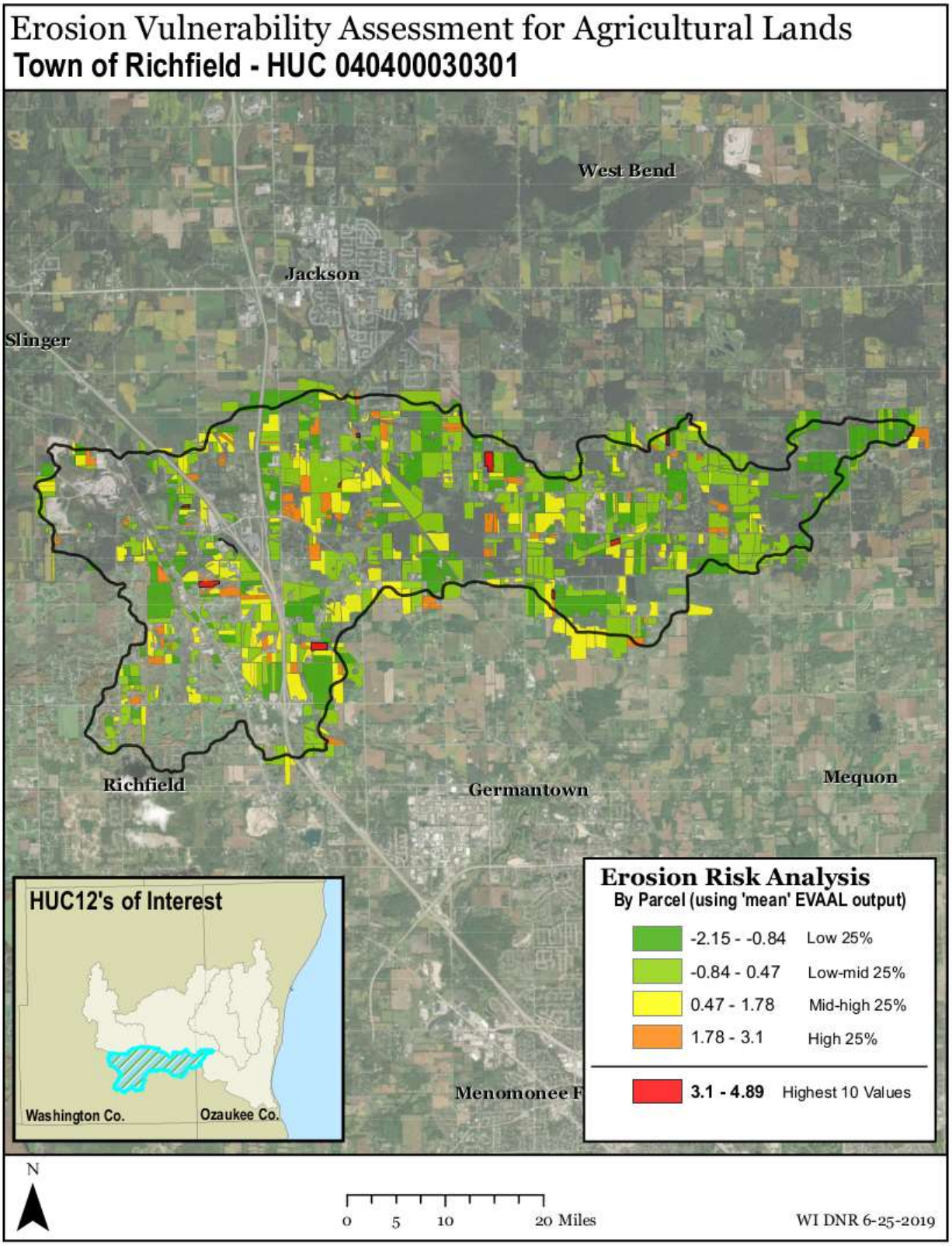
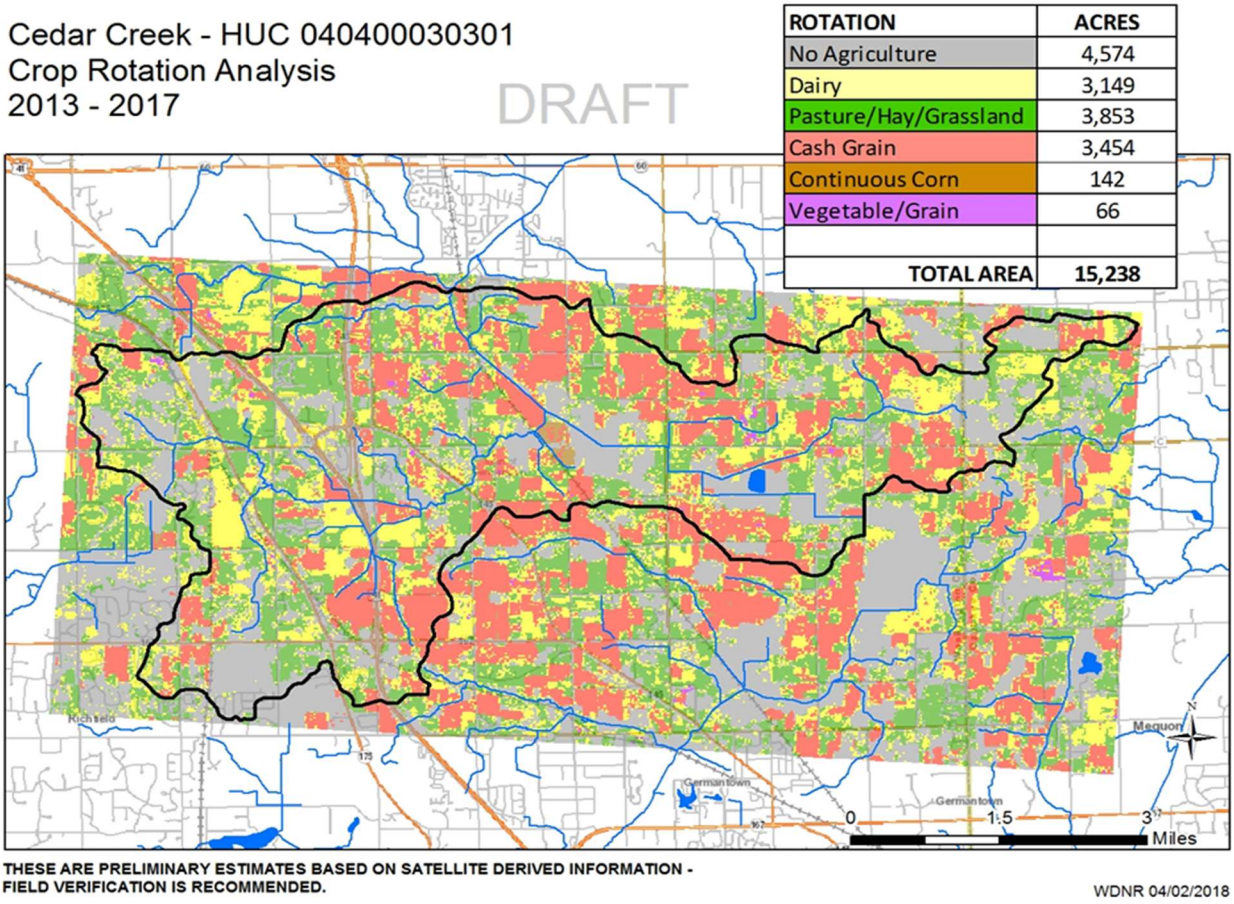


FIGURE 19 – HUC 0301 LAND USE AND AGRICULTURAL ROTATIONS



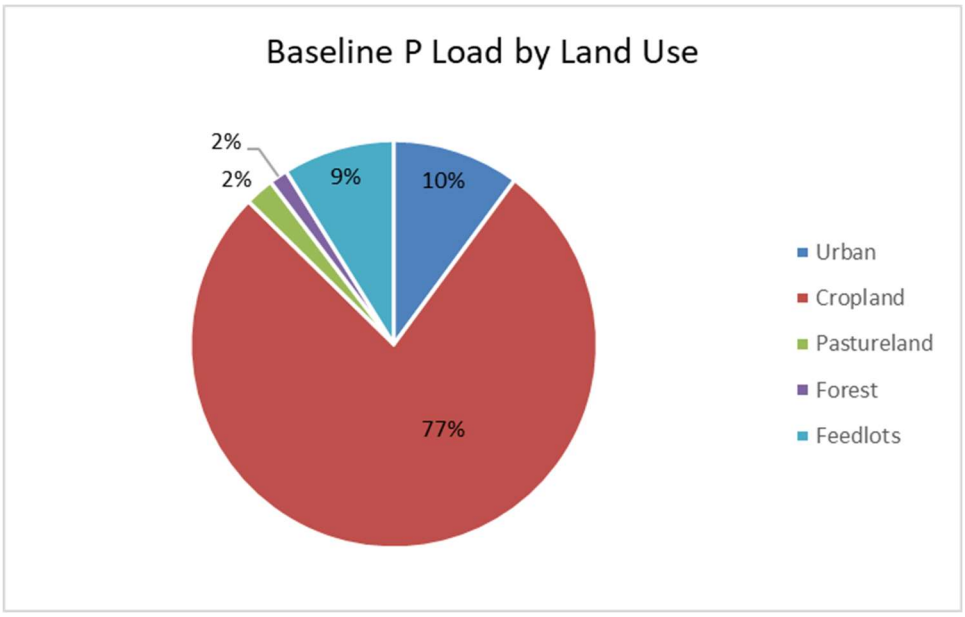
As indicated in the following STEPL tables, agricultural uses (cropland, pastureland, and feedlots) account for over 47% of the land use in the sub-watershed. STEPL land use from the EVAAL analysis (fig. 19), adapted as needed with information from the national data server (urban and forest breakout), and from Washington County (pastureland, grassland, and feedlots) is shown in Table 6.

TABLE 8 – LAND USE IN HUC 0301

	Urban	Cropland	Pastureland	Forest	Grassland	Feedlots
Land Area (acres)	2250	6811	380	2324	3468	5.0
Land Area %	15%	45%	2%	15%	23%	.03%

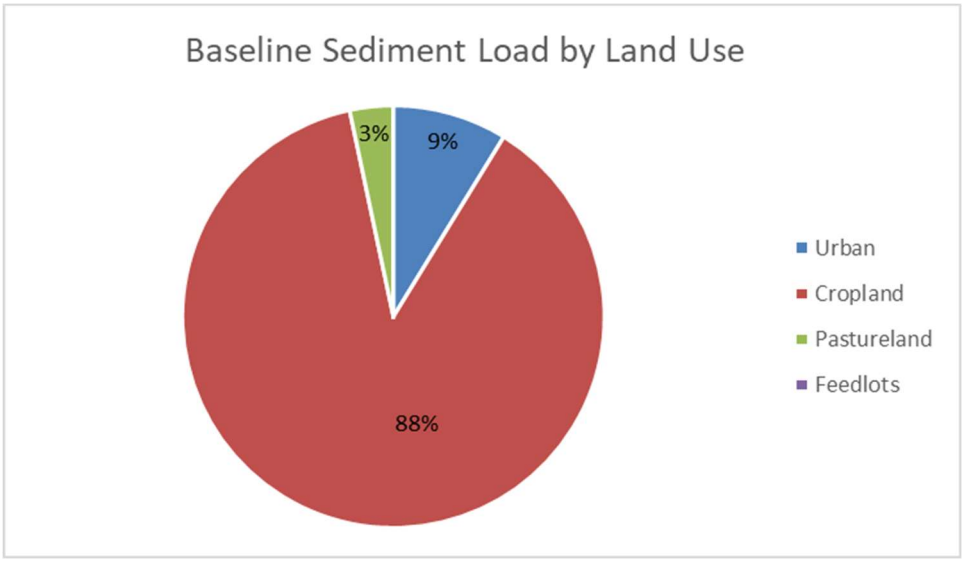
STEPL baseline loading for this sub-watershed accounts for installed agricultural BMPs as of January 2017 (the baseline date). Agricultural land uses modeled in STEPL include cropland, pastureland, feedlots, and gullies. Installed cropland BMPs include Nutrient Management Plans covering 80 acres and 4,200 linear feet of grassed waterways (gullies). There were no baseline practices on pastureland or feedlots. STEPL modeling indicates that agriculture accounts for 88% of the calculated P (TP in the TMDL) and 90% of Sediment (TSS in the TMDL) loads (Figures 20 and 21).

FIGURE 20 – BASELINE P (TP) LOAD % BY LAND USE FOR HUC 0301



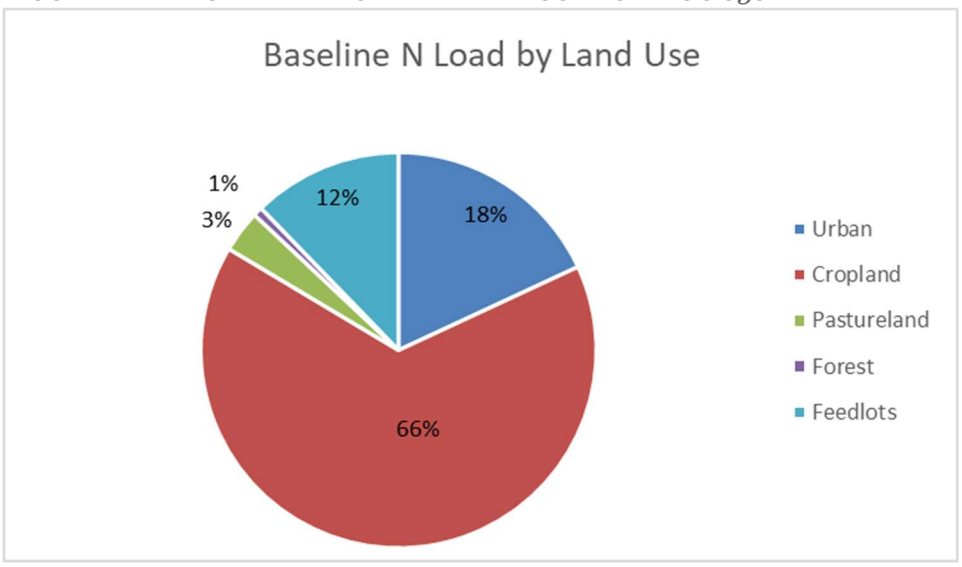
(Sources contributing 1% or less are not shown)

FIGURE 21 – BASELINE SEDIMENT (TSS) LOAD BY LAND USE FOR HUC 0301



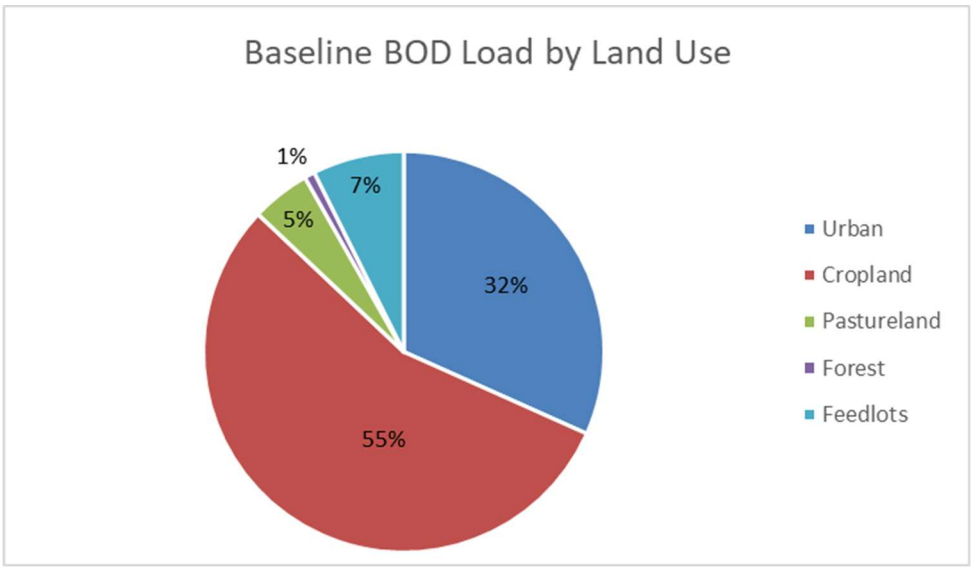
(Sources contributing 1% or less are not shown)

FIGURE 22 – BASELINE N LOAD BY LAND USE FOR HUC 0301



(Sources contributing less than 1% are not shown)

FIGURE 23 – BASELINE BOD LOAD BY LAND USE FOR HUC 0301



(Sources contributing less than 1% are not shown)

Although not included in the TMDL, Nitrogen (N) and Biological Oxygen Demand (BOD) may also contribute to water quality problems. As shown in figures 22 and 23, agricultural uses account for 81% and 67% of these loadings, respectively. The same BMPs that reduce TP and TSS loadings can also reduce levels of N and BOD (Table 7 and 9) in this sub-watershed. In addition, some of the cropland BMPs described in this plan (e.g., reduced tillage, increased residue, cover crops, low disturbance manure injection) will help, over time, to improve the infiltration capacity of agricultural fields and may help reduce bacteria loadings from cropland in this sub-watershed.

As shown in Table 8B, STEPL predicts total P loading from all agricultural sources is 16,677 lbs/year and sediment loading is 3,008 tons/year. These loadings are each reduced by 0.3% by the agricultural baseline practices compared to no controls (not shown).

TABLE 8B – STEPL BASELINE LOADING WITH EXISTING BMPs in HUC 0301

Sources	N Load (lb/yr)	P Load (lb/yr)	BOD Load (lb/yr)	Sediment Load (t/yr)
Cropland	44,517	14,497	83,290	2,828
Pastureland	2,330	432	7,143	107
Feedlots	8,324	1,665	11,098	0
Gully*	100	83	199	73
Agriculture Sub-total	**55,271**	**16,677**	**101,730**	**3,008**
Urban	12,286	1,897	47,686	282
Forest	517	275	1,266	16
Grassland	104	86	209	33
Septic	261	102	1,065	0
Total	**68,439**	**19,037**	**151,956**	**3,339**

**Gully baselines modified per WDNR guidance*

There are approximately 6,800 acres of cropland and 15 animal housing operations in this sub-watershed. There are just two dairy operations and half of the total animal units are horses. There are currently no CAFOs (> 1,000 animal units) in this sub-watershed. Seven of the 15 feedlots are providing loads/nutrients to surface waters; the majority of the feedlot concerns are from larger open earthen lots. Washington County estimates that it will be feasible to adopt the agricultural management practices shown in Table 9 over the 10-year plan schedule. Table 9 practices were applied to 43% of feedlot acres, 32% of cropland acres, and 5% of pastureland acres in this sub-watershed. Information in parentheses refers to the corresponding practices as defined in STEPL. Combining practices (in parallel) treating the same land areas can result in greater load reductions due to synergistic effects compared with serial practices spread over more total land area; combined cropland practices are included in the planned BMPs listed in Table 9.

TABLE 9 – PROJECTED AG. PRACTICES TO BE INSTALLED OVER 10 YEARS

Agricultural Land Use	Practice(s)	Area Treated
Feedlots	Runoff Management systems	3 of 7 sites (42.9% of area)
Cropland	Nutrient Management Plans (NMP-1)	700 acres
	Reduced tillage (Con Till-2)	100 acres
	Grassed waterways (Gullies)	9,000 linear feet of 3" deep by 4" wide annual gully and BMP efficiency 0.7
	Grass buffers to filter riparian strips	50 acres
	Nutrient Management Plans (NMP-1) combined with Reduced Tillage (Con Till-2)	600 acres
	Nutrient Management Plans (NMP-1) combined with Cover Crops (Crop -3)	400 acres
	Nutrient Management Plans (NMP-1) combined with Grass Buffers (minimum 35 ft wide)	100 acres
	Reduced tillage (Con Till-2) combined with Cover crops (crop-3)	200 acres
Pastureland	Grass buffers (minimum 35 feet wide)	50 acres
	Grazing Land Management (rotational grazing with fenced areas)	40 acres
	Prescribed Grazing	30 acres
	Use Exclusion	15 acres

The estimated pollutant reductions from adopting these practices are shown in Table 10. P is reduced by 2,995 lbs. annually, which is an 18% reduction compared to the agricultural baseline of 16,677 lbs. Sediment is reduced by 427 tons annually, which is a 14.2% reduction compared to the agricultural baseline of 3,008 tons.

TABLE 10 – STEPL LOADING WITH PROPOSED 10-YEAR BMPs in HUC 0301

Sources	N Load (lb/yr)	P Load (lb/yr)	BOD Load (lb/yr)	Sediment Load (t/yr)
Cropland	40,170	12,201	80,997	2,469
Pastureland	2,020	389	7,077	97
Feedlots	8,324	1,076	11,098	0
Gully	20	16	40	15
Agriculture Sub-total	**50,534**	**13,682**	**99,212**	**2,581**
Urban	12,286	1,897	47,686	282
Forest	517	275	1,266	16
Grassland	104	86	209	33
Septic	261	102	1,065	0
Total	**63,702**	**16,043**	**149,438**	**2,912**

These BMPs are also estimated to reduce N, BOD, and some bacterial loads. STEPL-derived N and BOD reductions are included here although they are not addressed in the TMDL. As of 2020, STEPL does not calculate load reductions for bacteria. STEPL model results with bacteria reductions should be revised within 12 months of release of STEPL by USEPA. TMDL reach MI-21 covers approximately 95% of this sub-watershed, so the TMDL required percent reductions are derived solely from this reach (Figure 16).

Part 3 of this plan describes methods, milestones, management measures and funding sources for implementing Table 9 practices over the plan's ten-year schedule. Table 37 provides interim milestones. Table 39 provides cost estimates, and Table 38 of this plan describes information and educational milestones for this sub-watershed. As shown in Table 11, the required agricultural TP (P) reduction for Reach MI-21 is 51% and the agricultural TSS (Sediment) reduction is 70%. Because the agricultural TP (P) 18% and TSS (Sediment) 14.2% reductions modeled above make progress towards, but do not achieve, the overall TMDL reduction goals, multiple 10-year planning cycles with goals for adoption of additional BMPs on remaining cropland acres in this sub-watershed will be needed, over time, to meet the TMDL reduction goals

This plan also estimates meeting the TMDL-based Urban reductions in this sub-watershed will require multiple MS4 permit cycles – see **MS4 Permits and Milwaukee River TMDL** section above for details. For non-permitted urban and MS4 areas, the required TP reductions are nearly identical at 76% and 75%, and identical for TSS at 76%. In practice, the MS4s and non-permitted urban area percent reductions will likely be addressed at the individual reach or finer level by the municipalities located within the sub-watershed. The draft *Ozaukee County, Milwaukee River TMDL Watershed Based Solutions* report (Aug 2018) identifies and maps 13 agricultural sites with the potential for BMPs and P trading in this sub-watershed. The report includes STEPL analysis of expected TP and TSS reductions, as well as trade ratio approximations and cost ranges for the BMP(s) recommended for each site. This report may be used to define critical areas in the sub-watershed for adoption of new or additional BMPs to reduce pollutant loads.

TABLE 11 – TP AND TSS REDUCTIONS SPECIFIED IN THE TMDL SOURCE: TMDL APPENDIX A, ADAPTED FROM TABLES A.28 AND A.30

TMDL Reach	Corresponding HUC 12	TP Reduction		TSS Reduction	
		Agricultural	Non-Permitted Urban/MS4	Agricultural	Non-Permitted Urban/MS4
MI-21	040400030301	51%	76%/75%	70%	76%/76%

Urban jurisdictions in the sub-watershed include sections of several towns, villages, and cities, including the Town of Cedarburg, the Town and Village of Germantown, the Town and Village of Jackson, the City of Mequon, the Village of Richfield, and the Village of Slinger. Of these, the Towns of Jackson and Germantown are not MS4 permittees; the Town of Jackson comprises a significant area of the sub-watershed, while the Town of Germantown covers approximately 500 acres.

Streambank contributions to pollutant loadings were not modeled due to a current lack of data on the condition of streambanks in the sub-watershed. With that said, quantifying and addressing streambank erosion sites present another potential opportunity to further reduce pollutant loadings, especially TP and TSS, and contribute to improvements in aquatic and riparian habitat within the sub-watershed.

Consultants working in Ozaukee County on riparian and aquatic species preservation have expressed interest in working in the Cedar Creek sub-watersheds.

Cedar Creek Farmer-led group (Washington County):

http://www.co.washington.wi.us/default.iml?mdl=print_detail.mdl&DetailID=1224

The Cedar Creek Farmers group is a producer-led group that was initiated in 2016 as a component of a 5-year Milwaukee River Watershed Conservation Partnership (MRWCP). The group is currently comprised of six farmers who farm 4,150 acres, some of which is located in this sub-watershed. This peer-to-peer form of outreach is actively educating farmers in the Cedar Creek watershed on best practices to improve soil health. The focus on soil health and cost savings associated with some of the practices such as no-till, has led to significant interest from other agricultural producers. A component of this outreach involves communicating how these practices have beneficial impacts upon local waterbodies. Currently six farmers are participating but many more are considering adopting a suite of practices that are modeled in the STEPL outputs. The Washington County Land and Water Conservation Department is the lead in providing technical assistance to this group. Current efforts include farm tours and workshops that bring in guest speakers and allow farmers to ask questions of each other about their experiences. Incentive payments offered through the program require less paperwork than similar NRCS incentives and can be combined with other existing NRCS incentive programs.

Minimum Progress Criteria

This plan contains several milestones that will be carefully tracked and monitored over time to determine if sufficient progress is being made to meet plan goals/pollutant reductions. The following criteria will be used to determine when plan milestones and reduction goals should be revised due to minimal progress achieved:

- Less than 25% of planned cropland practices or estimated load reductions are met by year 3
- Less than 25% of funding is available/awarded to implement by year 3
- Less than 25% of funding for conservation staff is awarded/available by year 3
- Conservation staff shortages occur, and technical assistance resources are limited for two years between years 1-5

The proposed implementation schedule for the Cedar Creek (HUC 12 – 040400030301) watershed plan will require 10 years of BMP planning, design and installation. Over this time span, individual farms will be assessed to determine the location and efficiency of existing BMPs, current management practices and potential critical sites of pollution. Selected farm operations will be assessed to determine whether they are in compliance with the State of Wisconsin's agriculture performance standards in accordance with the Department of Natural Resources Chapter NR 151.

Over this plan's ten-year schedule, it will be important to monitor the functionality of BMPs implemented in the watershed periodically after their installation. Over time, BMPs can become less efficient at achieving designed pollutant reductions due to several factors. According to the USEPA Technical; Memorandum #1: Adjusting for Depreciation of Land Treatment when Planning Watershed Projects (available at
https://www.epa.gov/sites/production/files/2015-10/documents/tech_memo_1_oct15.pdf),
natural variability, lack of proper maintenance and unforeseen consequences are primary causes of BMP depreciation. Considering how erratic and unpredictable weather patterns are increasingly becoming,

checking BMPs in the watershed will be critical for assessing their performance. BMP performance data will be used to evaluate plan implementation, modeled load reduction estimates and to help determine if substantial progress is or is not being made toward attaining WQ standards.

There are several key indicators of the Cedar Creek (HUC 12 – 040400030301) watershed plan that will be carefully tracked and monitored to determine if sufficient progress is being made and milestones are being achieved. The Washington Department of Land Conservation will take the lead responsibility of monitoring plan implementation progress by tracking the following plan components:

1. Information and education activities and participation
2. Pollution reduction levels from installed BMP's
3. Administrative review
4. WQ monitoring efforts (completed by WDNR or others) within the watershed

With assistance from our cooperating partners, USDA-NRCS and UW-Extension Services, an annual review meeting will be conducted to assess the following activities:

1. Information and education
    a. Number of landowners/operators contacted
    b. Number of one-on-one landowner contacts
    c. Number of group meetings and attendance
    d. Number of cost share agreements signed

2. BMP installation, performance and pollution reduction
    a. That BMP design is in accordance with NRCS standards and specifications
    b. That BMP's are installed according to standards and specifications
    c. Inspect BMP's every 4 years to determine level of efficiency
    d. Conduct BMP operation and maintenance spot checks
    e. Rerun STEPL Model when BMP efficiency has changed to determine effects on pollutant loads
    f. Review Crop Residue and Tillage intensity satellite imagery results
    g. Estimate the types and amounts of BMPs installed on critical areas in the watershed

3. Water Quality Monitoring
    a. Results of WQ sampling for Total Phosphorus and other parameters

4. Administrative Review
    a. Grant source and application review
    b. Grant allocations for cost share assistance review
    c. Review practices and dollar amounts per cost share agreement
    d. Track and review staff expenses and support costs
    e. Review all other expenses related to the project
    f. Determine if milestones are sufficiently attained

Summary and Conclusion

In this sub-watershed, agricultural uses predominate pollutant loadings across the board. STEPL analysis indicates that adoption of more agricultural BMPs on approximately 30% of the cropland acres will make progress towards, but will not achieve, the overall TMDL reduction goals. Fully meeting the TMDL will likely require several 10-year planning cycles. STEPL modeling for agricultural areas aids in determining the amounts and types of BMPs necessary to meet TMDL goals. The EVAAL land cover and crop rotation maps, along with the Ozaukee P trade report, will be used to prioritize the locations and types of BMPs within the sub-watershed. The eventual goal of this plan is to achieve and maintain enough practices to improve water quality and allow impaired waters to fully meet their designated uses. The recent formation of the Cedar Creek producer-led watershed group indicates significant interest in improving water quality by addressing agricultural loadings. This group may assist with adoption of more agricultural practices than shown in this plan – which will help make further progress towards meeting the TMDL reduction goals for this sub-watershed.

8.3 Cedar Creek HUC 12 – 040400030302

The 040400030302 sub-watershed comprises the northwestern portion of the Cedar Creek watershed (Fig. 1 and 2). This 17,956-acre area includes approximately seven stream miles of Cedar Creek, the two-mile Lehner Creek, the one-mile Jackson Creek, and the four-mile Polk Springs Creek. It also encompasses Big Cedar Lake and Little Cedar Lake, the largest lakes in the Cedar Creek (HUC 10) basin, as well as a number of smaller lakes. The Cedar Lake Conservation Foundation is a land trust that maintains several properties in trust, including habitat restoration, while the Big Cedar Lake Protection Rehabilitation District provides aquatic plant mitigation for the lakes and maintains 150 acres of district-owned land. This sub-watershed is in a strategic portion of the planning area, where agricultural land use is giving way to residential development as the county grows in population.

The topography of this mid-Kettle Moraine area is characterized by numerous natural kettles, which form closed depressions that are internally drained. Loadings within these areas do not affect surface water quality beyond their immediate boundaries, so this must be taken into account when locating BMPs for maximum watershed effect. The largest kettle is approximately 1500 acres, located in the unincorporated area of Ackerville within the Town of Polk (MI-21).

This sub-watershed encompasses TMDL Reaches MI-18 (Cedar Creek), MI-19 (Lehner Creek), MI-20 (Jackson Creek), and the northwest portion of MI-21 (Polk Springs Creek) (Fig. 16). With the exception of Polk Springs Creek, all of the stream miles in this sub-watershed are impaired, including the one-mile channel between Big and Little Cedar Lakes. These streams are capable of supporting warm water and limited forage fish communities through their entire lengths, either year-round or seasonally. Cedar Creek is impaired by point and non-point sources of phosphorus, while Jackson and Lehner Creeks are impaired by sediment and degraded habitat from non-point sources. Polk Springs Creek is not currently impaired. Land uses in the sub-watershed contribute pollutants that may impair waters in neighboring areas, and the TMDL is also designed to be protective of currently non-impaired surface waters. The TMDL specifies current pollutant loadings and needed reductions in this HUC 12 for both impaired and non-impaired surface waters. Please refer to sections 7.1, 7.4 and Appendices F and I of this plan for discussion of impaired waters and results of recent water quality monitoring within this sub-watershed.

This sub-watershed is vulnerable to erosion, and an analysis of this vulnerability was completed using WDNR's EVAAL tool. The results of this analysis are shown in Figure 24. There is also significant agricultural

land use in this sub-watershed, and the land use/acreage information that is shown in shown in Figure 25 in conjunction with Washington County and WDNR staff input was used to complete STEPL modeling of this sub-watershed.

FIGURE 24 - HUC 30302 EROSION VULNERABILITY ASSESSMENT FOR AGRICULTURAL LANDS (EVAAL)

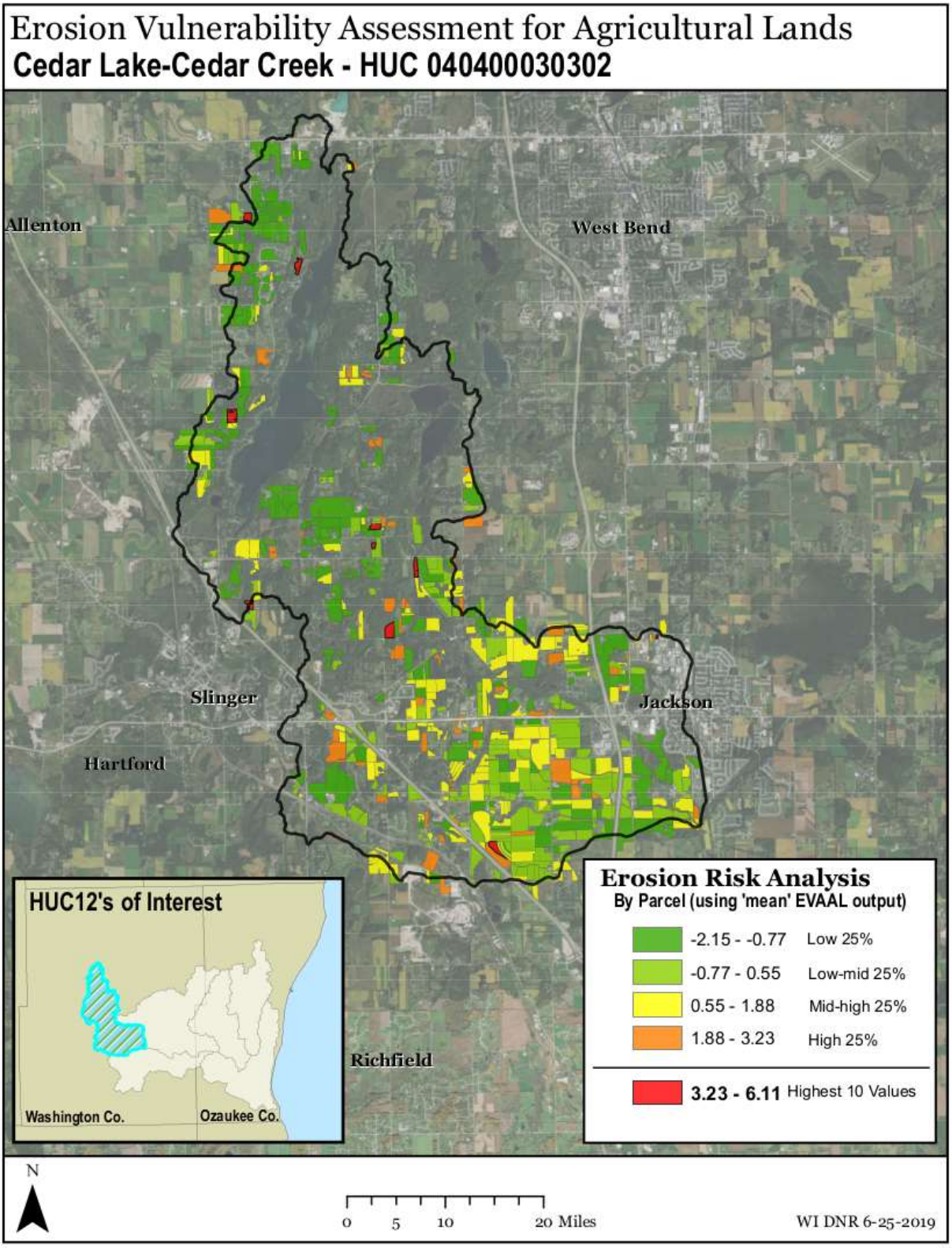
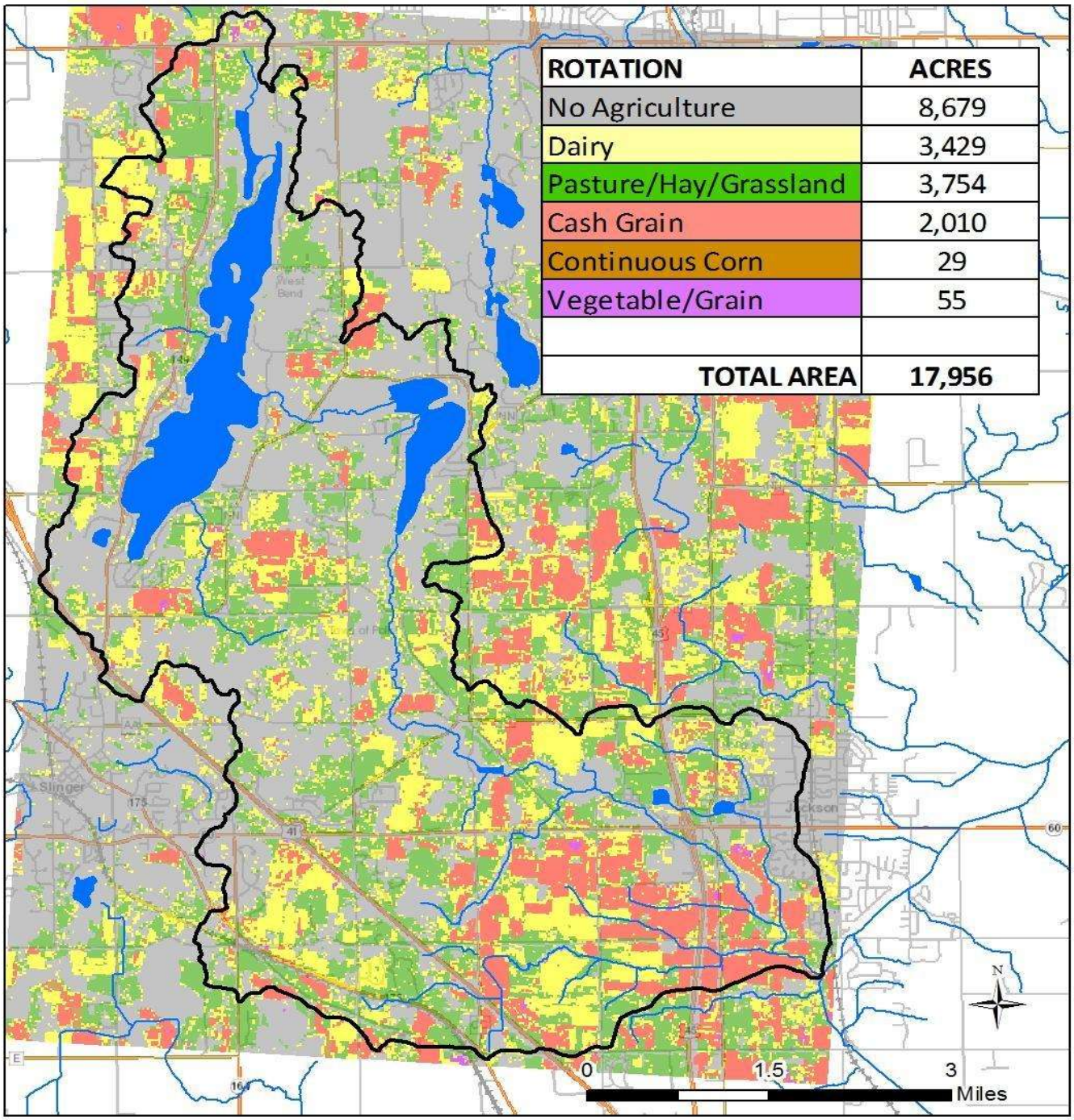


FIGURE 25 – LAND USE AND AG. ROTATIONS IN HUC 0302

Cedar Creek - HUC 040400030302
Crop Rotation Analysis
2013 - 2017

DRAFT



THESE ARE PRELIMINARY ESTIMATES BASED ON SATELLITE DERIVED INFORMATION - FIELD VERIFICATION IS RECOMMENDED.

WDNR 04/02/2018

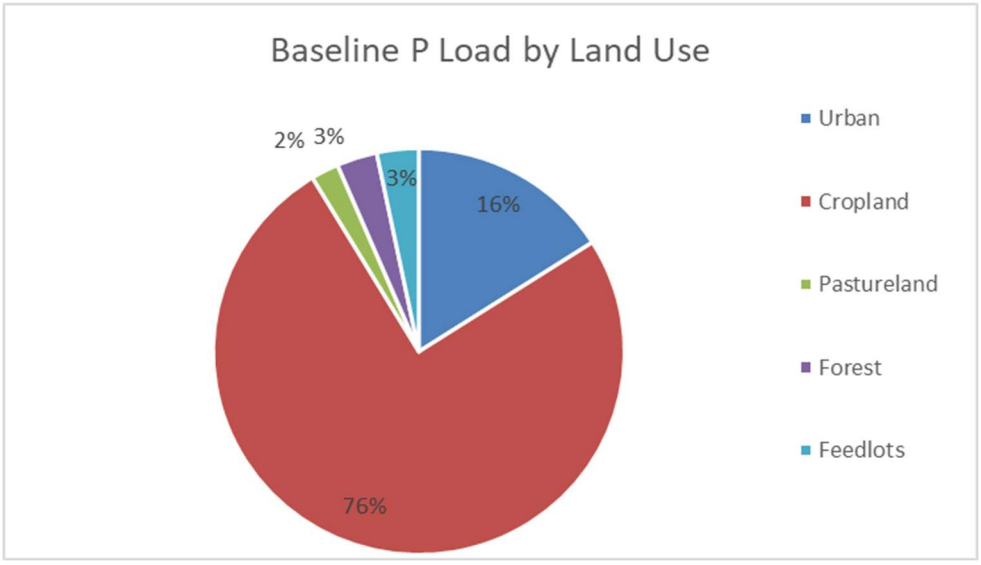
As indicated in the following STEPL tables, agricultural uses (cropland, pastureland, feedlots, and gullies) account for 33% of the land use in the sub-watershed. STEPL land use from the EVAAL analysis (Figure 25), adapted as needed with information from the national data server (urban and forest breakout), and from Washington County (feedlots) is shown in Table 12.

TABLE 12 – LAND USE INHUC 0302

	Urban	Cropland	Pastureland	Forest	Grassland	Feedlots
Land Area (acres)	3574	5523	373	5105	3379	2
Land Area %	20%	31%	2%	28%	19%	0%

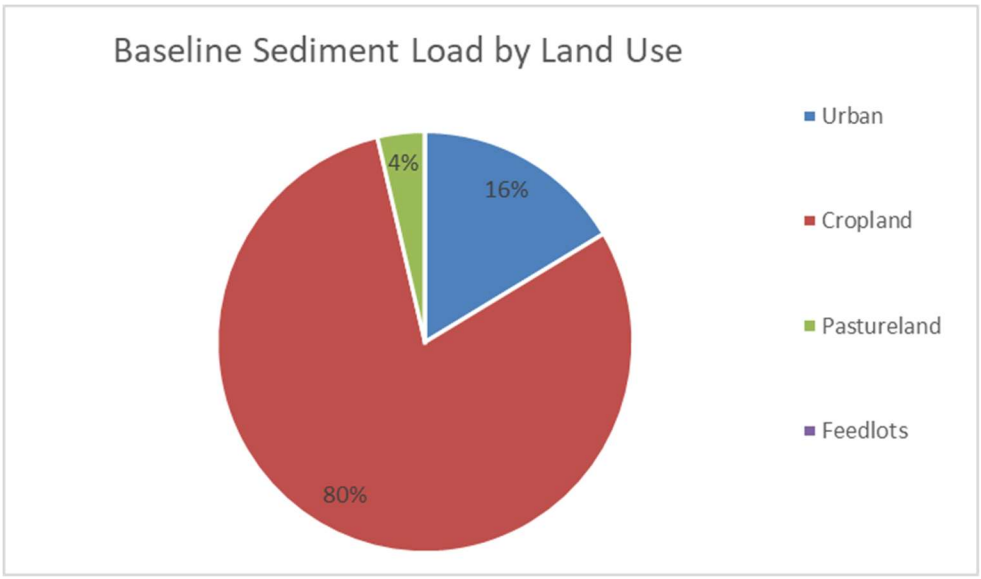
STEPL baseline loading for this sub-watershed accounts for installed agricultural BMPs as of January 2017 (the baseline date). Installed cropland BMPs include grass buffers treating 80 acres of cropland and prescribed grazing on 50 acres of pastureland. There were no baseline practices on feedlots. STEPL modeling indicates that agriculture accounts for 81% of P and 84% of TSS loads (Figures 26 and 27).

FIGURE 26 – BASELINE P LOAD % BY LAND USE FOR HUC 0302



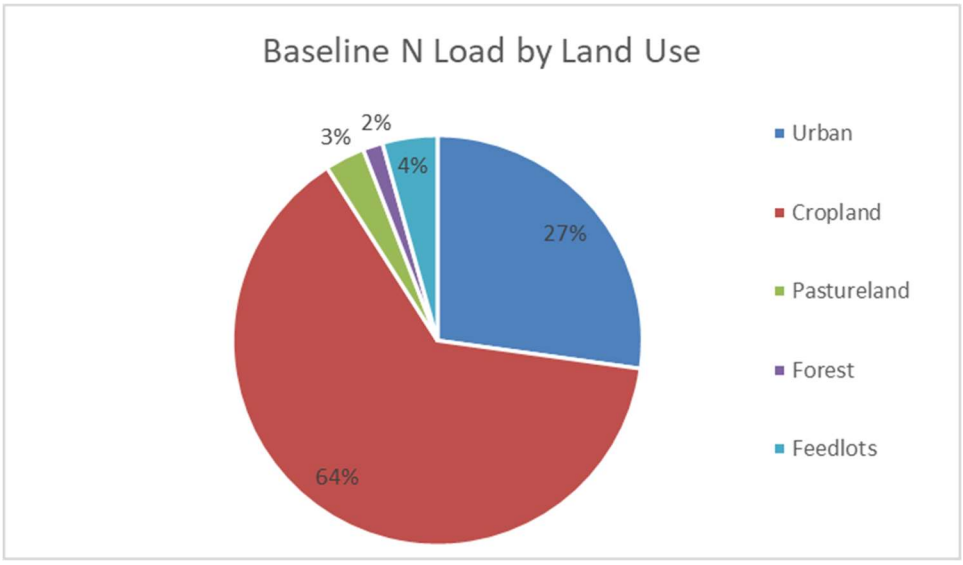
(Sources contributing 1% or less are not shown)

FIGURE 27 – BASELINE SEDIMENT LOAD BY LAND USE IN HUC 0302



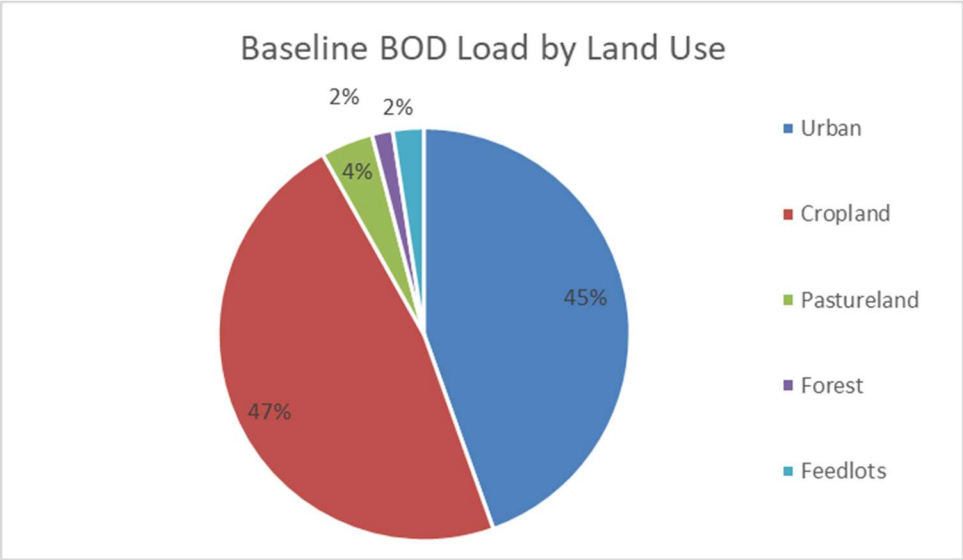
(Sources contributing 1% or less are not shown)

FIGURE 28 – BASELINE N LOAD BY LAND USE IN HUC 0302



(Sources contributing 1% or less are not shown)

FIGURE 29 – BASELINE BOD LOAD BY LAND USE IN HUC 0302



(Sources contributing 1% or less are not shown)

Although not included in the TMDL, Nitrogen (N) and Biological Oxygen Demand (BOD) are also surface water pollutants. As shown in figures 28 and 29, agricultural uses account for 71% and 53% of these loadings, respectively. The same BMPs that reduce P and sediment loadings can also reduce levels of N and BOD (Tables 13 and 15) in this sub-watershed. In addition, some of the cropland BMPs described in this plan (e.g., reduced tillage, increased residue, cover crops, low disturbance manure injection) will help, over time, to improve the infiltration capacity of agricultural fields and may help reduce bacteria loadings from cropland in this sub-watershed.

As shown in Table 13, STEPL predicts total P loading from all agricultural sources is 15,266 lbs/year and sediment loading is 2,295 tons/year. P loading is reduced by 0.5% and sediment loading by 0.7% from the agricultural baseline practices compared to no controls (not shown).

TABLE 13 – STEPL BASELINE LOADING WITH EXISTING BMPs IN HUC 0302

Source	N Load (lb/yr)	P Load (lb/yr)	BOD Load (lb/yr)	Sediment Load (t/yr)
Cropland	45,752	14,220	80,416	2,182
Pastureland	2,261	411	6,981	100
Feedlots	3,110	622	4,146	0
Gully	16	13	32	12
Agriculture Sub-total	**51,139**	**15,266**	**91,575**	**2,295**
Urban	19,515	3,013	75,747	448
Forest	1,130	601	2,771	35
User Defined	98	80	195	30
Septic	516	202	2,106	0
Streambank	72	59	143	53
Total	**72,398**	**19,162**	**172,394**	**2,808**

*baseline gully and streambank loadings modified per WDNR guidance

There are approximately 22 animal housing operations in this sub-watershed. Five of the 22 feedlots are providing loads/nutrients to surface waters; the majority of the feedlot concerns are from larger open earthen lots. There are just two significant dairy operations. Washington County estimates that it will be feasible to adopt the agricultural management practices shown in Table 13 over the 10-year plan schedule. Table 13 practices were applied to 60% of feedlot acres, 28% of cropland acres, and 50% of pastureland acres in this sub-watershed. Information in parentheses refers to the corresponding practices as defined in STEPL. Combining practices (in parallel) treating the same land areas can result in greater load reductions due to synergistic effects compared with serial practices spread over more total land area; combined cropland practices are included in the planned BMPs listed in Table 13.

TABLE 14 – PROJECTED AG. PRACTICES TO BE INSTALLED OVER 10 YEARS IN HUC 0302

Agricultural Land Use	Practice(s)	Area Treated
Feedlots	Runoff Management systems	3 sites 5 sites (60%/total area)
Cropland	Nutrient Management Plans (NMP-1)	265 acres
	Reduced tillage (Con Till-2)	325 acres
	Cover Crops (Crop-3)	400 acres
	Grassed waterways (Gullies)	4,500 linear feet of 3" deep by 4" wide annual gully and BMP efficiency 0.7
	Grass buffers to filter riparian strips	125 acres
	Nutrient Management Plans (NMP-1) combined with Reduced Tillage (Con Till-2)	200 acres
	Nutrient Management Plans (NMP-1) combined with Cover Crops (Crop -3)	130 acres
	Nutrient Management Plans (NMP-1) combined with Grass Buffers (minimum 35 ft wide)	30 acres
	Reduced tillage (Con Till-2) combined with Cover crops (crop-3)	75 acres
Pastureland	Grass buffers (minimum 35 feet wide)	100 acres
	Grazing Land Management (rotational grazing with fenced areas)	35 acres
	Prescribed Grazing	25 acres
	Use Exclusion	10 acres

The estimated pollutant reductions from adopting these practices are shown in Table 14. TP is reduced by 2,182 lbs. annually, which is a 14.3% reduction compared to the agricultural baseline of 15,266 lbs. TSS is reduced by 272 tons annually, which is an 11.9% reduction compared to the agricultural baseline of 2,295 tons.

TABLE 15 – STEPL LOADING WITH PROPOSED 10-YEAR BMPS IN HUC 0302

Source	N Load (lb/yr)	P Load (lb/yr)	BOD Load (lb/yr)	Sediment Load (t/yr)
Cropland	42,298	12,443	78,852	1,938
Pastureland	1,607	321	6,848	80
Feedlots	3,110	314	4,146	0
Gully	7	6	14	5
Agriculture Sub-total	**47,021**	**13,084**	**89,861**	**2,023**
Urban	19,515	3,013	75,747	448
Forest	1,130	601	2,771	35
Grassland	98	80	195	30
Septic	516	202	2,106	0
Streambank	72	59	143	53
Total	**68,352**	**17,039**	**170,822**	**2,589**

These BMPs are also estimated to reduce N, BOD, and some bacterial loads. STEPL-derived N and BOD reductions are included here although they are not addressed in the TMDL. STEPL currently does not calculate load reductions for bacteria. STEPL model results with bacteria reductions should be revised within 12 months of release of STEPL by USEPA. TMDL reach MI-18 comprises approximately 55% of the sub-watershed, with MI-21 at 30%, MI-20 at 8% and MI-19 at 7%.

Part 3 of this plan describes methods, milestones, management measures and funding sources for implementing Table 14 practices over the plan's ten-year schedule. Table 37 provides interim milestones. Table 39 provides cost estimates, and Table 38 of this plan describes information and educational milestones for this sub-watershed.

As shown in Table 16, the required agricultural TP reduction for the sub-watershed ranges from 40% to 51%, and the required agricultural TSS reduction ranges over 63% to 70%. Reach MI-18 and the portion of MI-21 within the sub-watershed combined with reach MI-20 have roughly the same amount of agricultural land, as indicated by the EVAAL map. The required percent reductions for agricultural land for MI-20 are very close to those required for MI-21, with the smallest reach, MI-19, as the outlier. In the present plan, the overall weighted average percent reductions for agricultural land are the averages of MI-18 and MI-21 for both TP and TSS.

Because the agricultural TP and TSS reductions modeled make progress towards, but do not achieve, the overall TMDL reduction goals, multiple 10-year planning cycles with goals for adoption of additional BMPs on remaining cropland acres in this sub-watershed will be needed, over time, to meet the TMDL reduction goals. Similarly, urban reductions will be addressed over multiple MS4 permit cycles.

For nonpermitted urban and MS4 areas, TP and TSS reductions range from 57% - 76%. Weighted average percent reductions were calculated as above and are shown in Table 16 for informational purposes. In practice, the MS4s and non-permitted urban area percent reductions will likely be addressed at the individual reach or finer level by the municipalities located within the sub-watershed. The draft *Ozaukee County, Milwaukee River TMDL Watershed Based Solutions* report (Aug 2018) identifies and maps 13

agricultural sites with the potential for P trading in this sub-watershed. The report includes STEPL analysis of expected TP and TSS reductions, trade ratio approximations, and cost ranges for the BMP(s) recommended for each site. This report may be used to define critical areas in the sub-watershed for adoption of new or additional BMPs to reduce pollutant loads.

TABLE 16 – TP AND TSS REDUCTIONS SPECIFIED IN THE TMDL FOR HUC 0302 SOURCE: (TMDL APPENDIX A, ADAPTED FROM TABLES A.28 AND A.30)

TMDL Reach	Corresponding HUC 12	TP Reduction		TSS Reduction	
		Agricultural	Non-Permitted Urban/MS4	Agricultural	Non-Permitted Urban/MS4
MI-18	040400030302	40%	69%/68%	63%	72%/71%%
MI-19		40%	57%/56%	68%	73%/72%
MI-20		49%	76%/75%	68%	76%/76%
MI-21		51%	76%/75%	70%	76%/76%
AVG*		**46%**	**72%**	**67%**	**73%**

** see discussion.*

Civil divisions in the sub-watershed include sections of several towns, villages, and cities, including the Town of Addison, the Town of Polk, the Town of Jackson, the Village of Jackson, the Village of Slinger, and the Town of West Bend. Of these, the Town of Jackson, the Town of Polk, and the Town of Addison are not MS4 permittees. Together, these non-permitted civil divisions cover approximately 60% of the sub-watershed, suggesting some potential for pollutant reductions from non-permitted urban areas, though these comprise a relatively small portion of the loadings.

In this sub-watershed, some streambank inventory has taken place, with current and planned practices reducing loadings, as shown in tables 13 and 15. With that said, quantifying and addressing additional streambank erosion sites present another potential opportunity to further reduce pollutant loadings and contribute to improvements in aquatic and riparian habitat within the watershed. Consultants working in Ozaukee County on riparian and aquatic species preservation have expressed interest in working in the Cedar Creek sub-watersheds. Figure 30 is an example of streambank erosion occurring in the sub-watershed.

Minimum Progress Criteria

This plan contains several milestones that will be carefully tracked and monitored over time to determine if sufficient progress is being made to meet plan goals/pollutant reductions. The following criteria will be used to determine when plan milestones and reduction goals should be revised due to minimal progress achieved:

- Less than 25% of planned cropland practices or estimated load reductions are met by year 3
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- Conservation staff shortages occur, and technical assistance resources are limited for two years between years 1-5

The proposed implementation schedule for the Cedar Creek (HUC 12 – 040400030302) watershed plan will require 10 years of BMP planning, design and installation. Over this time span, individual farms will

be assessed to determine the location and efficiency of existing BMPs, current management practices and potential critical sites of pollution. Selected farm operations will also be assessed to determine whether they are in compliance with the State of Wisconsin's agriculture performance standards in accordance with the Department of Natural Resources Chapter NR 151.

Over this plan's ten-year schedule, it will be important to monitor the functionality of BMPs implemented in the watershed periodically after their installation. Over time, BMPs can become less efficient at achieving designed pollutant reductions due to several factors. According to the USEPA Technical Memorandum #1: Adjusting for Depreciation of Land Treatment when Planning Watershed Projects (available at https://www.epa.gov/sites/production/files/2015-10/documents/tech_memo_1_oct15.pdf), natural variability, lack of proper maintenance and unforeseen consequences are primary causes of BMP depreciation. Considering how erratic and unpredictable weather patterns are increasingly becoming, checking BMPs in the watershed will be critical for assessing their performance. BMP performance data will be used to evaluate plan implementation, modeled load reduction estimates and to help determine if substantial progress is or is not being made toward attaining WQ standards.

There are several key indicators of the Cedar Creek (HUC 12 – 040400030302) watershed plan that will be carefully tracked and monitored to determine if sufficient progress is being made and milestones are being achieved. The Washington Department of Land Conservation will take the lead responsibility of monitoring plan implementation progress by tracking the following plan components:

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    a. Number of landowners/operators contacted
    b. Number of one-on-one landowner contacts
    c. Number of group meetings and attendance
    d. Number of cost share agreements signed

2. BMP installation, performance and pollution reduction
    a. That BMP design is in accordance with NRCS standards and specifications
    b. That BMP's are installed according to standards and specifications
    c. Inspect BMP's every 4 years to determine level of efficiency
    d. Conduct BMP operation and maintenance spot checks
    e. Rerun STEPL Model when BMP efficiency has changed to determine effects on pollutant loads
    f. Review Crop Residue and Tillage intensity satellite imagery results
    g. Estimate the types and amounts of BMPs installed on critical areas in the watershed

3. Water Quality Monitoring

a. Results of WQ sampling for Total Phosphorus and other parameters

4. Administrative Review
    a. Grant source and application review
    b. Grant allocations for cost share assistance review
    c. Review practices and dollar amounts per cost share agreement
    d. Track and review staff expenses and support costs
    e. Review all other expenses related to the project
    f. Determine if milestones are sufficiently attained

FIGURE 30 – STREAMBANK EROSION IN POLK SPRINGS CREEK

photo credit: Paul Sebo 05-2017

Summary and Conclusion

In this sub-watershed, agricultural uses predominate land use and pollutant loadings across the board. STEPL analysis indicates that adoption of more agricultural BMPs on approximately 30% of the cropland acres will make progress towards, but will not achieve, the overall TMDL reduction goals. Fully, meeting the TMDL will likely require several 10-year planning cycles. STEPL modeling for agricultural areas aids in determining the amounts and types of BMPs necessary to meet TMDL goals. The EVAAL land cover and crop rotation maps, along with the Ozaukee P trade report, will be used to prioritize the locations and types of BMPs within the sub-watershed. The eventual goal of this plan is to achieve and maintain enough practices to improve water quality and allow impaired waters to fully meet their designated uses. The recent formation of the Cedar Creek producer-led watershed group indicates significant interest in improving water quality by addressing agricultural loadings. This group may assist with adoption of more

agricultural practices than shown in this plan – which will help make further progress towards meeting the TMDL reduction goals for this sub-watershed.

8.4 Cedar Creek HUC 12 - 040400030303

The 040400030303 sub-watershed comprises the central portion of the Cedar Creek watershed (Fig. 1 and 2). This area includes approximately six stream miles of Cedar Creek, the five-mile Evergreen Creek, and several smaller creeks. The Jackson Marsh Wildlife Area covers 2,312 acres of this 29,828-acre sub-watershed and includes the 1,571-acre Jackson Swamp Natural Area. The entire wildlife area is managed by WDNR. All of the stream miles of Cedar and Evergreen Creeks in this sub-watershed are impaired. This sub-watershed is in a strategic portion of the planning area, where agricultural land use is giving way to residential development as the area grows in population.

This sub-watershed includes a portion of TMDL reach MI-21, MI-22 (Cedar Creek), MI-23 (Evergreen Creek), and the northwest portion of MI-24 (Fig. 16). These streams are capable of supporting warm water sport fishing communities through their entire lengths, either year-round or seasonally. Cedar Creek is impaired by point and non-point sources of phosphorus, while Evergreen Creek is impaired by degraded habitat due to sediment from non-point sources. Land uses in the sub-watershed contribute pollutants that may impair waters in neighboring areas, and the TMDL is also designed to be protective of currently non-impaired surface waters. The TMDL specifies current pollutant loadings and needed reductions in this HUC 12 for both impaired and non-impaired surface waters. Please refer to sections 7.1, 7.4 and Appendices F and I of this plan for discussion of impaired waters and results of recent water quality monitoring within this sub-watershed.

This sub-watershed is vulnerable to erosion, and an analysis of this vulnerability was completed using WDNR's EVAAL tool. The results of this analysis are shown in the Figure 31. There is also significant agricultural land use in this sub-watershed, and the land use/acreage information that is shown in Figure 32 in conjunction with Washington County and WDNR staff input was used to complete STEPL modeling of this sub-watershed.

FIGURE 31 – HUC 30303 EROSION VULNERABILITY ASSESSMENT FOR AGRICULTURAL LANDS (EVAAL)

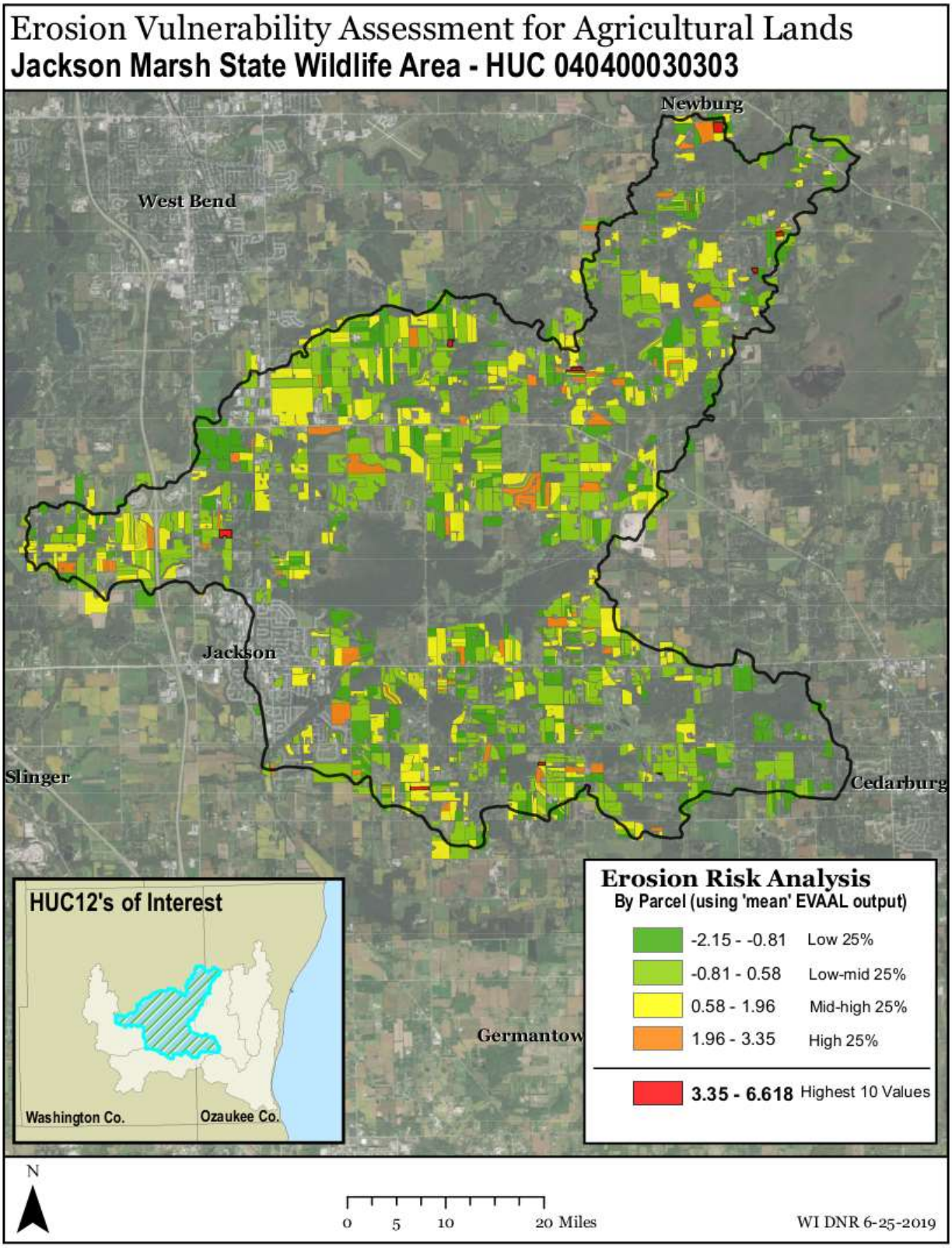
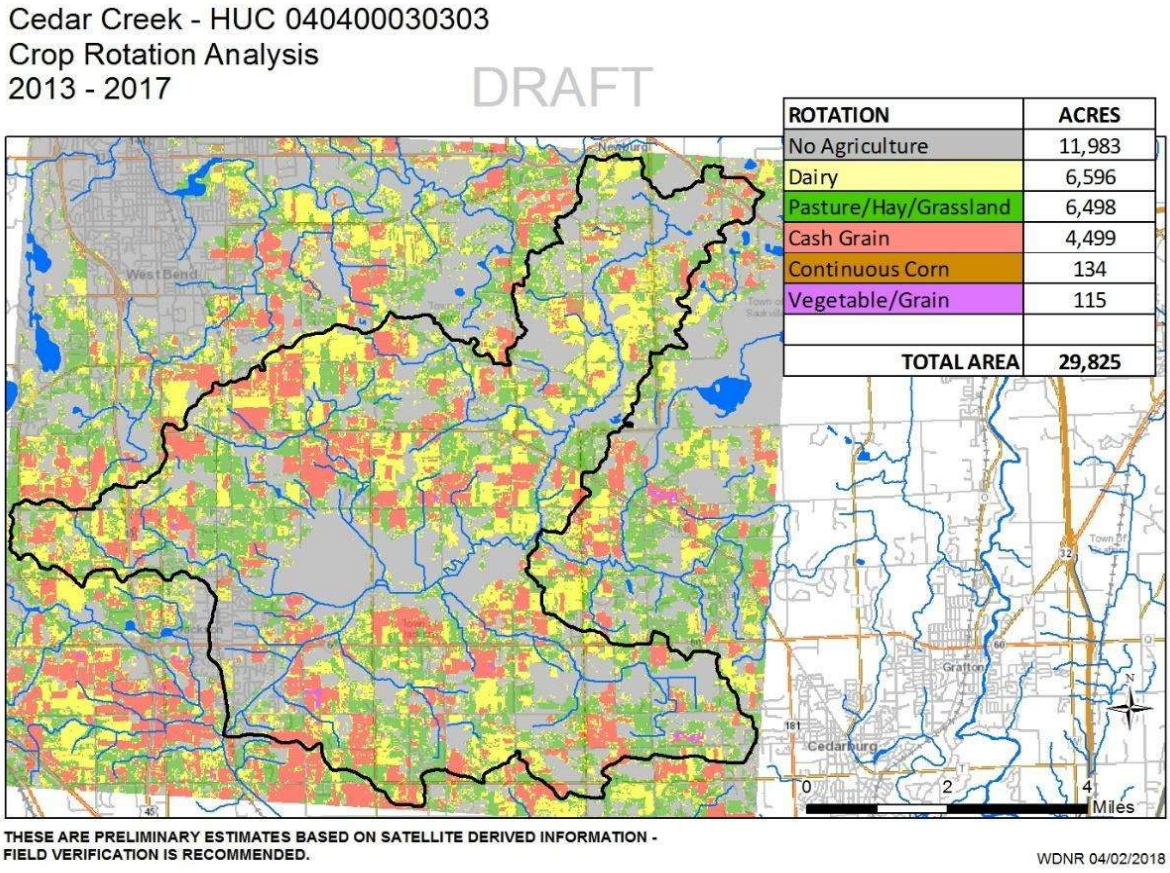


FIGURE 32 – LAND USE AND AG. ROTATIONS IN HUC 0303



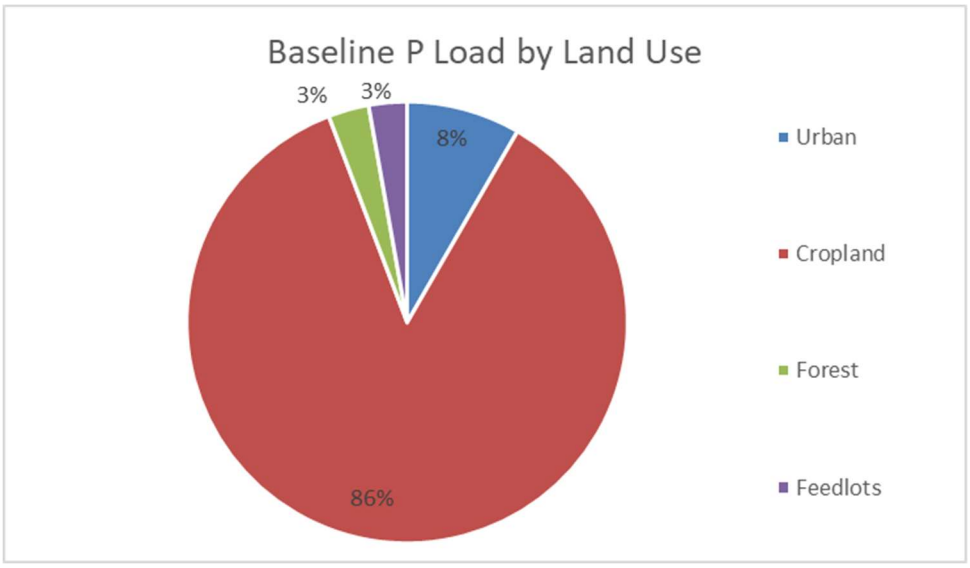
As indicated in the following STEPL tables, agricultural uses (cropland, pastureland, and feedlots) account for 40% of the land use in the sub-watershed. STEPL land use from the EVAAL analysis (Figure 32), adapted as needed with information from the national data server (urban and forest breakout), and from Washington County (pastureland and feedlots) is shown in Table 17.

TABLE 17 – LAND USE IN HUC 0303

	Urban	Cropland	Pastureland	Forest	Grassland	Feedlots
Land Area (acres)	3323	11344	647	8660	5851	3
Land Area %	11%	38%	2%	29%	20%	0%

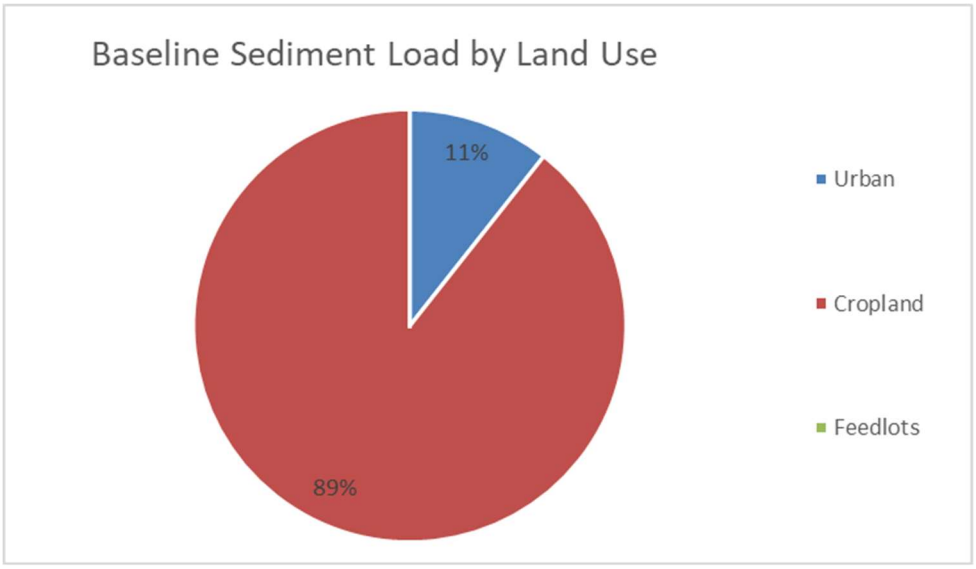
STEPL baseline loading for this sub-watershed accounts for installed agricultural BMPs as of January 2017 (the baseline date). Installed cropland BMPs include 900 acres of nutrient management plans, grass buffers treating 40 acres of cropland, and prescribed grazing on 40 acres of pastureland. There were no baseline practices on feedlots. STEPL modeling indicates that agriculture accounts for 89% of both the P (TP in the TMDL) and sediment (TSS in the TMDL) loads (Figures 33 and 34).

FIGURE 33 – BASELINE P LOAD % BY LAND USE IN HUC 0303



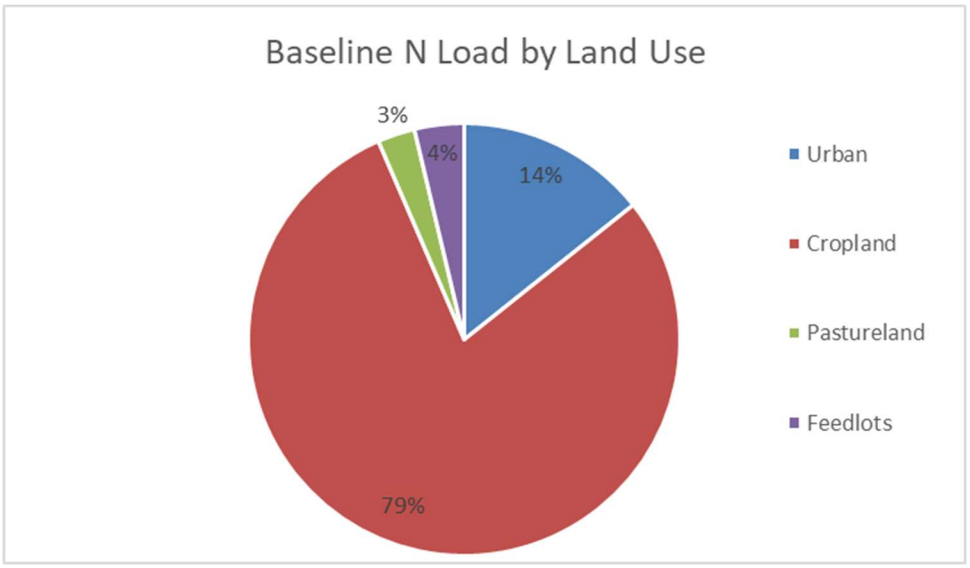
(Sources contributing 1% or less are not shown)

FIGURE 34 - BASELINE SEDIMENT LOAD BY LAND USE IN HUC 0303



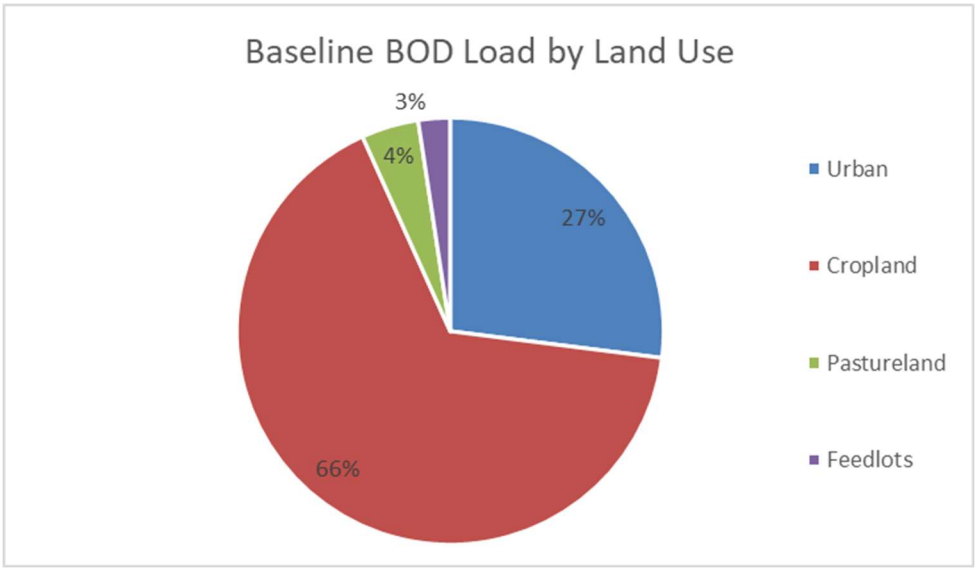
(Sources contributing 1% or less are not shown)

FIGURE 35 – BASELINE NITROGEN (N) LOAD BY LAND USE IN HUC 0303



(Sources contributing 1% or less are not shown)

FIGURE 36 – BASELINE BOD LOAD BY LAND USE IN HUC 0303



(Sources contributing 1% or less are not shown)

Although not included in the TMDL, Nitrogen (N) and Biological Oxygen Demand (BOD) may also contribute to water quality problems. As shown in figures 35 and 36, agricultural uses account for 86% and 73% of these loadings, respectively. The same BMPs that reduce TP and TSS loadings can also reduce levels of N and BOD (Tables 18 and 20) in this sub-watershed. In addition, some of the cropland BMPs described in this plan (e.g., reduced tillage, increased residue, cover crops, low disturbance manure injection) will help, over time, to improve the infiltration capacity of agricultural fields and may help reduce bacteria loadings from cropland in this sub-watershed.

As shown in Table 18, STEPL predicts total P (TP) loading from all agricultural sources is 30,192 lbs/year and sediment (TSS) loading is 3,589 tons/year. P loading is reduced by 2.3% and sediment loading by 0.2% from the agricultural baseline practices compared to no controls (not shown).

TABLE 18 – STEPL BASELINE LOADING WITH EXISTING BMPs

Source	N Load (lb/yr)	P Load (lb/yr)	BOD Load (lb/yr)	Sediment Load (t/yr)
Cropland	100,410	28,818	172,830	3,499
Pastureland	3,537	388	11,319	51
Feedlots	4,711	942	6,282	0
Gully*	53	44	106	39
Agriculture Sub-total	**108,712**	**30,192**	**190,536**	**3,589**
Urban	18,145	2,801	70,427	417
Forest	1,894	1,000	4,653	51
Grassland	4,263	3,517	8,527	1,332
Septic	402	158	1,643	0
Total	**133,416**	**37,668**	**275,785**	**5,389**

*baseline gully loadings modified per WDNR guidance

There are approximately 61 animal housing operations in this sub-watershed. Of the 61 feedlots, 22 are providing loads/nutrients to surface waters, split evenly between dairy and horse operations. Once of the dairy producers may expand to house over 1,000 animal units, and they will then be required to be permitted as a CAFO. Washington County estimates that it will be feasible to adopt the agricultural management practices shown in Table 19 over the 10-year plan schedule. Table 19 practices were applied to 25% of cropland acres, 49% of pastureland acres, and 46% of feedlot acres in the sub-watershed. Information in parentheses refers to the corresponding practices as defined in STEPL. Combining practices (in parallel) treating the same land areas can result in greater load reductions due to synergistic effects compared with serial practices spread over more total land area; combined cropland practices are included in the planned BMPs listed in Table 19.

TABLE 19 – PROJECTED AG PRACTICES TO BE INSTALLED OVER 10 YEARS IN HUC 0303

Agricultural Land Use	Practice(s)	Area Treated
Feedlots	Runoff Management systems	10 sites (45% of 22 sites/total area)
Cropland	Nutrient Management Plans (NMP-1)	1000 acres
	Reduced tillage (Con Till-2)	300 acres
	Cover Crops (Crop-3)	200 acres
	Grassed waterways (Gullies)	15,000 linear feet of 3" deep by 4" wide annual gully and BMP efficiency 0.7
	Grass buffers to filter riparian strips	40 acres
	Nutrient Management Plans (NMP-1) combined with Reduced Tillage (Con Till-2)	1000 acres
	Nutrient Management Plans (NMP-1) combined with Cover Crops (Crop -3)	800 acres
	Nutrient Management Plans (NMP-1) combined with Grass Buffers (minimum 35 ft wide)	200 acres
	Reduced tillage (Con Till-2) combined with Cover crops (Crop-3)	200 acres
Pastureland	Grass buffers (minimum 35 feet wide)	200 acres
	Grazing Land Management (rotational grazing with fenced areas)	50 acres
	Prescribed Grazing	25 acres
	Use Exclusion	10 acres

The estimated pollutant reductions from adopting these practices are shown in Table 20. TP is reduced by 4,948 lbs. annually, which is a 16.4% reduction compared to the agricultural baseline of 30,192 lbs. TSS is reduced by 489 tons annually, which is a 13.6% reduction compared to the agricultural baseline of 3,589 tons.

TABLE 20 – STEPL LOADING WITH PROPOSED 10-YEAR BMPs

Sources	N Load (lb/yr)	P Load (lb/yr)	BOD Load (lb/yr)	Sediment Load (t/yr)
Cropland	91,576	24,348	169,918	3,044
Pastureland	2,388	289	11,246	39
Feedlots	4,711	589	6,282	0
Gully	23	19	45	17
Agriculture Sub-total	**98,698**	**25,244**	**187,491**	**3,100**
Urban	18,145	2,801	70,427	417
Forest	1,894	1,000	4,653	51
Grassland	147	122	295	46
Septic	402	158	1,643	0
Total	**119,286**	**29,324**	**264,509**	**3,614**

These BMPs are also estimated to reduce N, BOD, and some bacterial loads. STEPL-derived N and BOD reductions are included here although they are not addressed in the TMDL. STEPL currently does not calculate load reductions for bacteria. STEPL model results with bacteria reductions should be revised within 12 months of release of STEPL by USEPA.

TMDL reach MI-21 comprises approximately 7% of the sub-watershed, and reach MI-22 comprises 50%, with MI-23 at 35% and MI-23 at 8%. As shown in Table 21, the required agricultural TP reduction for the sub-watershed ranges from 37% to 52%, and the required agricultural TSS reduction ranges is 60% to 72%. Weighted average percent reductions based on estimated areas covered by each reach result in required overall reductions for agricultural uses of 43% for TP and 66% for TSS.

Part 3 of this plan describes methods, milestones, management measures and funding sources for implementing Table 19 practices over the plan's ten-year schedule. Table 37 provides interim milestones. Table 39 provides cost estimates, and Table 38 of this plan describes information and educational milestones for this sub-watershed.

Because the agricultural TP and TSS reductions modeled above make progress towards, but do not achieve, the overall TMDL reduction goals, multiple 10-year planning cycles with goals for adoption of additional BMPs on remaining cropland acres in this sub-watershed will be needed, over time, to meet the TMDL reduction goals.

This plan also estimates meeting the TMDL-based urban reductions in this sub-watershed will require multiple MS4 permit cycles – see **MS4 Permits and Milwaukee River TMDL** section above for details. For non-permitted urban and MS4 areas, TP and TSS reductions range from 47% - 78%. Weighted average percent reductions were calculated as above and are shown in Table 21 for informational purposes. In practice, the MS4s and non-permitted urban area percent reductions will likely be addressed at the individual reach or finer level by the municipalities located within the sub-watershed. The draft *Ozaukee County, Milwaukee River TMDL Watershed Based Solutions* report (Aug 2018) identifies and maps 32 agricultural sites with the potential for BMPs and P trading in this sub-watershed. The report includes STEPL analysis of expected TP and TSS reductions, as well as trade ratio approximations and cost ranges

for the BMP(s) recommended for each site. This report may be used to define critical areas in the sub-watershed for adoption of new or additional BMPs to reduce pollutant loads.

TABLE 21 – TP AND TSS REDUCTIONS SPECIFIED IN THE TMDL IN HUC 0303 SOURCE: TMDL APPENDIX A, ADAPTED FROM TABLES A.28 AND A.30

TMDL Reach	Corresponding HUC 12	TP Reduction		TSS Reduction	
		Agricultural	Non-Permitted Urban/MS4	Agricultural	Non-Permitted Urban/MS4
MI-21	040400030303	51%	76%/75%	70%	76%/76%
MI-22		37%	50%/49%	68%	72%/71%
MI-23		38%	49%/47%	72%	75%/74%
MI-24		52%	78%/77%	60%	68%/67%
AVG*		**43%**	**61%**	**66%**	**71%**

** see discussion.*

Civil divisions in the sub-watershed include sections of several towns, villages, and cities, including the Town of Barton, the Town of Cedarburg, the Town and Village of Jackson, the Town of Saukville, the Town of Trenton, and the City of West Bend. Of these, the Town of Jackson, the Town of Saukville, and the Town of Trenton are not MS4 permittees. Together, these non-permitted civil divisions cover approximately 90% of the sub-watershed, suggesting some potential for pollutant reductions from non-permitted urban areas, though these comprise a relatively small portion of the loadings.

In this sub-watershed, there is no systematic streambank inventory except for some portions within the Jackson Marsh Wildlife Area. With that said, quantifying and addressing additional streambank erosion sites present another potential opportunity to further reduce pollutant loadings and contribute to improvements in aquatic and riparian habitat within the sub-watershed. This is a 3-5-year milestone in the present plan. Consultants working in Ozaukee County on riparian and aquatic species preservation have expressed interest in working in the Cedar Creek sub-watersheds.

Minimum Progress Criteria

This plan contains several milestones that will be carefully tracked and monitored over time to determine if sufficient progress is being made to meet plan goals/pollutant reductions. The following criteria will be used to determine when plan milestones and reduction goals should be revised due to minimal progress achieved:

- Less than 25% of planned cropland practices or estimated load reductions are met by year 3
- Less than 25% of funding is available/awarded to implement by year 3
- Less than 25% of funding for conservation staff is awarded/available by year 3
- Conservation staff shortages occur, and technical assistance resources are limited for two years between years 1-5

The proposed implementation schedule for the Cedar Creek (HUC 12 – 040400030303) watershed plan will require 10 years of BMP planning, design and installation. Over this time span, individual farms will be assessed to determine the location and efficiency of existing BMPs, current management practices and

potential critical sites of pollution. Selected farm operations will also be assessed to determine whether they are in compliance with the State of Wisconsin's agriculture performance standards in accordance with the Department of Natural Resources Chapter NR 151.

Over this plan's ten-year schedule, it will be important to monitor the functionality of BMPs implemented in the watershed periodically after their installation. Over time, BMPs can become less efficient at achieving designed pollutant reductions due to several factors. According to the USEPA Technical Memorandum #1: Adjusting for Depreciation of Land Treatment when Planning Watershed Projects (available at https://www.epa.gov/sites/production/files/2015-10/documents/tech_memo_1_oct15.pdf), natural variability, lack of proper maintenance and unforeseen consequences are primary causes of BMP depreciation. Considering how erratic and unpredictable weather patterns are increasingly becoming, checking BMPs in the watershed will be critical for assessing their performance. BMP performance data will be used to evaluate plan implementation, modeled load reduction estimates and to help determine if substantial progress is or is not being made toward attaining WQ standards.

There are several key indicators of the Cedar Creek (HUC 12 – 040400030303) watershed plan that will be carefully tracked and monitored to determine if sufficient progress is being made and milestones are being achieved. The Washington Department of Land Conservation will take the lead responsibility of monitoring plan implementation progress by tracking the following plan components:

1. Information and education activities and participation
2. Pollution reduction levels from installed BMP's
3. Administrative review
4. WQ monitoring efforts (completed by WDNR or others) within the watershed

With assistance from our cooperating partners, USDA-NRCS and UW-Extension Services, an annual review meeting will be conducted to assess the following activities:

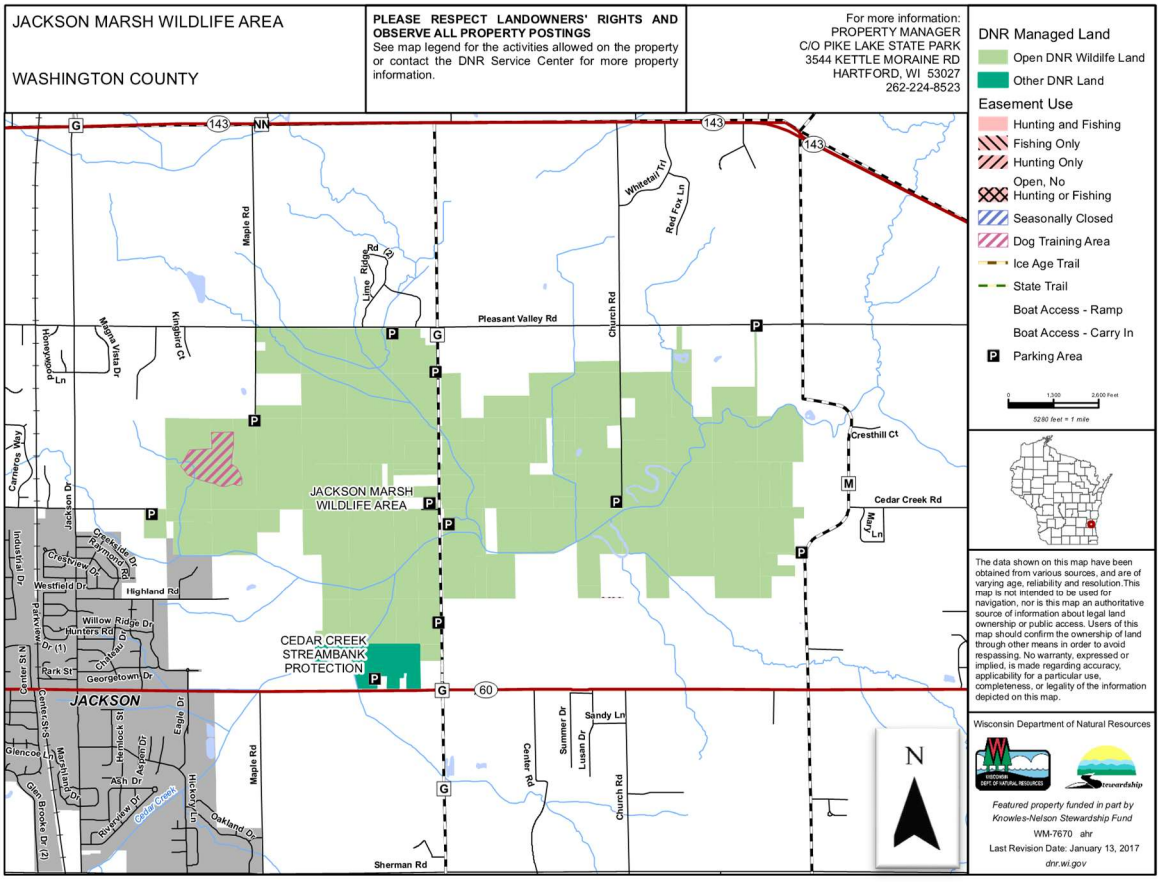
1. Information and education
    a. Number of landowners/operators contacted
    b. Number of one-on-one landowner contacts
    c. Number of group meetings and attendance
    d. Number of cost share agreements signed

2. BMP installation, performance and pollution reduction
    a. That BMP design is in accordance with NRCS standards and specifications
    b. That BMP's are installed according to standards and specifications
    c. Inspect BMP's every 4 years to determine level of efficiency
    d. Conduct BMP operation and maintenance spot checks
    e. Rerun STEPL Model when BMP efficiency has changed to determine effects on pollutant loads
    f. Review Crop Residue and Tillage intensity satellite imagery results
    g. Estimate the types and amounts of BMPs installed on critical areas in the watershed

3. Water Quality Monitoring
    a. Results of WQ sampling for Total Phosphorus and other parameters

4. Administrative Review
    a. Grant source and application review
    b. Grant allocations for cost share assistance review
    c. Review practices and dollar amounts per cost share agreement
    d. Track and review staff expenses and support costs
    e. Review all other expenses related to the project
    f. Determine if milestones are sufficiently attained

FIGURE 37 – MAP OF THE JACKSON MARSH WILDLIFE AREA



<u>Summary and Conclusion</u>

In this sub-watershed, agricultural uses predominate in pollutant loadings across the board. STEPL analysis indicates that adoption of more agricultural BMPs on approximately 30% of the cropland acres will make progress towards, but will not achieve, the overall TMDL reduction goals. Fully meeting the TMDL will likely require several 10-year planning cycles. STEPL modeling for agricultural areas aids in determining the amounts and types of BMPs necessary to meet TMDL goals. The EVAAL land cover and crop rotation maps, along with the Ozaukee P trade report, will be used to prioritize the locations and types of BMPs within the sub-watershed. The eventual goal of this plan is to achieve and maintain enough practices to improve water quality and allow impaired waters to fully meet their designated uses. The recent formation of the Cedar Creek producer-led watershed group indicates significant interest in improving

water quality by addressing agricultural loadings. This group may assist with adoption of more agricultural practices than shown in this plan – which will help make further progress towards meeting the TMDL reduction goals for this sub-watershed.

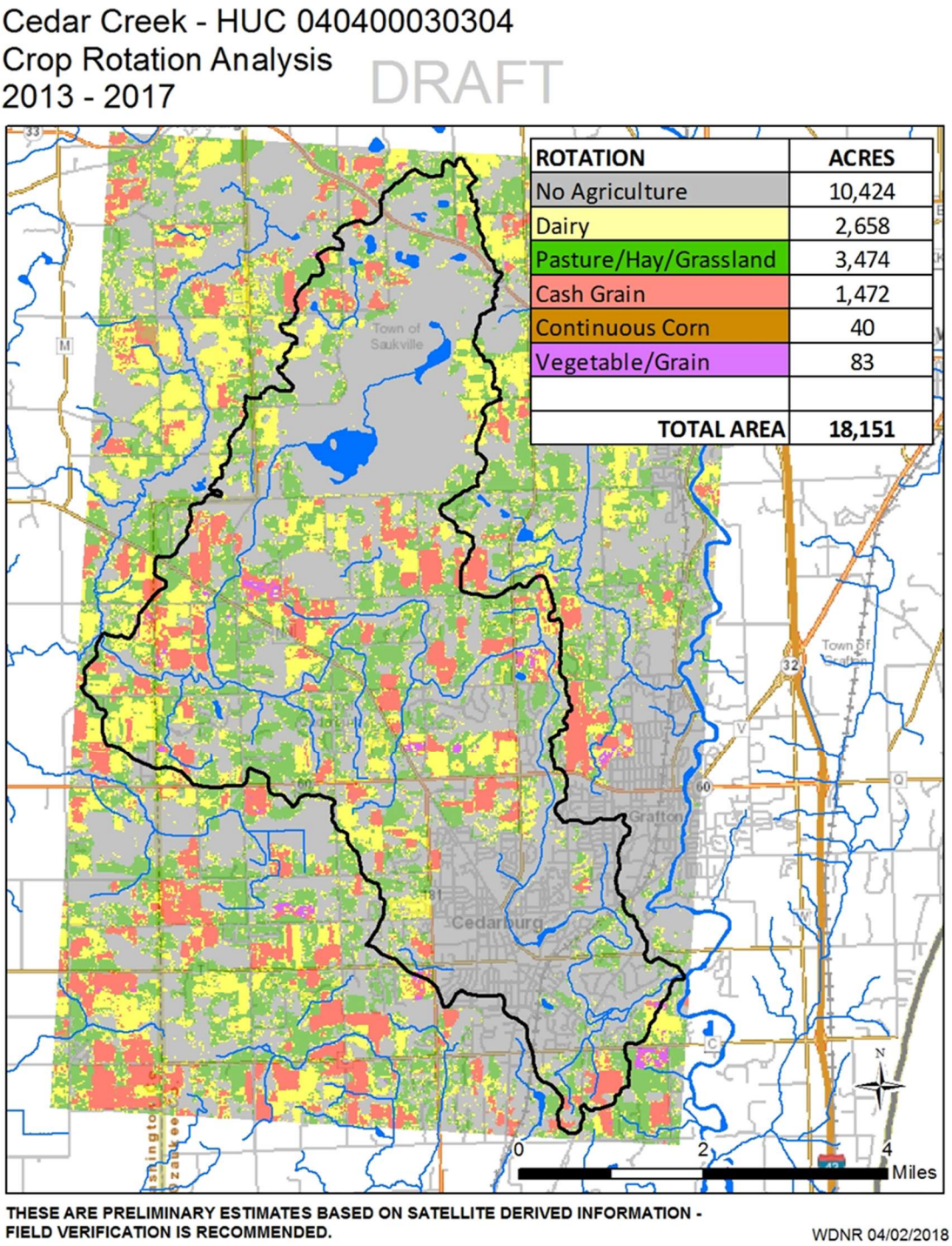
8.5 Cedar Creek HUC 12 – 040400030304

The 040400030304 sub-watershed comprises the eastern portion of the Cedar Creek watershed (Fig. 1 and 2). This 18,151-acre area includes approximately 18 stream miles of Cedar Creek and several small tributaries. The 1,845-acre Cedarburg Bog State Natural Area, owned by WDNR and UW-Milwaukee, is within this sub-watershed and includes its largest lakes, the 245-acre Mud Lake and 34-acre Long Lake. The bog area, located within the Town of Saukville, is managed under the DNR's 2016 *Northern Kettle Moraine Region Wildlife, Fish and Natural Areas Master Plan and Environmental Analysis.* The Friends of the Cedarburg Bog is an NGO that engages in planning, outreach and stewardship, including invasive species initiatives, within the bog area. This sub-watershed is in a strategic portion of the planning area, where agricultural land use is giving way to residential development as Washington County grows in population. The Town and Village of Cedarburg cover a significant portion of this area. Together with the Town of Saukville, these civil divisions cover over 90% of this sub-watershed.

TMDL Reach MI-24 covers all of the sub-watershed area (Fig. 16). Cedar creek is capable of supporting warm water sport fish communities through its entire length, either year-round or seasonally (Figure 17). Cedar Creek is impaired throughout its entire length. Point and non-point sources of phosphorus are the causes of the impairments. Land uses in the sub-watershed contribute pollutants that may impair waters in neighboring areas, and the TMDL is also designed to be protective of currently non-impaired surface waters. Therefore, the TMDL specifies current pollutant loadings and needed reductions in this HUC 12. Please refer to sections 7.1, 7.4 and Appendices F and I of this plan for discussion of impaired waters and results of recent water quality monitoring within this sub-watershed.

This sub-watershed is vulnerable to erosion, and an analysis of this vulnerability was completed using WDNR's EVAAL tool. The results of this analysis are shown in Figure 99 in Appendix J. There is also significant agricultural land use in this sub-watershed, and the land use/acreage information that is shown in Figure 38 in conjunction with Washington County and WDNR staff input was used to complete STEPL modeling of this sub-watershed.

FIGURE 38 – LAND USE AND AG. ROTATIONS IN HUC 0304



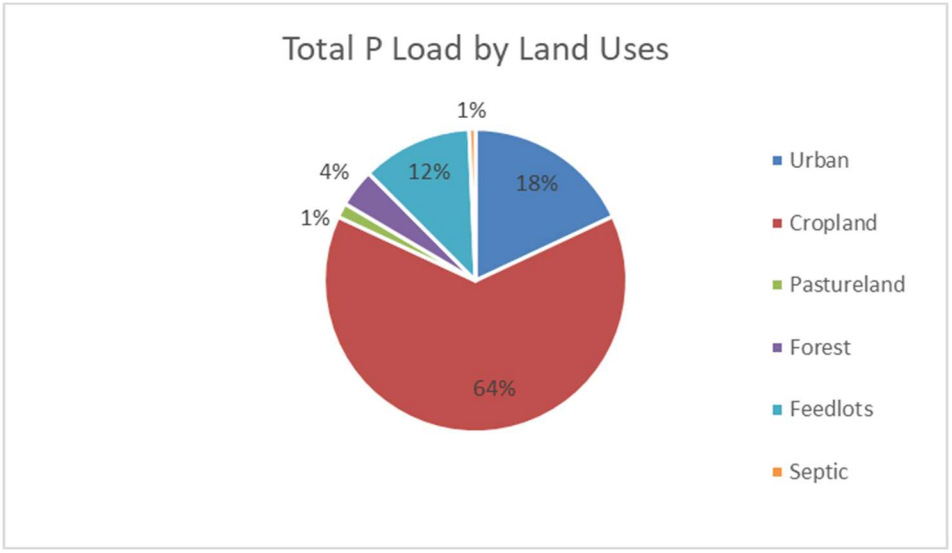
As indicated in the following STEPL tables, agricultural uses (cropland, pastureland, and feedlots) account for just over 25% of the land use in the sub-watershed. STEPL land use from the EVAAL analysis (Figure 38), adapted as needed with information from the national data server (urban and forest breakout), and from Washington County (pastureland, grassland, and feedlots) is shown in Table 22.

TABLE 22 – LAND USE IN HUC 0304

	Urban	Cropland	Pastureland	Forest	Grassland	Feedlots
Land Area (acres)	4206	4253	450	6218	3006	18
Land Area %	23%	23%	2%	34%	17%	0.1%

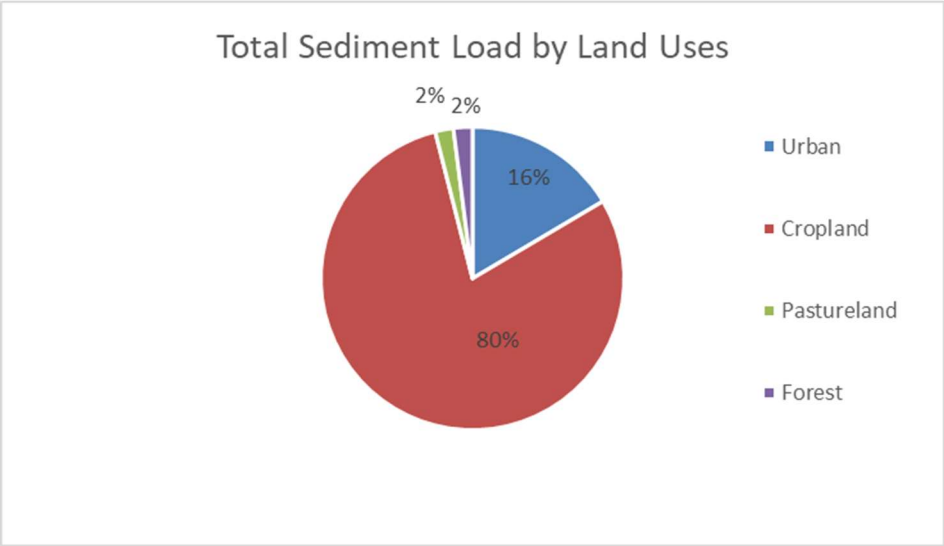
STEPL baseline loading for this sub-watershed accounts for installed agricultural BMPs as of January 2017 (the baseline date). Agricultural land uses modeled in STEPL include cropland, pastureland, feedlots, and gullies. Installed cropland BMPs include Nutrient Management Plans covering 750 acres, 300 acres of conservation tillage, and 300 linear feet of grassed waterways (gullies). Pastureland baseline practices comprise 100 acres of rotational grazing. Bare soil pasture areas are included in feedlot acres - feedlot baseline practices include waste storage facilities serving 4 acres, with 2 acres treated with sediment basins and infiltration beds. STEPL modeling indicates that agriculture accounts for 77% of the calculated P (TP in the TMDL) and 82% of Sediment (TSS in the TMDL) loads (Figures 39 and 40).

FIGURE 39 – BASELINE P (TP) % BY LAND USE IN HUC 0304



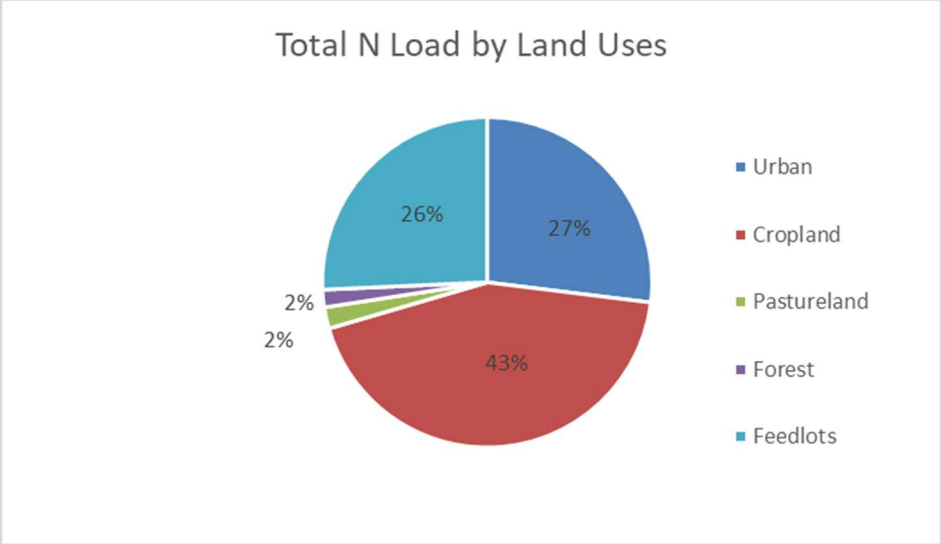
(Sources contributing less than 1% are not shown)

FIGURE 40 – BASELINE SEDIMENT (TSS) % BY LAND USE IN HUC 0304



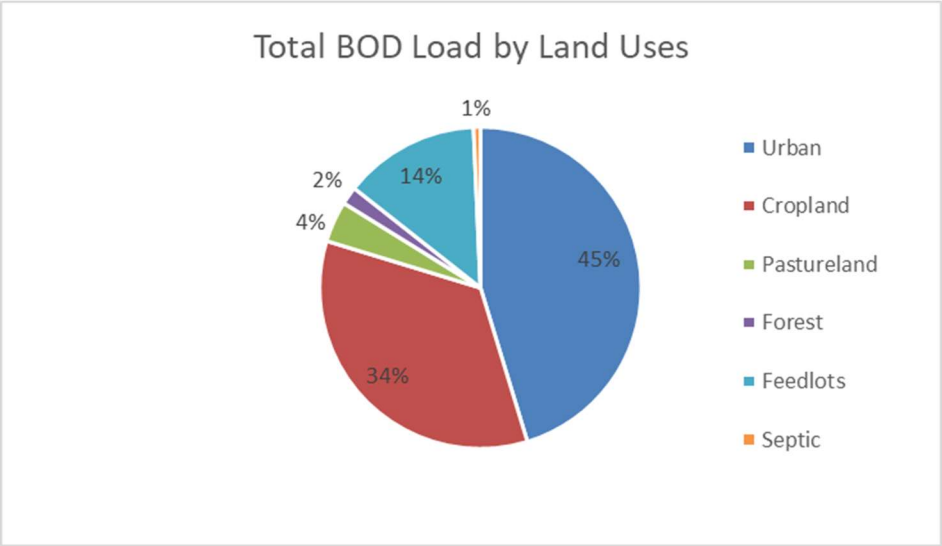
(Sources contributing 1% or less are not shown)

FIGURE 41 – BASELINE N % BY LAND USE IN HUC 0304



(Sources contributing 1% or less are not shown)

FIGURE 42 – BASELINE BOD % BY LAND USE IN HUC 0304



(Sources contributing less than 1% are not shown)

Although not included in the TMDL, Nitrogen (N) and Biological Oxygen Demand (BOD) may also contribute to water quality problems. As shown in figures 41 and 42, agricultural uses account for 71% and 52% of these loadings, respectively. The same BMPs that reduce TP and TSS loadings can also reduce levels of N and BOD (Tables 23 and 24) in this sub-watershed. In addition, some of the cropland BMPs described in this plan (e.g., reduced tillage, increased residue, cover crops, low disturbance manure injection will help, over time, to improve the infiltration capacity of agricultural fields and may help reduce bacteria loadings from cropland in this sub-watershed.

As shown in Table 23, STEPL predicts total P loading from all agricultural sources is 15,303 lbs/year and Sediment loading is 2,693 tons/year. N and P loading are reduced by 7%, and BOD and sediment by 3% from the agricultural baseline practices compared to no controls (not shown).

TABLE 23 – STEPL BASELINE LOADING WITH EXISTING BMPs IN HUC 0304

Sources	N Load (lb/yr)	P Load (lb/yr)	BOD Load (lb/yr)	Sediment Load (t/yr)
Cropland	37,053	12,551	67,656	2,541
Pastureland	2341	332	8,095	62
Feedlots	21,888	2,318	26,913	0
Gully*	123	102	246	90
Agriculture Sub-total	**61,406**	**15,303**	**102,909**	**2,693**
Urban	22,939	3,542	89,079	527
Forest	1,459	796	3,543	65
Grassland	133	110	266	42
Septic	333	130	1,359	0
Total	**86,269**	**19,881**	**197,157**	**3,326**

**Gully baselines modified per WDNR guidance*

There are approximately 4300 acres of cropland, 450 acres of pastureland and 25 animal housing operations in this sub-watershed. Horses account for half of the animal housing operations. Fourteen of the 25 feedlots are providing loads/nutrients to surface waters; the majority of the feedlot concerns are from larger open earthen lots. There is currently one CAFO (> 1,000 animal units) in this sub-watershed. CAFO production areas (feedlots) are regulated as point sources. Permits specify zero discharge from the production areas, but do not apply to cropland. Ozaukee County estimates that it will be feasible to adopt the agricultural management practices shown in Table 24 over the 10-year plan schedule. Table 24 practices were applied to 22% of cropland acres, 24% of pastureland acres and 5% of feedlot acres in this sub-watershed. Combining practices (in parallel) treating the same land areas can result in greater load reductions due to synergistic effects compared with serial practices spread over more total land area; combined cropland practices are included in the planned BMPs listed in Table 24. Information in parentheses refers to the corresponding practices as defined in STEPL.

TABLE 24 – PROJECTED AG. PRACTICES TO BE INSTALLED OVER 10 YEARS IN HUC 0304

Agricultural Land Use	Practice(s)	Area Treated
Feedlots	Diversion (roofs/gutters)	0.85 acre (4.7% of area)
Cropland	Nutrient Management Plans (NMP-1)	118 acres
	Reduced Tillage (Con Till-1)	100 acres
	Reduced Tillage (Con Till-2)	100 acres
	Cover Crops (Cover Crop -2)	100 acres
	Grassed waterways (Gullies)	3,960 linear feet of 9" deep by 12" wide annual gully and BMP efficiency 0.6
	Nutrient Management Plans (NMP-1) combined with Reduced Tillage (Con Till-1)	100 acres
	Nutrient Management Plans (NMP-1) combined with Reduced Tillage (Con Till-2)	100 acres
	Nutrient Management Plans (NMP-1) combined with Cover Crops (Crop-2)	100 acres
	Nutrient Management Plans (NMP-1) combined with Grass Buffers (minimum 35 ft wide)	32 acres
Pastureland	Alternative watering	5 acres
	Grazing Land Management (rotational grazing with fenced areas)	100 acres
	Heavy Use Area Protection	1 acre

The estimated pollutant reductions from adopting these practices are shown in Table 25. TP is reduced by 1,521 lbs. annually, which is a 9.9% reduction compared to the agricultural baseline of 15,303 lbs. Sediment is reduced by 230 tons annually, which is an 8.5% reduction compared to the agricultural baseline of 2,693 tons.

TABLE 25 – STEPL LOADING WITH PROPOSED 10-YEAR BMPs IN HUC 0304

Sources	N Load (lb/yr)	P Load (lb/yr)	BOD Load (lb/yr)	Sediment Load (t/yr)
Cropland	34,511	11,220	66,577	2,372
Cropland	34,512	11,145	66,393	2,344
Pastureland	2,101	321	8,095	62
Feedlots	21,195	2,252	26,998	0
Gully	78	65	156	58
Agriculture Sub-total	**57,886**	**13,782**	**101,642**	**2,463**
Urban	22,939	3,542	89,079	527
Forest	1,459	796	3,543	65
Grassland	133	110	266	42
Septic	333	130	1,359	0
Total	**82,749**	**18,360**	**195,890**	**3,096**

These BMPs are also estimated to reduce N, BOD, and some bacterial loads. STEPL-derived N and BOD reductions are included here although they are not addressed in the TMDL. STEPL currently does not calculate load reductions for bacteria. STEPL model results with bacteria reductions should be revised within 12 months of release of STEPL by USEPA. TMDL reach MI-24 covers all of this sub-watershed, so the TMDL required percent reductions are derived solely from this reach (Figure 16).

Part 3 of this plan describes methods, milestones, management measures and funding sources for implementing Table 24 practices over the plan's ten-year schedule. Table 37 provides interim milestones. Table 39 provides cost estimates, and Table 38 of this plan describes information and educational milestones for this sub-watershed.

As shown in Table 26 the required agricultural TP (P) reduction for Reach MI-21 is 52% and the agricultural TSS (Sediment) reduction is 60%. Because the agricultural TP (P) 10% and TSS (Sediment) 8.5% reductions modeled above make progress towards, but do not achieve, the overall TMDL reduction goals, multiple 10-year planning cycles with goals for adoption of additional BMPs on remaining cropland acres in this sub-watershed will be needed, over time, to meet the TMDL reduction goals.

This plan also estimates meeting the TMDL-based urban reductions in this sub-watershed will require multiple MS4 permit cycles – see **MS4 Permits and Milwaukee River TMDL** section above for details. For non-permitted urban and MS4 areas, the required TP reductions are nearly identical at 78% and 77%, which is also the case for TSS at 68% and 67% respectively. In practice, the MS4s and non-permitted urban area percent reductions will likely be addressed at the individual reach or finer level by the municipalities located within the sub-watershed. The draft *Ozaukee County, Milwaukee River TMDL Watershed Based Solutions* report (Aug 2018) identifies and maps 11 agricultural sites and three municipal sites with the potential for BMPs and P trading in this sub-watershed. The report includes a high-level STEPL analysis of expected TP and TSS reductions, as well as trade ratio approximations and cost ranges for the BMP(s) recommended for each site. This report may be used to define critical areas in the sub-watershed for adoption of new or additional BMPs to reduce pollutant loads.

TABLE 26 – TP AND TSS REDUCTIONS SPECIFIED IN THE TMDL SOURCE: APPENDIX A, ADAPTED FROM TABLES A.28 AND A.30

TMDL Reach	Corresponding HUC 12	TP Reduction		TSS Reduction	
		Agricultural	Non-Permitted Urban/MS4	Agricultural	Non-Permitted Urban/MS4
MI-24	040400030304	52%	78%/77%	60%	68%/67%

Civil divisions in the sub-watershed include sections of several towns, villages, and cities. The Town and Village of Cedarburg, both MS4 permittees, comprise the majority of the area, and virtually all of the stream miles of the portion of Cedar Creek within this sub-watershed. The Town of Saukville, which is not an MS4 permittee, covers the next largest portion. This suggests some potential for practices in non-permitted urban areas, though a significant portion is already under DNR management covering the Cedarburg Bog area. The Town of Grafton, the Village of Grafton, the Town of Jackson, and the City of Mequon comprise much smaller portions of the land area. Of these, only the Town of Jackson is not an MS4 permittee.

Streambank contributions to pollutant loadings were not modeled due to a current lack of data on the condition of streambanks in the sub-watershed. With that said, quantifying and addressing streambank erosion sites present another potential opportunity to reduce pollutant loadings, especially TP and TSS, and contribute to improvements in aquatic and riparian habitat within the sub-watershed. Consultants working in Ozaukee County on riparian and aquatic species preservation have expressed interest in working in the Cedar Creek sub-watersheds.

Milwaukee Clean Farm Families Farmer-led group (Ozaukee County):

https://www.cleanfarmfamilies.com/

The Milwaukee River Watershed Clean Farm Families, working as part of the Milwaukee River Watershed Conservation Partnership (MRWCP) and DATPC Producer Led Watershed Protection statewide network, is providing a platform for producers and landowners to share ideas, concerns, priorities, and lessons learned about agricultural conservation efforts within the Milwaukee River Watershed. This group was formed in 2016 and also came out of the MRWCP and has funding for the next 5 years. Clean Farm Families promotes best soil and water conservation practices, by working directly with area producers, Natural Resources Conservation Service's Environmental Quality Incentive Program, and the Ozaukee County Land and Water Management Department.

The group is currently comprised of seven farmers/board members, some located within this subwatershed. Many of the soil health practices adopted by this group are similar to the practices included within the STEPL outputs in this plan.

Outreach efforts undertaken so far are similar to the Cedar Creek farmer led group and includes bringing speakers to events to talk about the connection of soil health to watershed health. Cost-sharing opportunities are discussed and explained. Incentive payments offered through the program require less paperwork than similar NRCS incentives and can be combined with other existing NRCS incentive programs within this sub-watershed.

Minimum Progress Criteria

This plan contains several milestones that will be carefully tracked and monitored over time to determine if sufficient progress is being made to meet plan goals/pollutant reductions. The following criteria will be used to determine when plan milestones and reduction goals should be revised due to minimal progress achieved:

- Less than 25% of planned cropland practices or estimated load reductions are met by year 3
- Less than 25% of funding is available/awarded to implement by year 3
- Less than 25% of funding for conservation staff is awarded/available by year 3
- Conservation staff shortages occur, and technical assistance resources are limited for two years between years 1-5

The proposed implementation schedule for the Cedar Creek (HUC 12 – 040400030303) watershed plan will require 10 years of BMP planning, design and installation. Over this time span, individual farms will be assessed to determine the location and efficiency of existing BMPs, current management practices and potential critical sites of pollution. Selected farm operations will also be assessed to determine whether they are in compliance with the State of Wisconsin's agriculture performance standards in accordance with the Department of Natural Resources Chapter NR 151.

Over this plan's ten-year schedule, it will be important to monitor the functionality of BMPs implemented in the watershed periodically after their installation. Over time, BMPs can become less efficient at achieving designed pollutant reductions due to several factors. According to the USEPA Technical Memorandum #1: Adjusting for Depreciation of Land Treatment when Planning Watershed Projects (available at https://www.epa.gov/sites/production/files/2015-10/documents/tech_memo_1_oct15.pdf), natural variability, lack of proper maintenance and unforeseen consequences are primary causes of BMP depreciation. Considering how erratic and unpredictable weather patterns are increasingly becoming, checking BMPs in the watershed will be critical for assessing their performance. BMP performance data will be used to evaluate plan implementation, modeled load reduction estimates and to help determine if substantial progress is or is not being made toward attaining WQ standards.

There are several key indicators of the Cedar Creek (HUC 12 – 040400030303) watershed plan that will be carefully tracked and monitored to determine if sufficient progress is being made and milestones are being achieved. The Ozaukee Department of Land Conservation will take the lead responsibility of monitoring plan implementation progress by tracking the following plan components:

1. Information and education activities and participation
2. Pollution reduction levels from installed BMP's
3. Administrative review
4. WQ monitoring efforts (completed by WDNR or others) within the watershed

With assistance from our cooperating partners, USDA-NRCS and UW-Extension Services, an annual review meeting will be conducted to assess the following activities:

1. Information and education
    a. Number of landowners/operators contacted

b. Number of one-on-one landowner contacts
c. Number of group meetings and attendance
d. Number of cost share agreements signed

2. BMP installation, performance and pollution reduction
   a. That BMP design is in accordance with NRCS standards and specifications
   b. That BMP's are installed according to standards and specifications
   c. Inspect BMP's every 4 years to determine level of efficiency
   d. Conduct BMP operation and maintenance spot checks
   e. Rerun STEPL Model when BMP efficiency has changed to determine effects on pollutant loads
   f. Review Crop Residue and Tillage intensity satellite imagery results
   g. Estimate the types and amounts of BMPs installed on critical areas in the watershed

3. Water Quality Monitoring
   a. Results of WQ sampling for Total Phosphorus and other parameters

4. Administrative Review
   a. Grant source and application review
   b. Grant allocations for cost share assistance review
   c. Review practices and dollar amounts per cost share agreement
   d. Track and review staff expenses and support costs
   e. Review all other expenses related to the project
   f. Determine if milestones are sufficiently attained

Summary and Conclusion

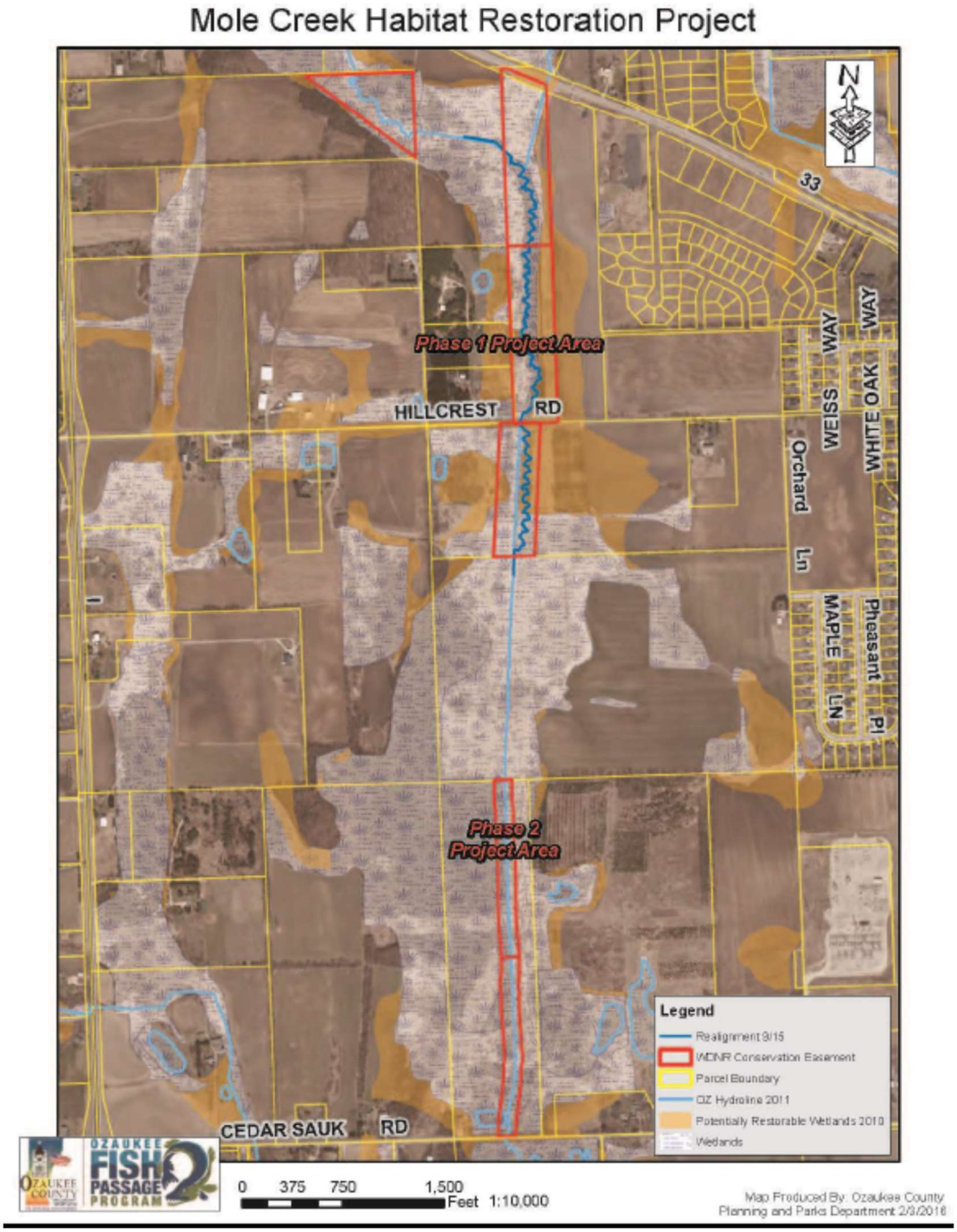
In this sub-watershed, agricultural uses predominate pollutant loadings across the board. STEPL analysis indicates that adoption of more agricultural BMPs on approximately 22% of the cropland acres will make progress toward, but will not achieve, the overall TMDL reduction goals. Fully meeting the TMDL will likely require several 10-year planning cycles. STEPL modeling for agricultural areas aids in determining the amounts and types of BMPs necessary to meet TMDL goals. The EVAAL land cover and crop rotation maps, along with the Ozaukee P trade report, will be used to prioritize the locations and types of BMPs within the sub-watershed. The eventual goal of this plan is to achieve and maintain enough practices to improve water quality and allow impaired waters to fully meet their designated uses. The recent formation of the Milwaukee Clean Farm Families producer-led watershed group indicates significant interest in improving water quality by addressing agricultural loadings in this sub-watershed. This group may assist with adoption of more agricultural practices than shown in this plan – which will help make further progress towards meeting the TMDL reduction goals for this sub-watershed. There is also a need to address relatively high loadings from failing septic systems in this area. Accordingly, a milestone of this plan is to collaborate with local health department staff to identify and then repair or replace failing septic systems within this sub-watershed.

8.6 Milwaukee Frontal - Mole HUC 12 - 040400030603

The 040400030603 sub-watershed comprises the northwestern portion of the Milwaukee Lake Michigan Frontal watershed (Fig. 1 and 2). The area includes approximately 11 miles of the Milwaukee River, the entire 7 stream miles of Mole Creek and several small named and un-named streams. This sub-watershed is in a strategic portion of the planning area, where agricultural land use is giving way to residential development as Ozaukee County grows in population. The Town and Village of Grafton and Town of Cedarburg cover much of the central and southern portions of this sub-watershed, while the Town and Village of Saukville, and small areas of the City and Town of Port Washington, and a small area of the Town of Fredonia cover the central and northern portions.

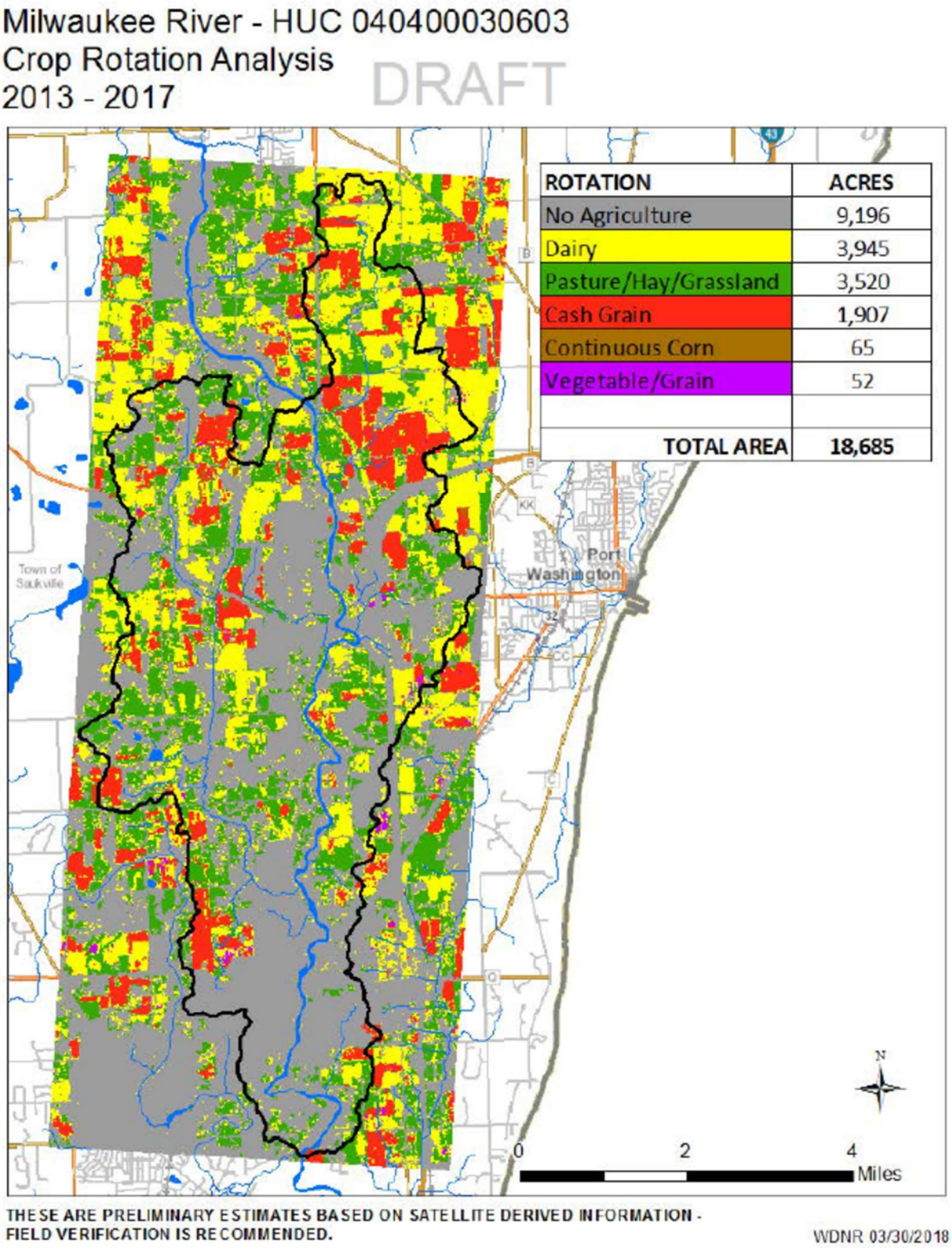
TMDL reach MI-17 covers 60% of this sub-watershed, including the central, southern and western portions, while reach MI-16 comprises the northeastern lobe (Fig. 7). Mole Creek, entirely within reach MI-17, is currently not 303(d) listed as impaired, but Ozaukee County and its partners are working on habitat improvements, including re-meandering sections of the creek that were channelized for agricultural purposes (Figure 2). The creek is capable of supporting cold water sport fish communities. The entire length of the Milwaukee River in this area is impaired by point and non-point sources of phosphorus. Land uses in the sub-watershed contribute pollutants that may impair waters in neighboring areas, and the TMDL is also designed to be protective of currently non-impaired surface waters. Therefore, the TMDL specifies current pollutant loadings and needed reductions in this HUC 12. Please refer to sections 7.1, 7.4 and Appendices F and I of this plan for discussion of impaired waters and results of recent water quality monitoring within this sub-watershed.

FIGURE 43 - MAP OF MOLE CREEK HABITAT RESTORATION PROJECT



This sub-watershed is vulnerable to erosion, and an analysis of this vulnerability was completed using WDNR's EVAAL tool. The results of this analysis are shown in Figure 100 in Appendix J. There is also significant agricultural land use in this sub-watershed, and the land use/acreage information that is shown in Figure 44 in conjunction with Washington County and WDNR staff input was used to complete STEPL modeling of this sub-watershed.

FIGURE 44 - LAND USE AND AGRICULTURAL ROTATIONS IN HUC 0603



As indicated in the following STEPL tables, agricultural uses (cropland, pastureland, and feedlots) account for just over 34% of the land use in the sub-watershed. STEPL land use from the EVAAL analysis (fig. 44), adapted as needed with information from the national data server (urban and forest breakout), and from Ozaukee County (pastureland, grassland, and feedlots) is shown in Table 27.

TABLE 27 - LAND USE IN THE SUB-WATERSHED

	Urban	Cropland	Pastureland	Forest	Grassland	Feedlots
Land Area (acres)	5365	5969	350	3831	3120	25
Land Area %	29%	32%	2%	21%	17%	0.1%

STEPL baseline loading for this sub-watershed accounts for installed agricultural BMPs as of January 2017 (the baseline date). Agricultural land uses modeled in STEPL include cropland, pastureland, feedlots, and gullies. Installed cropland BMPs include Nutrient Management Plans covering 3500 acres, 300 acres of conservation tillage, and 1500 linear feet of grassed waterways (gullies). Bare soil pasture areas are included in feedlot acres - feedlot baseline practices include waste storage facilities serving 8 acres, with 3 acres treated with sediment basins and infiltration beds. STEPL modeling indicates that agriculture accounts for 71% of the calculated P (TP in the TMDL) and 81% of Sediment (TSS in the TMDL) loads (Figures 18 and 19).

There are 1429 septic systems in this sub-watershed, and Ozaukee County estimates a failure rate of approximately 22%. A shown in the following figures, septic systems contribute significant percentages of P, N, and BOD in the watershed. Accordingly, a milestone of this plan is to collaborate with local health department staff to identify and then repair or replace failing septic systems within this sub-watershed. The current annual replacement rate for septic systems in Ozaukee county is 33 systems.

FIGURE 45 - BASELINE P (TP) LOAD % BY LAND USE IN HUC 0603

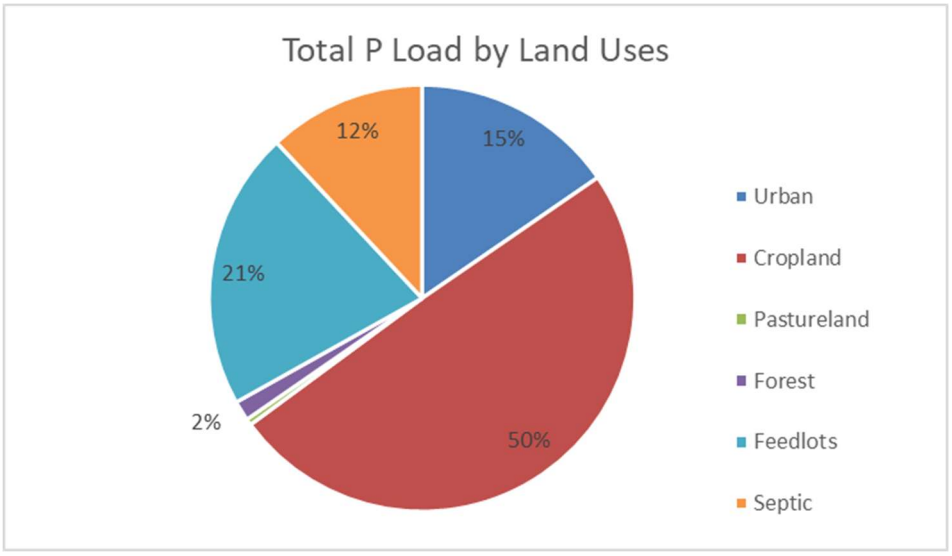


FIGURE 46 - BASELINE SEDIMENT (TSS) LOAD BY LAND USE IN HUC 0603

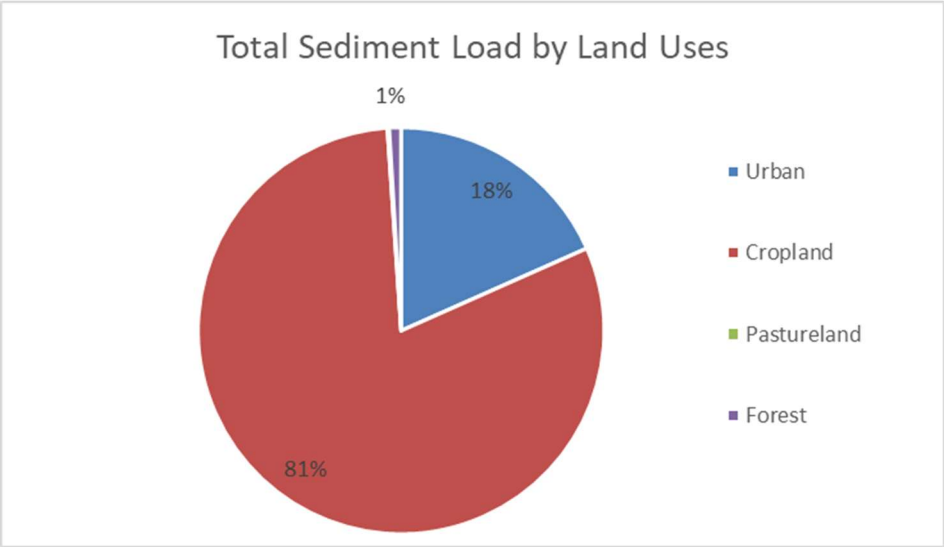


FIGURE 47 - BASELINE N LOAD BY LAND USE IN HUC 0603

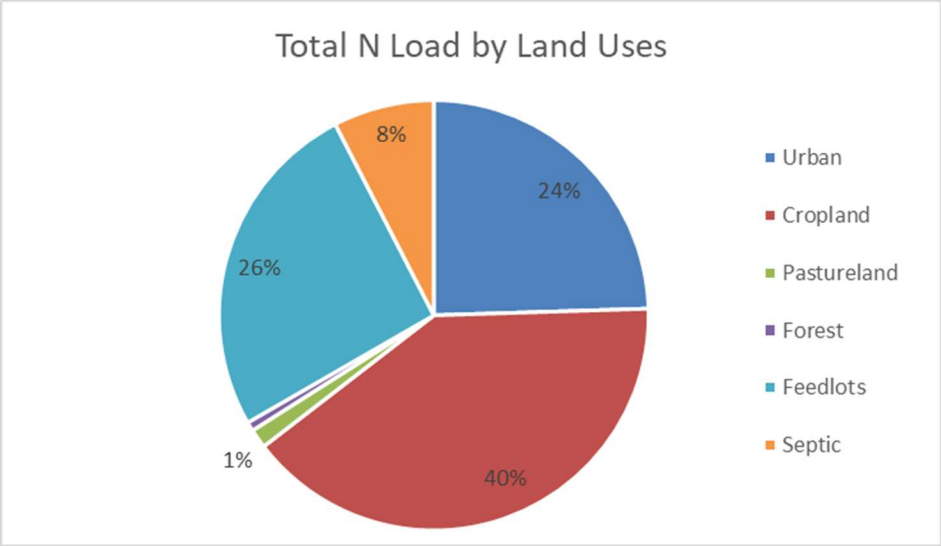
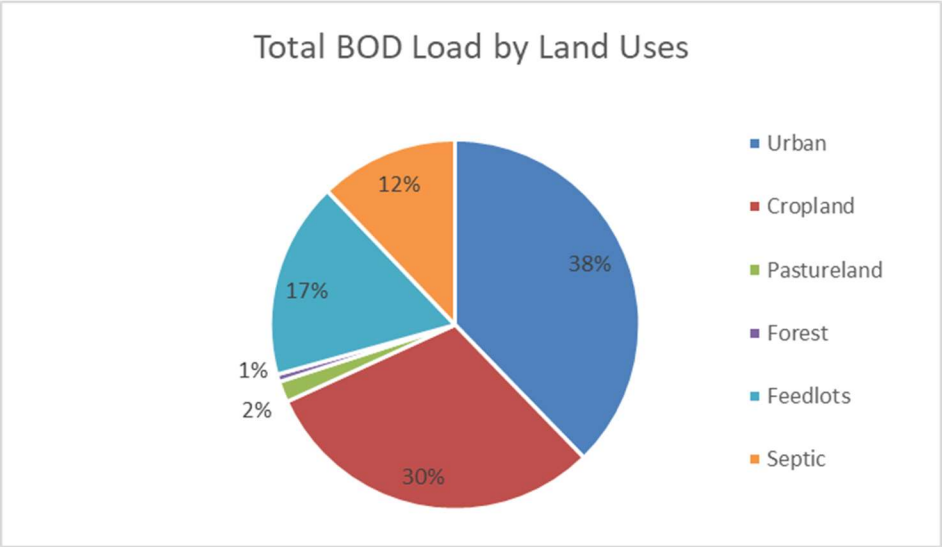


FIGURE 48 - BASELINE BOD LOAD BY LAND USE IN HUC 0603



Although not included in the TMDL, Nitrogen (N) and Biological Oxygen Demand (BOD) may also contribute to water quality problems. As shown in figures 47 and 48, agricultural uses account for 67% and 49% of these loadings, respectively. The same BMPs that reduce TP and TSS loadings can also reduce levels of N and BOD (Tables 8 and 10) in this sub-watershed. In addition, some of the cropland BMPs described in this plan (e.g., reduced tillage, increased residue, cover crops, low disturbance manure injection) will help, over time, to improve the infiltration capacity of agricultural fields and may help reduce bacteria loadings from cropland in this sub-watershed.

As shown in Table 28, STEPL predicts total P loading from all agricultural sources is 22,912 lbs/year and Sediment loading is 3,372 tons/year. N loading is reduced by 12%, P loading by 17%, BOD loading by 0.6% and sediment loading by 8% from the agricultural baseline practices compared to no controls (not shown).

TABLE 28 - STEPL BASELINE LOADING WITH EXISTING BMPS IN HUC 0603

Sources	N Load (lb/yr)	P Load (lb/yr)	BOD Load (lb/yr)	Sediment Load (t/yr)
Cropland	51,552	15,827	99,832	3,176
Pastureland	1,860	153	6,023	6
Feedlots	33,099	6,762	56,464	0
Gully	206	170	413	190
Agriculture Sub-total	**86,717**	**22,912**	**162,732**	**3,372**
Urban	31,548	4,934	124,026	724
Forest	890	483	2,165	37
Grassland	171	141	343	54
Septic	9,774	3,828	39,909	0
Total	**129,100**	**32,298**	**329,175**	**4,187**

**Gully baselines modified per WDNR guidance*

There are approximately 6,000 acres of cropland, 350 acres of pastureland, and 21 animal housing operations in this sub-watershed for dairy, beef and hogs. Twelve of the 21 feedlots are providing loads/nutrients to surface waters. There are currently three CAFOs (> 1,000 animal units) within or adjacent to this sub-watershed. CAFO production areas (feedlots) are regulated as point sources. Permits specify zero discharge from the production areas, but do not apply to cropland. Ozaukee County estimates that it will be feasible to adopt the agricultural management plan practices shown in Table 29 over the 10-year plan schedule. Table 29 practices were applied to 30% of cropland acres and 3% of feedlot acres in this sub-watershed. No pastureland practices are planned. Combining practices (in parallel) treating the same land areas can result in greater load reductions due to synergistic effects compared with serial practices spread over more total land area; combined cropland practices are included in the planned BMPs listed in Table 29. Information in parentheses refers to the corresponding practices as defined in STEPL.

TABLE 29 - PROJECTED AGRICULTURAL PRACTICES TO BE INSTALLED OVER 10 YEARS IN HUC 0603

Agricultural Land Use	Practice(s)	Area Treated
Feedlots	Diversion (roofs/gutters)	0.82 acre (3.3% of area)
Cropland	Nutrient Management Plans (NMP-1)	775 acres
	Low Disturbance Manure Injection	1075 acres
	Grassed waterways (Gullies)	5,000 linear feet of 9” deep by 12” wide annual gully and BMP efficiency 0.6
	Nutrient Management Plans (NMP-1) combined with Reduced Tillage (Con Till-1)	1000 acres
	Nutrient Management Plans (NMP-1) combined with Reduced Tillage (Con Till-2)	250 acres
	Nutrient Management Plans (NMP-1) combined with Cover Crops (Crop-2)	1000 acres
	Grass Buffers (minimum 35 ft wide)	439 acres

The estimated pollutant reductions from adopting these practices are shown in Table 30. P is reduced by 2,586 lbs. annually, which is a 11.3% reduction compared to the agricultural baseline of 23,264 lbs. Sediment is reduced by 543 tons annually, which is a 16.1% reduction from the agricultural baseline of 3,372 tons.

TABLE 30- STEPL LOADING WITH PROPOSED 10-YEAR BMPS IN HUC 0603

Sources	N Load (lb/yr)	P Load (lb/yr)	BOD Load (lb/yr)	Sediment Load (t/yr)
Cropland	47,717	13,485	97,010	2,735
Pastureland	1,860	153	6,023	6
Feedlots	32,163	6,589	56,464	0
Gully	119	98	239	88
Agriculture Sub-total	**81,860**	**20,326**	**159,736**	**2,829**
Urban	31,548	4,934	124,026	724
Forest	890	483	2,165	37
Grassland	171	141	343	54
Septic	9,774	3,828	39,909	0
Total	**124,243**	**29,712**	**326,179**	**3,643**

These BMPs are also estimated to reduce N, BOD, and some bacterial loads. STEPL-derived N and BOD reductions are included here although they are not addressed in the TMDL. STEPL currently does not calculate load reductions for bacteria. STEPL model results with bacteria reductions should be revised within 12 months of release of STEPL by USEPA. TMDL reach MI-24 covers all of this sub-watershed, so the TMDL required percent reductions are derived solely from this reach (Figure 16).

Part 3 of this plan describes methods, milestones, management measures and funding sources for implementing Table 29 practices over the plan's ten-year schedule. Table 37 provides interim milestones. Table 39 provides cost estimates, and Table 38 of this plan describes information and educational milestones for this sub-watershed.

As shown in Table 31, the required agricultural TP (P) reduction for Reach MI-21 is 55% and the agricultural TSS (Sediment) reduction is 63%. Although reach MI-17 is larger in area, reach MI-16 contains proportionally more agricultural land use, so a simple average characterizes the required agricultural percent reductions for TP and TSS. Since reach MI-17 is both larger and contains proportionately more urban land use, the required urban reductions (MS4 and non-permitted) are derived from that reach. Because the agricultural TP (P) 11.3% and TSS (Sediment) 16.1% reductions modeled above make progress towards, but do not achieve, the overall TMDL reduction goals, multiple 10-year planning cycles with goals for adoption of additional BMPs on remaining cropland acres in this sub-watershed will be needed, over time, to meet TMDL reduction goals.

TABLE 31 - TP AND TSS REDUCTIONS SPECIFIED IN THE TMDL

TMDL Reach	Corresponding HUC 12	TP Reduction		TSS Reduction	
		Agricultural	Non-Permitted Urban/MS4	Agricultural	Non-Permitted Urban/MS4
MI-16	040400030603	53%	76%/75%	65%	70%/69%
MI-17		57%	82%/81%	61%	71%/70%
Weighted Average (see discussion)		55%	82%/81%	63%	71%/70%

This plan also estimates meeting the TMDL-based urban reductions in this sub-watershed will require multiple MS4 permit cycles – see **MS4 Permits and Milwaukee River TMDL** section above for details. For nonpermitted urban and MS4 areas, the required TP reductions are nearly identical at 82% and 81% respectively, as well as for TSS at 71% and 70% respectively. In practice, the MS4s and non-permitted urban area percent reductions will likely be addressed at the individual reach or finer level by the municipalities located within the sub-watershed. The draft *Ozaukee County, Milwaukee River TMDL Watershed Based Solutions* report (Aug 2018) identifies and maps two agricultural sites and two municipal sites with the potential for BMPs and P trading in this sub-watershed. The report includes STEPL analysis of expected TP and TSS reductions, as well as trade ratio approximations and cost ranges for the BMP(s) recommended for each site. This report may be used to define critical areas in the sub-watershed for adoption of new or additional BMPs to reduce pollutant loads. In addition, P, N, and BOD levels could be further reduced with septic system repair or replacement. Accordingly, a milestone of this plan is to collaborate with local health department staff to identify and then repair or replace failing septic systems within this sub-watershed. The current annual replacement rate for septic systems in Ozaukee county is 33 systems.

Civil divisions in the sub-watershed include sections of several towns, villages, and cities, as noted in the introduction to this sub-watershed. The area is largely covered by MS4 permittees, except for areas in the north in the Towns of Port Washington, Saukville, and Fredonia. The latter areas may have some potential for non-permitted urban BMPs.

Streambank contributions to pollutant loadings were not modeled due to a current lack of data on the condition of streambanks in the sub-watershed. With that said, quantifying and addressing streambank erosion sites present another potential opportunity to further reduce pollutant loadings, especially TP and TSS, and contribute to improvements in aquatic and riparian habitat within the sub-watershed. Ozaukee County and its partners are currently working on riparian and aquatic species preservation in this sub-watershed. For example, the Ozaukee County Planning and Parks Department (Department) are developing an Ecological Prioritization GIS Tool at a countywide scale and, in conjunction with the Wisconsin Wetlands Association (WWA). In particular, streambank naturalization and stabilization efforts, along with wetlands restoration, are likely to have co-benefits in reducing pollutant loadings in this sub-watershed.

Milwaukee Clean Farm Families Farmer-led group (Ozaukee County):

https://www.cleanfarmfamilies.com/

The Milwaukee River Watershed Clean Farm Families, working as part of the Milwaukee River Watershed Conservation Partnership, is providing a platform for producers and landowners to share ideas, concerns, priorities, and lessons learned about agricultural conservation efforts within the Milwaukee River Watershed. This group was formed in 2016 and has funding for the next 5 years. Clean Farm Families promotes best soil and water conservation practices by working directly with area producers, Natural Resources Conservation Service's Environmental Quality Incentive Program, and the Ozaukee County Land and Water Management Department.

The group is currently comprised of seven farmers/board members, some who farm within this subwatershed. Many of the soil health practices adopted by this group are similar to the practices included within the STEPL outputs in this plan.

Outreach efforts undertaken so far are similar to the Cedar Creek farmer led group and includes bringing speakers to events to talk about the connection of soil health to watershed health. Cost-sharing opportunities are discussed and explained. Incentive payments offered through the program require less paperwork than similar NRCS incentives and can be combined with other existing NRCS incentive programs within this sub-watershed.

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- Less than 25% of planned cropland practices or estimated load reductions are met by year 3
- Less than 25% of funding is available/awarded to implement by year 3
- Less than 25% of funding for conservation staff is awarded/available by year 3
- Conservation staff shortages occur, and technical assistance resources are limited for two years between years 1-5

The proposed implementation schedule for the Milwaukee Frontal – Mole (HUC 12 – 040400030603) watershed plan will require 10 years of BMP planning, design and installation. Over this time span, individual farms will be assessed to determine the location and efficiency of existing BMPs, current management practices and potential critical sites of pollution. Selected farm operations will also be assessed to determine whether they are in compliance with the State of Wisconsin's agriculture performance standards in accordance with the Department of Natural Resources Chapter NR 151.

Over this plan's ten-year schedule, it will be important to monitor the functionality of BMPs implemented in the watershed periodically after their installation. Over time, BMPs can become less efficient at achieving designed pollutant reductions due to several factors. According to the USEPA Technical Memorandum #1: Adjusting for Depreciation of Land Treatment when Planning Watershed Projects (available at https://www.epa.gov/sites/production/files/2015-10/documents/tech_memo_1_oct15.pdf), natural variability, lack of proper maintenance and unforeseen consequences are primary causes of BMP depreciation. Considering how erratic and unpredictable weather patterns are increasingly becoming, checking BMPs in the watershed will be critical for assessing their performance. BMP performance data will be used to evaluate plan implementation, modeled load reduction estimates and to help determine if substantial progress is or is not being made toward attaining water quality standards.

There are several key indicators of the Milwaukee Frontal - Mole (HUC 12 – 040400030603) watershed plan that will be carefully tracked and monitored to determine if sufficient progress is being made and milestones are being achieved. The Ozaukee Department of Land Conservation will take the lead responsibility of monitoring plan implementation progress by tracking the following plan components:

1. Information and education activities and participation
2. Pollution reduction levels from installed BMP's
3. Administrative review
4. WQ monitoring efforts (completed by WDNR or others) within the watershed

With assistance from our cooperating partners, USDA-NRCS and UW-Extension Services, an annual review meeting will be conducted to assess the following activities:

1. Information and education
    a. Number of landowners/operators contacted
    b. Number of one-on-one landowner contacts
    c. Number of group meetings and attendance
    d. Number of cost share agreements signed

2. BMP installation, performance and pollution reduction
    a. That BMP design is in accordance with NRCS standards and specifications
    b. That BMP's are installed according to standards and specifications
    c. Inspect BMP's every 4 years to determine level of efficiency
    d. Conduct BMP operation and maintenance spot checks
    e. Rerun STEPL Model when BMP efficiency has changed to determine effects on pollutant loads
    f. Review Crop Residue and Tillage intensity satellite imagery results
    g. Estimate the types and amounts of BMPs installed on critical areas in the watershed

3. Water Quality Monitoring
    a. Results of WQ sampling for Total Phosphorus and other parameters

4. Administrative Review
    a. Grant source and application review
    b. Grant allocations for cost share assistance review

c. Review practices and dollar amounts per cost share agreement
d. Track and review staff expenses and support costs
e. Review all other expenses related to the project
f. Determine if milestones are sufficiently attained

Summary and Conclusion

In this sub-watershed, agricultural uses predominate pollutant loadings across the board. STEPL analysis indicates that adoption of more agricultural BMPs on approximately 30% of the cropland acres will make progress toward, but will not achieve, the overall TMDL reduction goals. Fully meeting the TMDL will likely require several 10-year planning cycles. STEPL modeling for agricultural areas aids in determining the amounts and types of BMPs necessary to meet TMDL goals. The EVAAL land cover and crop rotation maps, along with the Ozaukee P trade report, will be used to prioritize the locations and types of BMPs within the sub-watershed. The eventual goal of this plan is to achieve and maintain enough practices to improve water quality and allow impaired waters to fully meet their designated uses. The recent formation of the Milwaukee Clean Farm Families producer-led watershed group indicates significant interest in improving water quality by addressing agricultural loadings in this sub-watershed. This group may assist with adoption of more agricultural practices than shown in this plan – which will help make further progress towards meeting the TMDL reduction goals for this sub-watershed. There is also a need to address relatively high loadings from failing septic systems in this area.

8.7 Milwaukee Frontal - Pigeon/Ulao Creeks HUC 12 - 040400030604

The 040400030604 sub-watershed is part of the northern portion of the Milwaukee River South watershed (Fig. 1 and 2). The area includes approximately eight river miles of the Milwaukee River, the entire nine-mile Ulao Creek, one-mile Kaul Creek, four-mile Pigeon Creek and several other small named and un-named streams. This sub-watershed is in a strategic portion of the planning area, where agricultural land use is giving way to residential development as the Ozaukee County grows in population. The Town and Village of Grafton cover much of the northern portions of this sub-watershed, while the City of Mequon and Village of Thiensville largely cover the southern portion. Small portions of The Town and Village of Cedarburg and the City of Port Washington round out the rest of the sub-watershed area.

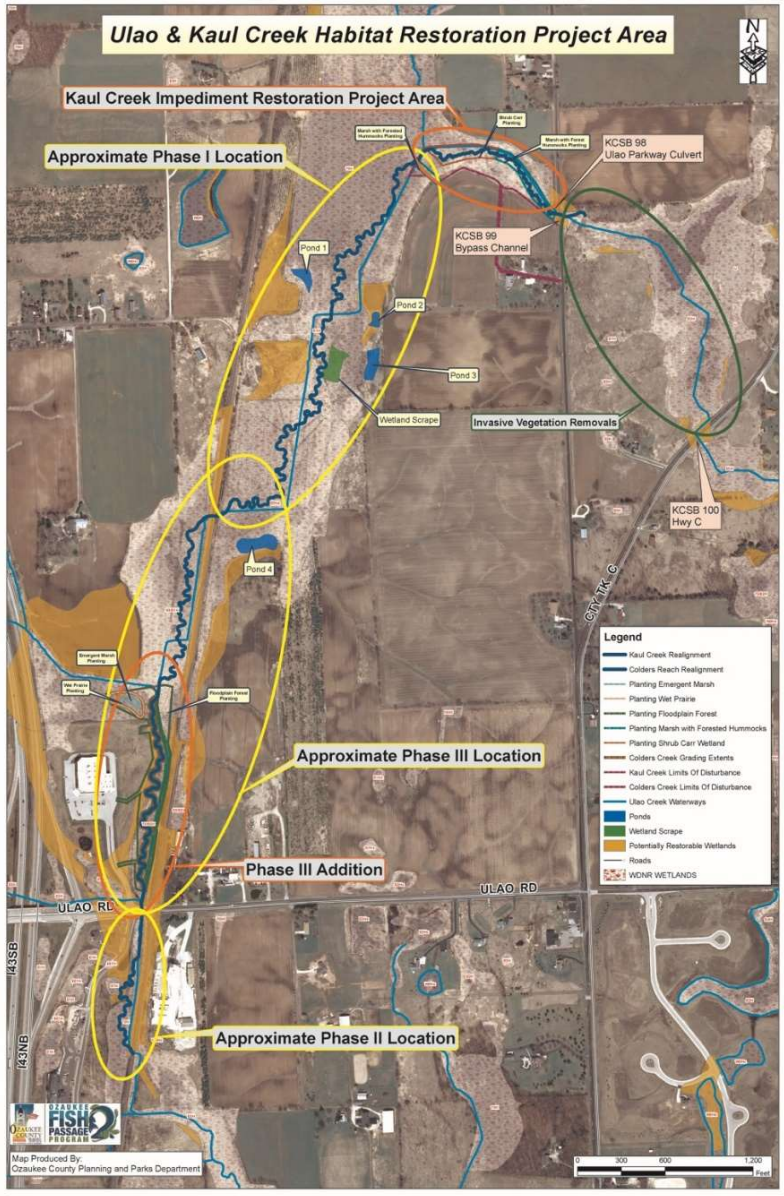
TMDL reach MI-25 covers approximately 70% of this sub-watershed, including the entire eastern portions, while reach MI-26 covers the remainder, and comprises most of the western lobe, which includes a very small portion of reach MI-24 (Fig. 16). Pigeon Creek lies entirely within reach MI-26 and is not currently listed as impaired. Ulao Creek lies entirely within reach MI-25 and is listed as impaired from point and non-point sources of phosphorus and non-point sources of chlorides. The creek is capable of supporting warm water sport fishing, while the wetlands and riparian areas are capable of supporting northern pike spawning in the Milwaukee River. The entire length of the Milwaukee River in this area is impaired by point and non-point sources of phosphorus. Land uses in the sub-watershed contribute pollutants that may impair waters in neighboring areas, and the TMDL is also designed to be protective of currently non-impaired surface waters. Therefore, the TMDL specifies current pollutant loadings and needed reductions in this HUC 12.

Ulao Creek originates in the 490-acre Ulao Swamp, and its watershed area encompasses the 347-acre Ulao Lowland Forest, which is included in the *Regional Natural Areas and Critical Species Habitat Protection and Management Plan for Southeastern Wisconsin*. The Ulao Creek Partnership is an NGO

dedicated to the restoration of wetlands and native plants in the Ulao watershed. Ozaukee County is also working on habitat restoration over 2.5 miles of Ulao and Kaul Creeks in the Town and Village of Grafton. Projects include re-meandering, floodplain reconnection, wetland creation or enhancement, invasive plant removal, native plant restoration, and installation of fish and wildlife habitat structures (Figure 49).

FIGURE 49 – MAP OF ULAO AND KAUL CREEKS HABITATION RESTORATION PROJECTS

SOURCE: https://www.co.ozaukee.wi.us/1879/Ulao-Creek

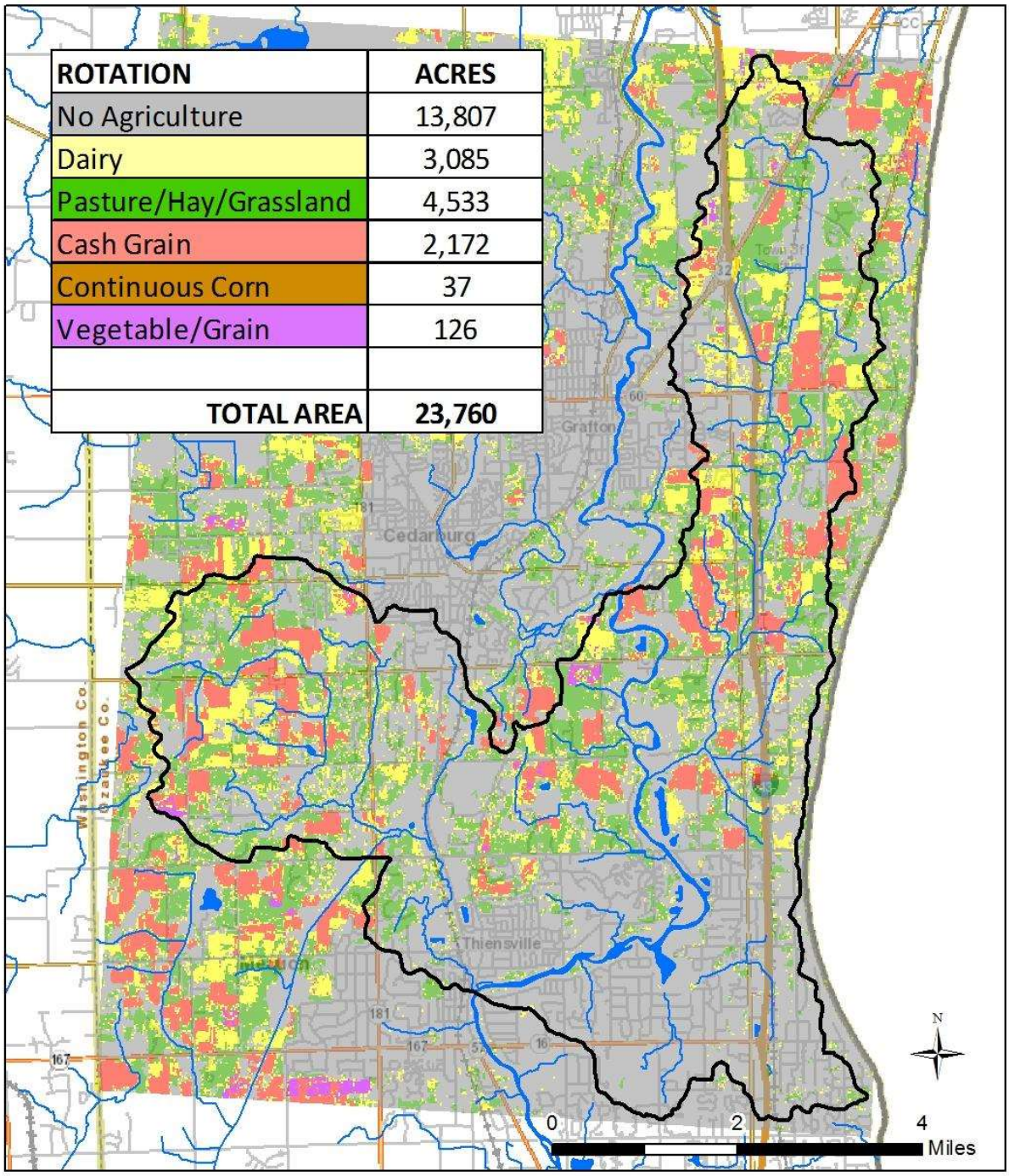


This sub-watershed is vulnerable to erosion, and an analysis of this vulnerability was completed using WDNR's EVAAL tool. The results of this analysis are shown in Figure 102 in Appendix J. There is also significant agricultural land use in this sub-watershed, and the land use/acreage information that is shown in Figure 50 in conjunction with Washington County and WDNR staff input was used to complete STEPL modeling of this sub-watershed.

FIGURE 50 – LAND USE AND AG. ROTATIONS IN HUC 0604

Milwaukee River - HUC 040400030604
Crop Rotation Analysis
2013 - 2017

DRAFT



THESE ARE PRELIMINARY ESTIMATES BASED ON SATELLITE DERIVED INFORMATION - FIELD VERIFICATION IS RECOMMENDED.

WDNR 04/02/2018

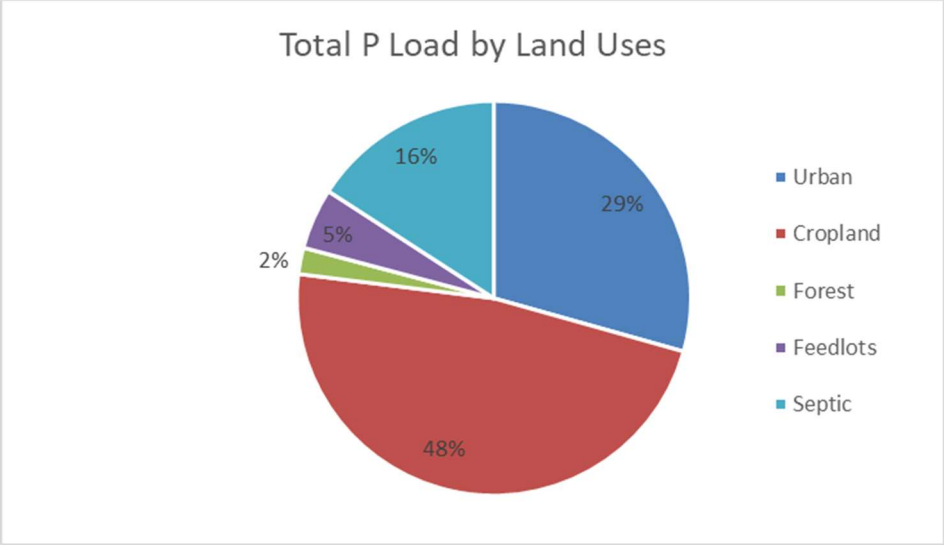
As indicated in the following STEPL tables, agricultural uses (cropland, pastureland, and feedlots) account for just over 38% of the land use in the sub-watershed. STEPL land use from the EVAAL analysis (fig. 50), adapted as needed with information from the national data server (urban and forest breakout), and from Ozaukee County (pastureland, grassland, and feedlots) is shown in Table 32.

TABLE 32 – LAND USE IN HUC 0604

	Urban	Cropland	Pastureland	Forest	Grassland	Feedlots
Land Area (acres)	8938	5420	350	4868	4033	100
Land Area %	38%	23%	15%	21%	17%	0.4%

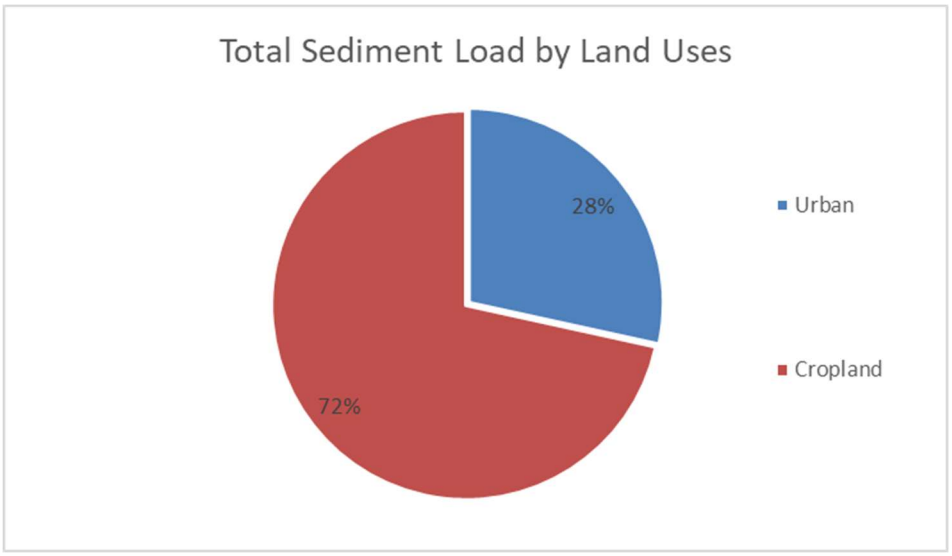
STEPL baseline loading accounts for this sub-watershed for installed agricultural BMPs as of January 2017 (the baseline date). Agricultural land uses modeled in STEPL include cropland, pastureland, feedlots, and gullies. Installed cropland BMPs include Nutrient Management Plans covering 425 acres, 200 acres of conservation tillage, and 50 acres of cover crops. Bare soil pasture areas are included in feedlot acres - there are no baseline pasture or feedlot BMPs. STEPL modeling indicates that agriculture accounts for 53% of the calculated P (TP in the TMDL) and 72% of sediment (TSS in the TMDL) loads (Figures 51 and 52).

FIGURE 51 – BASELINE P (TP) LOAD % BY LAND USE IN HUC 0604



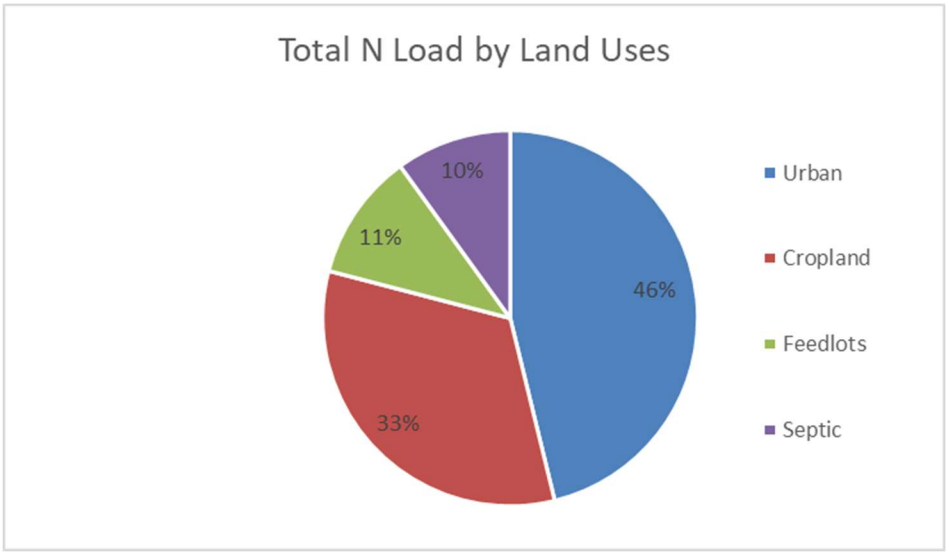
(Sources contributing 1% or less are not shown)

FIGURE 52 – BASELINE TSS LOAD % BY LAND USE IN HUC 0604



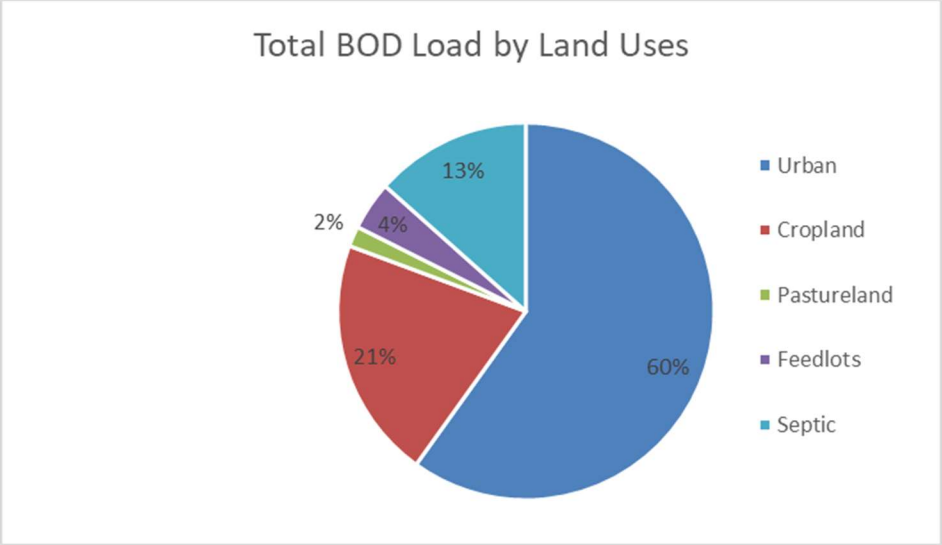
(Sources contributing 1% or less are not shown)

FIGURE 53 – BASELINE N LOAD % BY LAND USE IN HUC 0604



(Sources contributing 1% or less are not shown)

FIGURE 54 – BASELINE BOD LOAD % BY LAND USE IN HUC 0604



(Sources contributing 1% or less are not shown)

Although not included in the TMDL, Nitrogen (N) and Biological Oxygen Demand (BOD) may also contribute to water quality problems. As shown in figures 53 and 54, agricultural uses account for 44% and 27% of these loadings, respectively. The same BMPs that reduce TP and TSS loadings can also reduce levels of N and BOD (Tables 32 and 34) in this sub-watershed. In addition, some of the cropland BMPs described in this plan (e.g., reduced tillage, increased residue, cover crops, low disturbance manure injection) will help, over time, to improve the infiltration capacity of agricultural fields and may help reduce bacteria loadings from cropland in this sub-watershed.

As shown in Table 33, STEPL predicts total P loading from all agricultural sources is 15,000 lbs/year and Sediment loading is 3,075 tons/year. N loading is reduced by 7%, P loading by 2%, BOD loading by 0.1% and sediment loading by 2% from the agricultural baseline practices compared to no controls (not shown).

TABLE 33 – STEPL BASELINE LOADING WITH EXISTING BMPs IN 0604

Sources	N Load (lb/yr)	P Load (lb/yr)	BOD Load (lb/yr)	Sediment Load (t/yr)
Cropland	37,613	13,449	71,753	3,070
Pastureland	1,859	152	6,021	5
Feedlots	12,486	1,399	14,385	0
Gully	0	0	0	0
Agriculture Sub-total	**51,959**	**15,000**	**92,159**	**3,075**
Urban	52,559	8,219	206,626	1,206
Forest	1,121	606	2,732	44
User Defined	208	172	416	65
Septic	11,347	4,444	46,334	0
Total	**117,194**	**28,441**	**348,267**	**4,390**

There are approximately 5,400 acres of cropland, 350 acres of pastureland, and 25 animal housing operations in this sub-watershed; the majority are horse operations. Nine of the 21 feedlots are providing loads/nutrients to surface waters. There are currently no CAFOs (> 1,000 animal units) in this sub-watershed. Ozaukee County estimates that it will be feasible to adopt the agricultural management practices shown in Table 34 over the 10-year plan schedule. 14% of cropland acres, 22% of pastureland acres, and 14% of feedlot acres in the sub-watershed. Combining practices (in parallel) treating the same land areas can result in greater load reductions due to synergistic effects compared with serial practices spread over more total land area; combined cropland practices are included in the planned BMPs listed in Table 34. Information in parentheses refers to the corresponding practices as defined in STEPL.

TABLE 34 – PROJECTED AG. PRACTICES TO BE INSTALLED OVER 10 YEARS IN 0604

Agricultural Land Use	Practice(s)	Area Treated
Feedlots	Diversion (roofs/gutters)	13.7 acres
Cropland	Nutrient Management Plans (NMP-1)	300 acres
	Reduced Tillage (Con Till-1)	50 acres
	Reduced Tillage (Con Till-2)	50 acres
	Cover Crops (Crop-2)	25 acres
	Nutrient Management Plans (NMP-1) combined with Reduced Tillage (Con Till-1)	350 acres
	Nutrient Management Plans (NMP-1) combined with Reduced Tillage (Con Till-2)	250 acres
	Nutrient Management Plans (NMP-1) combined with Cover Crops (Crop-2)	250 acres
	Grass Buffers (minimum 35 ft wide)	32 acres
Pastureland	Critical Area Planting	50 acres
	Grass Buffers (minimum 35 ft wide)	12.8 acres
	Heavy Use Area Protection	2 acres
	Streambank Stabilization with Fencing	12.8 acres

The estimated pollutant reductions from adopting these practices are shown in Table 35. P is reduced by 1,122 lbs. annually, which is a 7.5% reduction compared to the agricultural baseline of 15,000 lbs. Sediment is reduced by 183 tons annually, which is a 6% reduction compared to the agricultural baseline of 3,075 tons.

TABLE 35 – STEPL LOADING WITH PROPOSED 10-YEAR BMPs IN 0604

Sources	N Load (lb/yr)	P Load (lb/yr)	BOD Load (lb/yr)	Sediment Load (t/yr)
Cropland	35,809	12,474	70,587	2,888
Pastureland	1,700	139	6,017	5
Feedlots	11,717	1,264	14,385	0
Gully	0	0	0	0
Agriculture Sub-total	**49,226**	**13,878**	**90,988**	**2,892**
Urban	52,559	8,219	206,626	1,206
Forest	1,121	606	2,732	44
Cropland	208	172	416	65
Septic	11,347	4,444	46,334	0
Total	**114,461**	**27,320**	**347,097**	**4,207**

These BMPs are also estimated to reduce N, BOD, and some bacterial loads. STEPL-derived N and BOD reductions are included here although they are not addressed in the TMDL. STEPL currently does not calculate load reductions for bacteria (Figure 16). STEPL model results with bacteria reductions should be revised within 12 months of release of STEPL by USEPA.

Part 3 of this plan describes methods, milestones, management measures and funding sources for implementing Table 34 practices over the plan's ten-year schedule. Table 37 provides interim milestones. Table 39 provides cost estimates, and Table 38 of this plan describes information and educational milestones for this sub-watershed.

As shown in Table 36, the required agricultural TP (P) reduction for Reach MI-25 is 23% and the agricultural TSS (Sediment) reduction is 62%. Required agricultural reductions for reach MI-26 are 65% and 75%, respectively. Given the large range of required P reductions, these reaches are best treated as separate areas for agricultural BMP planning purposes. For example, BMPs in reach MI-25 should be targeted to reduce TSS as much as possible, while those in reach MI-25 can be more balanced between P and TSS reduction. While the required reductions for reach MI-25 non-permitted and MS4 areas are 38% and 36% respectively for P and 78% and 77% respectively for TSS, there are no required reductions for non-permitted urban areas in reach MI-26. All of the reduction in this reach will fall to MS4s, at 87% for P and 88% for TSS.

Ozaukee County has identified a large number (365) of failing private septic systems in this sub-watershed, which contribute significantly to N, P, and BOD loads in the STEPL model. Addressing loads from septic systems may be an opportunity to improve water quality within this sub-watershed; the current annual septic system replacement rate for Ozaukee county is 33 systems.

TABLE 36 – TP AND TSS REDUCTIONS SPECIFIED IN THE TMDL IN 0604

TMDL Reach	Corresponding HUC 12	TP Reduction		TSS Reduction	
	040400030604	Agricultural	Non-Permitted Urban/MS4	Agricultural	Non-Permitted Urban/MS4
MI-25		23%	38%/36%	62%	78%/77%
MI-26		65%	0%/87%	75%	0%/88%

Source: TMDL Appendix A, adapted from Tables A.28 and A.30

Because the agricultural TP (P) 7.5% and TSS (Sediment) 6% reductions modeled above make progress towards, but do not achieve, the overall TMDL reduction goals, multiple 10-year planning cycles with goals for adoption of additional BMPs on remaining cropland acres in this sub-watershed will be needed, over time, to meet the TMDL reduction goals.

This plan also estimates meeting the TMDL-based urban reductions in this sub-watershed will require multiple MS4 permit cycles – see **MS4 Permits and Milwaukee River TMDL** section above for details. In practice, the MS4s and non-permitted urban area percent reductions will likely be addressed at the individual reach or finer level by the municipalities located within the sub-watershed. The draft *Ozaukee County, Milwaukee River TMDL Watershed Based Solutions* report (Aug 2018) identifies and maps two agricultural sites and two municipal sites with the potential for BMPs and P trading in this sub-watershed. The report includes STEPL analysis of expected TP and TSS reductions, as well as trade ratio approximations and cost ranges for the BMP(s) recommended for each site. This report may be used to define critical areas in the sub-watershed for adoption of new or additional BMPs to reduce pollutant loads.

Civil divisions in the sub-watershed include sections of several towns, villages, and cities, as noted in the introduction to this sub-watershed. The area is covered exclusively by MS4 permittees, but there may be some non-permitted areas outside of the individual MS4 boundaries in each community with potential for BMPs.

Streambank contributions to pollutant loadings were not modeled due to a current lack of data on the condition of streambanks in the sub-watershed. With that said, quantifying and addressing streambank erosion sites present another potential opportunity to further reduce pollutant loadings, especially TP and TSS, and contribute to improvements in aquatic and riparian habitat within the sub-watershed. Ozaukee County and its partners are currently working on riparian and aquatic species preservation in this sub-watershed. For example, the Ozaukee County Planning and Parks Department (Department) is developing an Ecological Prioritization GIS Tool at a countywide scale and, in conjunction with the Wisconsin Wetlands Association (WWA). In particular, streambank naturalization and stabilization efforts, along with wetlands restoration, are likely to have co-benefits in reducing pollutant loadings in this sub-watershed.

Milwaukee Clean Farm Families Farmer-led group (Ozaukee County)

https://www.cleanfarmfamilies.com/

The Milwaukee River Watershed Clean Farm Families, working as part of the Milwaukee River Watershed Conservation Partnership, is providing a platform for producers and landowners to share ideas, concerns, priorities, and lessons learned about agricultural conservation efforts within the Milwaukee River Watershed. This group was formed in 2016 and also came out of the MRWCP and has funding for the next 5 years. Clean Farm Families promotes best soil and water conservation practices by working directly with area producers, Natural Resources Conservation Service's Environmental Quality Incentive Program, and the Ozaukee County Land and Water Management Department.

The group is currently comprised of seven farmers/board members, some who farm within this subwatershed. Many of the soil health practices adopted by this group are similar to the practices included within the STEPL outputs in this plan.

Outreach efforts undertaken so far are similar to the Cedar Creek farmer led group and includes bringing speakers to events to talk about the connection of soil health to watershed health. Cost-sharing opportunities are discussed and explained. Incentive payments offered through the program require less paperwork than similar NRCS incentives and can be combined with other existing NRCS incentive programs within this sub-watershed.

Minimum Progress Criteria

This plan contains several milestones that will be carefully tracked and monitored over time to determine if sufficient progress is being made to meet plan goals/pollutant reductions. The following criteria will be used to determine when plan milestones and reduction goals should be revised due to minimal progress achieved:

- Less than 25% of planned cropland practices or estimated load reductions are met by year 3
- Less than 25% of funding is available/awarded to implement by year 3
- Less than 25% of funding for conservation staff is awarded/available by year 3
- Conservation staff shortages occur, and technical assistance resources are limited for two years between years 1-5

The proposed implementation schedule for the Milwaukee Frontal – Pigeon/Ulao Creeks (HUC 12 – 040400030604) watershed plan will require 10 years of BMP planning, design and installation. Over this time span, individual farms will be assessed to determine the location and efficiency of existing BMPs, current management practices and potential critical sites of pollution. Selected farm operations will also be assessed to determine whether they are in compliance with the State of Wisconsin's agriculture performance standards in accordance with the Department of Natural Resources Chapter NR 151.

Over this plan's ten-year schedule, it will be important to monitor the functionality of BMPs implemented in the watershed periodically after their installation. Over time, BMPs can become less efficient at achieving designed pollutant reductions due to several factors. According to the USEPA Technical Memorandum #1: Adjusting for Depreciation of Land Treatment when Planning Watershed Projects (available at https://www.epa.gov/sites/production/files/2015-10/documents/tech_memo_1_oct15.pdf), natural variability, lack of proper maintenance and unforeseen consequences are primary causes of BMP depreciation. Considering how erratic and unpredictable weather patterns are increasingly becoming, checking BMPs in the watershed will be critical for assessing their performance. BMP performance data will be used to evaluate plan implementation, modeled load reduction estimates and to help determine if substantial progress is or is not being made toward attaining water quality standards.

There are several key indicators of the Milwaukee Frontal – Pigeon/Ulao (HUC 12 – 040400030604) watershed plan that will be carefully tracked and monitored to determine if sufficient progress is being made and milestones are being achieved. The Ozaukee Department of Land Conservation will take the lead responsibility of monitoring plan implementation progress by tracking the following plan components:

1. Information and education activities and participation
2. Pollution reduction levels from installed BMP's
3. Administrative review
4. WQ monitoring efforts (completed by WDNR or others) within the watershed

With assistance from our cooperating partners, USDA-NRCS and UW-Extension Services, an annual review meeting will be conducted to assess the following activities:

1. Information and education
    a. Number of landowners/operators contacted
    b. Number of one-on-one landowner contacts
    c. Number of group meetings and attendance
    d. Number of cost share agreements signed

2. BMP installation, performance and pollution reduction
    a. That BMP design is in accordance with NRCS standards and specifications
    b. That BMP's are installed according to standards and specifications
    c. Inspect BMP's every 4 years to determine level of efficiency
    d. Conduct BMP operation and maintenance spot checks
    e. Rerun STEPL Model when BMP efficiency has changed to determine effects on pollutant loads
    e. Review Crop Residue and Tillage intensity satellite imagery results
    f. Estimate the types and amounts of BMPs installed on critical areas in the watershed

3. Water Quality Monitoring
    a. Results of WQ sampling for Total Phosphorus and other parameters

4. Administrative Review
    a. Grant source and application review

b. Grant allocations for cost share assistance review
c. Review practices and dollar amounts per cost share agreement
d. Track and review staff expenses and support costs
e. Review all other expenses related to the project
f. Determine if milestones are sufficiently attained

Summary and Conclusion

In this sub-watershed, agricultural uses predominate pollutant loadings across the board. STEPL analysis indicates that adoption of more agricultural BMPs on approximately 15% of the cropland acres will make progress toward, but will not achieve, the overall TMDL reduction goals. Fully meeting the TMDL will likely require several 10-year planning cycles. STEPL modeling for agricultural areas aids in determining the amounts and types of BMPs necessary to meet TMDL goals. The EVAAL land cover and crop rotation maps, along with the Ozaukee P trade report, will be used to prioritize the locations and types of BMPs within the sub-watershed. The eventual goal of this plan is to achieve and maintain enough practices to improve water quality and allow impaired waters to fully meet their designated uses. The recent formation of the Milwaukee Clean Farm Families producer-led watershed group indicates significant interest in improving water quality by addressing agricultural loadings in this sub-watershed. This group may assist with adoption of more agricultural practices than shown in this plan – which will help make further progress towards meeting the TMDL reduction goals for this sub-watershed. There is also a need to address relatively high loadings from failing septic systems in this area.

9.0 Implementation, Management Measures, and Milestones

Element 6 for 9KE watershed planning calls for a schedule for implementing the plan, and element 4 calls for an estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon to implement this plan. Elements 7, 8, and 9 address the need to identify interim measurable milestones for determining whether plan recommendations are being implemented and whether the implemented measures are leading to anticipated water quality improvements. Where anticipated improvements are not being achieved, the plan will need to be revised, taking into consideration the reasons why the plan is failing to achieve the expected improvements and updating the plan to ensure that progress towards delisting will be made going forward. This section provides information in compliance with these element requirements.

9.1 Funding Sources

There are many state and federal programs that currently provide funding sources for conservation practices. Recently the option of adaptive management, water quality trading, and phosphorus variance has become another option for funding of practices.

A brief description of current funding programs available and their acronyms are listed below:

Environmental Quality Incentives Program (EQIP) – U.S. Department of Agriculture (USDA), through the Natural Resources Conservation Service, provides EQIP financial and technical assistance to implement conservation practices that address resource concerns. Farmers receive flat rate payments for installing and implementing agricultural conservation management practices.

Conservation Reserve Program (CRP) - A land conservation program administered by USDA. Farmers enrolled in the program receive a yearly rental payment for environmentally sensitive land that they agree to remove from production. Contracts are 10-15years in length. Eligible practices include buffers for wildlife habitat, wetlands buffer, riparian buffer, wetland restoration, filter strips, grass waterways, shelter belts, living snow fences, contour grass strips, and shallow water areas for wildlife.

Conservation Reserve Enhancement Program (CREP) – As part of the CRP, CREP provides funding for installation of conversation management practices, rental payments, and an installation incentive. A 15-year contract or perpetual contract conservation easement can be entered into. Eligible practices include filter strips, buffer strips, wetland restoration, tall grass prairie and oak savanna restoration, grassed waterway, and permanent native grasses.

ACEP- Agricultural Conservation Easement Program - New program that consolidates three former programs (Wetlands Reserve Program, Grassland Reserve Program, and Farm and Ranchlands Protection Program). Under this program NRCS provides financial assistance to eligible partners for purchasing Agricultural Land Easements that protect the agriculture use and conservation values of eligible land.

Targeted Runoff Management Grant Program (TRM) - Program offers competitive grants for local governments for controlling nonpoint source pollution. Grants reimburse costs for agriculture or urban runoff management practices in critical areas with surface or groundwater quality concerns. The cost-share rate for TRM projects is up to 70% of eligible costs.

Conservation Stewardship Program (CSP) – Program offers funding for participants that take additional steps to improve resource condition. Program provides two types of funding through 5 year contracts; annual payments for installing new practices and maintaining existing practices as well as supplemental payments for adopting a resource conserving crop rotation.

Great Lakes Restoration Initiative (GLRI) - Program is the largest funding program investing in the Great Lakes. Under the initiative nonfederal governmental entities (state agencies, interstate agencies, local governments, non- profits, universities, and federally recognized Indian tribes) can apply for funding for projects related to restoring the Great Lakes.

Farmable Wetlands Program (FWP) - Program designed to restore previously farmed wetlands and wetland buffer to improve both vegetation and water flow. The Farm Service Agency runs the program through the Conservation Reserve Program with assistance from other government agencies and local conservation groups.

Land Trusts- Landowners also have the option of working with a land trust to preserve land. Land trusts preserve private land through conservation easements, purchase land from owners, and accept donated land.

Adaptive management and water quality trading mechanisms – Both adaptive management and water quality trading may be funding sources for implementing some of the project identified in Part 2. One publicly owned treatment plant is currently looking to enter in a WQT framework with agriculture producers in the watershed. Adaptive management may develop as a compliance alternative for MS4 as they work to meet future WPDES permits. Under these scenarios, verification of the installed BMPs may be stricter than through voluntary implementation. Typically trade ratios are employed at different rates depending upon whether the trade occurs within the immediate HUC 12 or involves agriculture producer in a broader (i.e., HUC 10) watershed.

9.2 Management measures implementation

The Cedar, Pigeon, Ulao, and Mole Creeks watershed plan presents the following implementation actions to make significant progress towards meeting water quality goals in these waterbodies. As stated earlier, it is expected that work beyond this ten-year horizon will be required in both the agriculture sector and municipal sector. After implementation of the measures indicated below, it is expected that this watershed plan will be updated with new reduction goal targets. Lessons learned from the work described in Table 38 will be incorporated into any future planning cycles.

In addition to implementation of the following measures, this plan recognizes that enforcement of existing NR151 regulations will have positive impact upon water quality going forward. Existing runoff management standards have been established by the State of Wisconsin. Chapter NR 151 provides runoff management standards and prohibitions for agriculture. This plan recommends enforcement of the state runoff standards when implementing the plan. NR 151.005 (Performance standard for total maximum daily loads) states that a crop producer or livestock producer subject to this chapter shall reduce discharges of pollutants from a livestock facility or cropland to surface waters if necessary to meet a load allocation in a US EPA and state approved TMDL. A milestone toward complying with NR 151 is as follows:

Milestone: Annually meet with WDNR Nonpoint Source and TMDL staff to review and discuss NR 151 implementation efforts in the watershed. Items for review will include, but will not be limited to:

1. Prioritize plan implementation efforts for agricultural cropland/operations in the watershed. Efforts should reflect the following priorities:
    a. Priority 1 – Achieve compliance with NR 151 performance standards on the majority of agricultural acres/operations in each sub-watershed
    b. Priority 2 – After a majority of agricultural cropland or operations in each sub-watershed* are found in compliance with existing NR151 standards, then work to adopt additional practices on agricultural acres/operations already in compliance with NR 151 to further reduce pollutant loads from agricultural sources in each sub-watershed.

    * NR 151 Implementation/Compliance rates may vary by watershed.

2. If item 1 is not met, identify how and when plan implementation efforts can change to meet this item.
3. Complete annual sub-watershed inventory to determine current number of agricultural cropland acres/farms (out of total number of cropland acres/farms in each sub-watershed) that are in compliance with NR151.
4. Identify how many cropland acres/farms in watershed have received/been documented in compliance with NR 151 via letter.
5. Share/Review copies of NR 151 compliance letters with WDNR staff.
6. Summarize NR 151 priorities, compliance inventory, and documentation efforts within annual 9 element plan progress reports.

Local ordinances and regulations will also be used to implement conservation practices and compliance. County Land Conservation and NRCS departments will work with landowners to implement conservation practices. Landowners will be educated on programs and funding available to them as well as current state and local agricultural regulations.

Implementation of the following actions will rely heavily upon the producer-led groups described in the information and education plan. County Land and Water Conservation staff will also be critical in reaching out to the producer community and achieving sufficient participation in the incentives offered for conservation practices. Several funding sources are available for this work, as indicated on the matrix. Additional funding sources may arise from water quality trading networks between municipalities and groups of producers.

Verification of the implementation by a third-party is recommended in this plan. Significant resources are expected to be spent to incentivize these practices and it is important that these resources are having the desired impact. It is recommended that an arrangement with a third-party entity is made to verify at least ten percent of all conservation practices.

Identifying ways to address barriers to implementing some of the recommended agricultural BMPs is an important focus for future years. The standard method of offering incentive payments is effective in many situations, but for some practices it does not address significant barriers. These barriers can include capital costs of the necessary no-till equipment. In many instances, the access to the right no-till seeder within a short window of time is critical. Without reliable access to these machines, it is much more difficult to convince a producer to change his or her farming practices. This plan recommends that the funding community and producers work together to identify new ways to support adoption of these practices which might include:

- no-interest loans for needed equipment in exchange for lease arrangements with neighboring farmers,
- co-operatively owned specialized equipment that can be borrowed or leased,
- arrangements with farm equipment suppliers to lease equipment on a trial basis.

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TABLE 37 - MANAGEMENT MEASURES IMPLEMENTATION MATRIX

MANAGEMENT MEASURES IMPLEMENTATION MATRIX FOR WASHINGTON CO.'S CEDAR CREEK HUC12S								
Recommendations	*Indicators*	*HUC12*	*Milestones*			*Timeline*	*Funding sources*	*Implementation*
			0-3 years	*3-7 years*	*7-10 years*			
Management objective 1: Reduce the amount of sediment and phosphorous loading from agricultural cropland								
Increase area covered by nutrient management plans (NMP)	# acres covered by NMPs	040400030301	225	250	225	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	Wash. County Land and Water Conservation Div. (WCLWCD)
Increase area covered by nutrient management plans (NMP)	# acres covered by NMPs	040400030302	85	95	85	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	Wash. County Land and Water Conservation Div. (WCLWCD)
Increase area covered by nutrient management plans (NMP)	# acres covered by NMPs	040400030303	333	334	333	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	Wash. County Land and Water Conservation Div. (WCLWCD)
Reduced tillage (Con-Till 2)	# of acres in reduced tillage	040400030301	33	34	33	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	WCLWCD and Water/Cedar Creek producers (CCP)
Reduced tillage (Con-Till 2)	# of acres in reduced tillage	040400030302	108	109	108	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	WCLWCD and Water/Cedar Creek producers
Reduced tillage (Con-Till 2)	# of acres in reduced tillage	040400030303	100	100	100	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	WCLWCD and Water/Cedar Creek producers
Grassed waterways	# of feet	040400030301	3,000	3,000	3,000	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	WCLWC and CCP
Grassed waterways	# of feet	040400030302	1,500	1,500	1,500	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	WCLWC and CCP

Grassed waterways	# of feet	040400030303	5,000	5,000	5,000	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	WCLWC and CCP
Cover crops	# of acres in cover crops	040400030302	133	134	133	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	WCLWC and CCP
Cover crops	# of acres in cover crops	040400030303	66	67	66	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	WCLWC and CCP
Grass buffers to filter riparian strips	# of acres of grass buffers	040400030301	16	17	16	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	WCLWC and CCP
Grass buffers to filter riparian strips	# of acres of grass buffers	040400030302	41	42	41	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	WCLWC and CCP
Grass buffers to filter riparian strips	# of acres of grass buffers	040400030303	13	14	13	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	WCLWC and CCP
NMP combined with Reduced tillage	# of acres of NMP w/ reduced till	040400030301	200	200	200	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	WCLWC and CCP
NMP combined with Reduced tillage	# of acres of NMP w/ reduced till	040400030302	133	134	133	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	WCLWC and CCP
NMP combined with Reduced tillage	# of acres of NMP w/ reduced till	040400030303	333	334	333	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	WCLWC and CCP
NMP combined with cover crops	# of acres of NMP w/ cover crops	040400030301	133	134	133	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	WCLWC and CCP
NMP combined with cover crops	# of acres of NMP w/ cover crops	040400030302	43	44	43	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	WCLWC and CCP
NMP combined with cover crops	# of acres of NMP w/ cover crops	040400030303	266	267	266	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	WCLWC and CCP
NMP combined with Grass buffers	# of acres of NMP w/	040400030301	33	34	33	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	WCLWC and CCP

	grass buffers							
NMP combined with Grass buffers	# of acres of NMP w/ grass buffers	040400030302	10	10	10	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	WCLWC and CCP
NMP combined with Grass buffers	# of acres of NMP w/ grass buffers	040400030303	66	67	66	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	WCLWC and CCP
Reduced tillage combined with cover crops	# of acres of reduced till w/ cover crops	040400030301	66	67	66	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	WCLWC and CCP
Reduced tillage combined with cover crops	# of acres of reduced till w/ cover crops	040400030302	25	25	25	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	WCLWC and CCP
Reduced tillage combined with cover crops	# of acres of reduced till w/ cover crops	040400030303	66	67	66	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	WCLWC and CCP
Annually estimate crop residue levels and tillage intensity in watershed using satellite imagery	Percent of acres with 0-30%, 30-70% and > 70% residue	040400030301 040400030302 040400030303	TBD	TBD	TBD	10 years	TRM SSWRM	WCLWC and WDNR
Management objective 2: **Reduce phosphorous runoff from barnyards and feedlots**								
Runoff management systems in place	# of sites managed	040400030301	1	1	1	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	WCLWC and CCP
Runoff management systems in place	# of sites managed	040400030302	1	1	1	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	WCLWC and CCP
Runoff management systems in place	# of sites managed	040400030303	3	4	3	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	WCLWC and CCP

Management objective 3: **Reduce amount of sediment and phosphorous loading from pastureland**								
Grass buffers (min 35 ft wide)	# of acres of grass buffers	040400030301	17	18	17	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	Wash. County Land and Water Conservation Div.
Grass buffers (min 35 ft wide)	# of acres of grass buffers	040400030302	33	34	33	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	Wash. County Land and Water Conservation Div.
Grass buffers (min 35 ft wide)	# of acres of grass buffers	040400030303	66	67	67	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	Wash. County Land and Water Conservation Div.
Rotational grazing with fencing	# of acres in grazing land mgmt..	040400030301	13	14	13	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	Wash. County Land and Water Conservation Div.
Rotational grazing with fencing	# of acres in grazing land mgmt..	040400030302	11	12	12	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	Wash. County Land and Water Conservation Div.
Rotational grazing with fencing	# of acres in grazing land mgmt..	040400030303	17	17	16	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	Wash. County Land and Water Conservation Div.
Prescribed grazing	# of acres in prescribed grazing	040400030301	10	10	10	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	Wash. County Land and Water Conservation Div.
Prescribed grazing	# of acres in prescribed grazing	040400030302	8	8	9	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	Wash. County Land and Water Conservation Div.

Prescribed grazing	# of acres in prescribed grazing	040400030303	8	8	9	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	Wash. County Land and Water Conservation Div.
Use exclusion	# of acres in use exclusion	040400030301	5	5	5	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	Wash. County Land and Water Conservation Div.
Use exclusion	# of acres in use exclusion	040400030302	3	3	4	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	Wash. County Land and Water Conservation Div.
Use exclusion	# of acres in use exclusion	040400030303	3	3	4	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	Wash. County Land and Water Conservation Div.
Management objective #4: **Reduce sediment and erosion from streambanks through stream restoration and stabilization**								
Stream stabilization	# of feet of stream stabilized						EQIP, CRP, CREP, ACEP, TRM SSWRM	Wash. County Land and Water Conservation Div.
MANAGEMENT MEASURES IMPLEMENTATION MATRIX FOR OZAUKEE CO.'S CEDAR CREEK HUC12 AND MOLE, PIGEON, AND ULAU								
Recommendations	*Indicators*	*HUC12*	*Milestones*			*Timeline*	*Funding sources*	*Implementation*
			0-3 years	*3-7 years*	*7-10 years*			
Management objective 1: **Reduce the amount of sediment and phosphorous loading from agricultural cropland**								
Increase area covered by nutrient management plans (NMP)	# acres covered by NMPs	040400030304	39	39	40	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	Ozaukee Land and Water Management (OLWM)

Increase area covered by nutrient management plans (NMP)	# acres covered by NMPs	040400030603	333	333	334	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	Ozaukee Land and Water Management (OLWM)
Increase area covered by nutrient management plans (NMP)	# acres covered by NMPs	040400030604	100	100	100	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	Ozaukee Land and Water Management (OLWM)
Reduced tillage (Con-Till 1)	# of acres in reduced tillage	040400030304	33	34	33	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	OLWM and MR Clean Farm Families (MRCFF)
Reduced tillage (Con-Till 1)	# of acres in reduced tillage	040400030604	16	17	16	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	OLWM and MRCFF
Reduced tillage (Con-Till 2)	# of acres in reduced tillage	040400030304	33	34	33	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	OLWM and MRCFF
Reduced tillage (Con-Till 2)	# of acres in reduced tillage	040400030603	100	100	100	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	OLWM and MRCFF
Reduced tillage (Con-Till 2)	# of acres in reduced tillage	040400030604	16	17	16	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	OLWM and MRCFF
Cover crops	# of acres in cover crops	040400030304	33	34	33	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	OLWM and MRCFF
Cover crops	# of acres in cover crops	040400030603	66	67	67	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	OLWM and MRCFF
Cover crops	# of acres in cover crops	040400030604	8	9	8	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	OLWM and MRCFF
Grassed waterways	# of feet	040400030304	1,320	1,320	1,320	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	OLWM and MRCFF
Grassed waterways	# of feet	040400030603	5,000	5,000	5,000	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	OLWM and MRCFF

NMP combined with Reduced tillage (con till 1 or 2)	# of acres of NMP w/ reduced till	040400030304	66	67	67	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	OLWM and MRCFF
NMP combined with Reduced tillage (con till 1 or 2)	# of acres of NMP w/ reduced till	040400030603	333	334	333	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	OLWM and MRCFF
NMP combined with Reduced tillage (con till 1 or 2)	# of acres of NMP w/ reduced till	040400030604	200	200	200	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	OLWM and MRCFF
NMP combined with cover crops	# of acres of reduced till w/ cover crops	040400030304	33	34	33	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	OLWM and MRCFF
NMP combined with cover crops	# of acres of reduced till w/ cover crops	040400030603	266	267	267	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	OLWM and MRCFF
NMP combined with cover crops	# of acres of reduced till w/ cover crops	040400030604	83	84	83	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	OLWM and MRCFF
Grass buffers to filter riparian strips	# of acres of grass buffers	040400030603	13	14	13	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	OLWM and MRCFF
Grass buffers to filter riparian strips	# of acres of grass buffers	040400030604	10	11	11	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	OLWM and MRCFF
NMP combined with Grass buffers	# of acres of NMP w/ grass buffers	040400030304	10	11	11	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	OLWM and MRCFF
NMP combined with Grass buffers	# of acres of NMP w/ grass buffers	040400030603	66	67	67	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	OLWM and MRCFF

Reduced tillage combined with cover crops	# of acres of reduced till w/ cover crops	040400030603	66	67	66	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	OLWM and MRCFF
Annually estimate crop residue levels and tillage intensity in watershed using satellite imagery	Percent of acres with 0-30%, 30-70% and > 70% residue	040400030603 040400030604 040400030304	TBD	TBD	TBD	10 years	TRM SSWRM	WCLWC and WDNR
Management objective 2: **Reduce phosphorous runoff from barnyards and feedlots**								
Diversion (roofs/gutters)	Area treated	040400030304	.28 acre	.28 acres	.29 acre	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	OLWM
Runoff management systems in place	# of sites managed	040400030603	3	4	3	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	OLWM
Diversion (roofs/gutters)	Area treated	040400030604	4.5 acre	4.6 acre	4.6 acre	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	OLWM
Management objective 3: **Reduce amount of sediment and phosphorous loading from pastureland**								
Rotational grazing with fencing	# of acres in grazing land mgmt..	040400030304	33	34	33	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	OLWM
Rotational grazing with fencing	# of acres in grazing land mgmt..	040400030603	17	17	16	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	OLWM
Alternative watering	# of acres in alt. water	040400030304	3	2	0	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	OLWM
Heavy use area protection	# of acres protected	040400030603	1	0	0	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	OLWM
Heavy use area protection	# of acres protected	040400030604	2	0	0	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	OLWM
Grass buffers	# of acres	040400030603	66	67	67	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	OLWM

Grass buffers	# of acres	040400030604	4	4	4.8	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	OLWM
Prescribed grazing	# of acres	040400030603	12	13	0	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	OLWM
Critical area planting	# of acres	040400030604	50			10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	OLWM
Use exclusion	# of acres	040400030603	10	0	0	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	OLWM
Streambank stabilization w/ fencing	# of acres	040400030604	12.8	0	0	10 years	EQIP, CRP, CREP, ACEP, TRM SSWRM	OLWM

9.3 Process for completing Normalized Data Tillage Index (NDTI) Assessments

Tillage conditions within watersheds change over time. Accordingly, this plan will employ a new method of analyzing crop residue levels and tillage intensity from readily available satellite imagery for each HUC 12 sub-watershed. Since tillage takes place at different times, a series of Landsat 8 satellite images – https://landsat.usgs.gov/landsat-8 - will be selected for analysis in spring and fall months to calculate a minimum Normalized Different Tillage Index (NDTI) for each HUC 12 sub-watershed, with assistance from WDNR. The NDTI estimate crop residue levels based on shortwave infrared wavelengths.

The images below apply to the six HUC 12 sub-watersheds in this plan It displays the mean minNDTI values per agricultural field in the watershed. The mean minNDTI can help to better identify areas in a watershed that would be good candidates for implementation of reduced tillage practices and cover crops. This analysis of imagery can also be used over time to track implementation of cropping practices as more years of imagery is collected, since satellites regularly circle the earth. Annual completion of this analysis for each sub-watershed is another milestone and method/criterion in this plan to determine whether load reductions are being achieved over time and substantial progress is being made toward attaining water quality standards in each sub-watershed.

FIGURE 54A: CROP RESIDUE COVER ESTIMATES BASED ON NDTI OUTPUTS, CEDAR CREEK HUC 10, 09/2017, 10, 2017, 05/2018

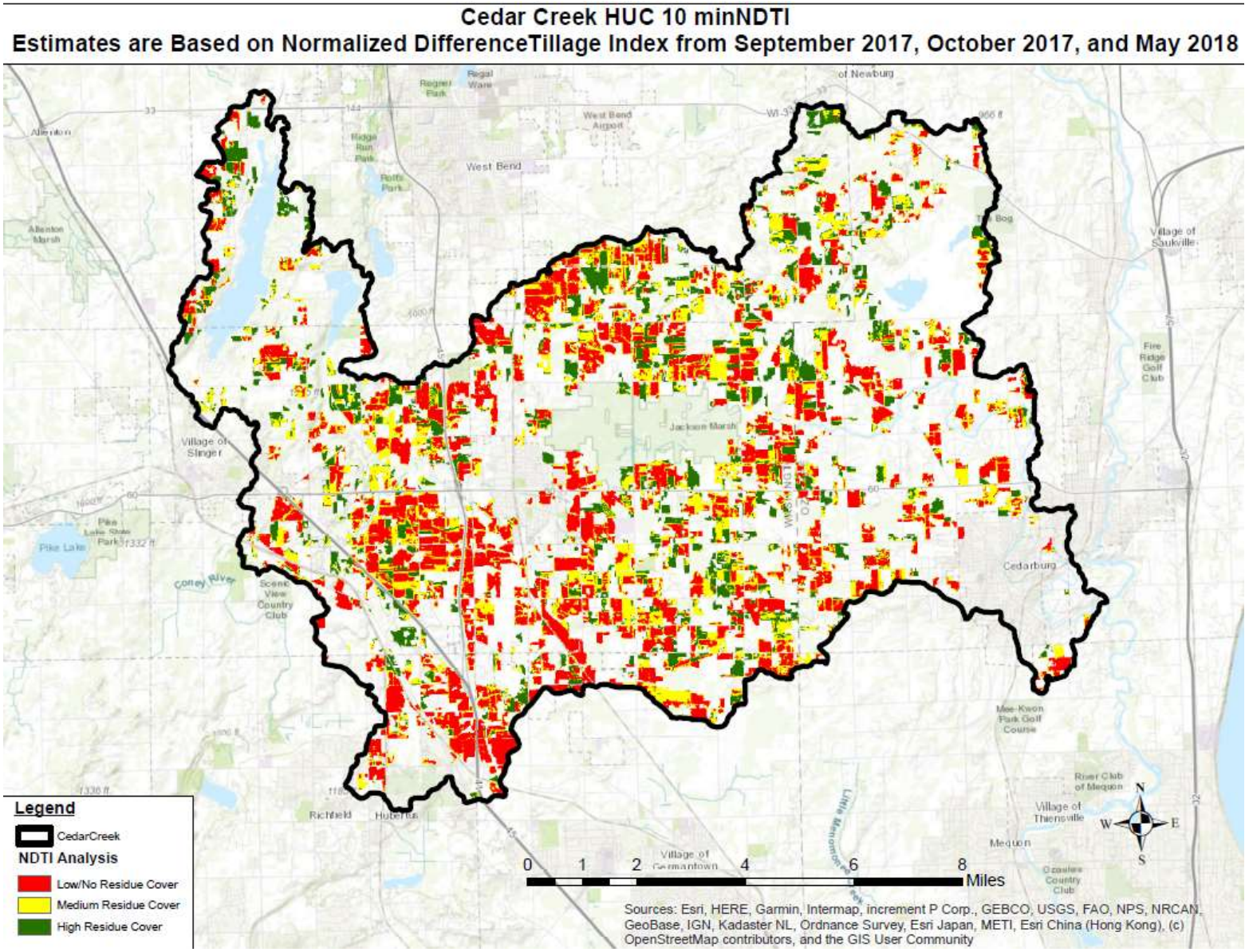


FIGURE 54B: CROP RESIDUE COVER ESTIMATES BASED ON NDTI OUTPUTS, CEDAR CREEK HUC 10, APRIL 2018

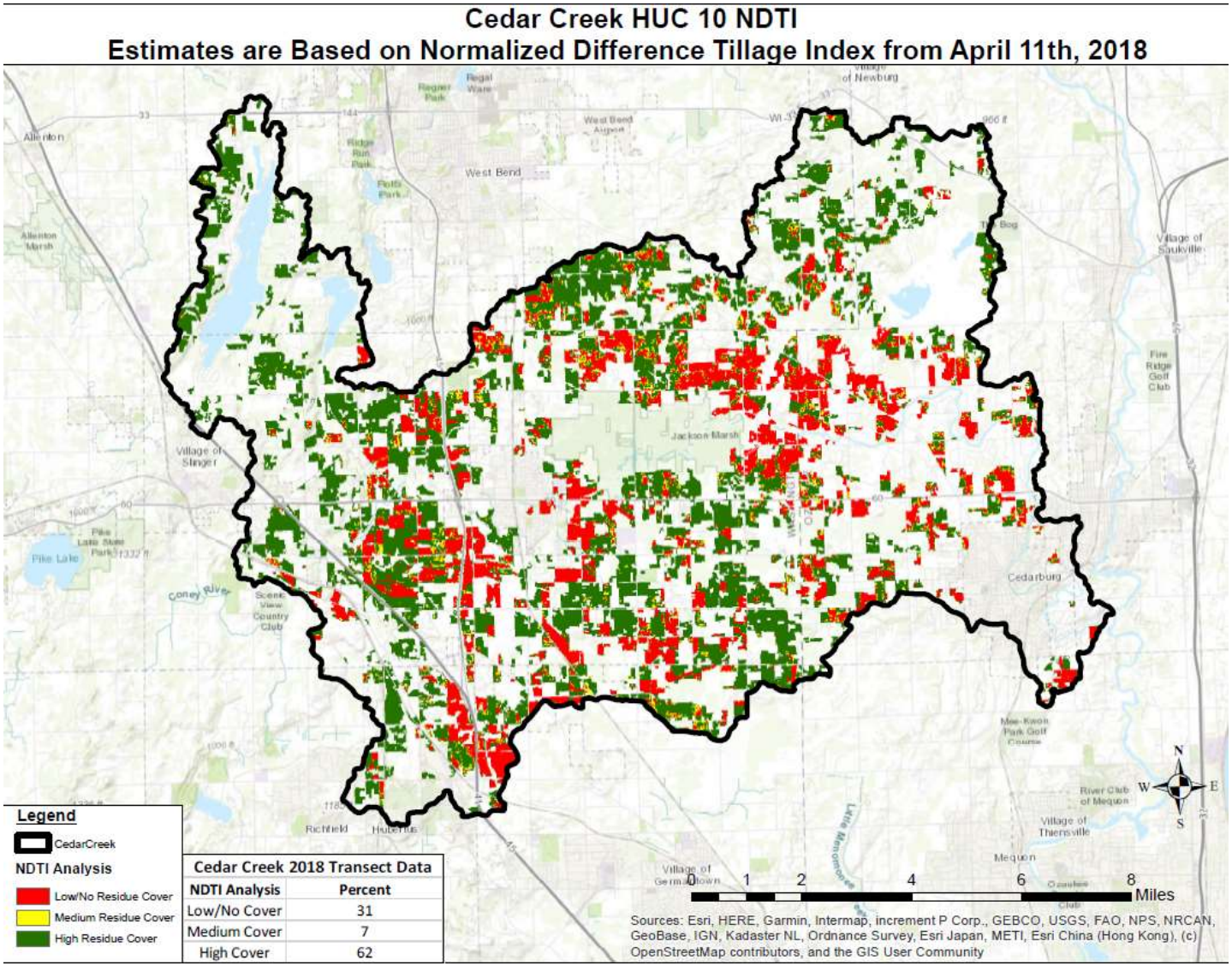
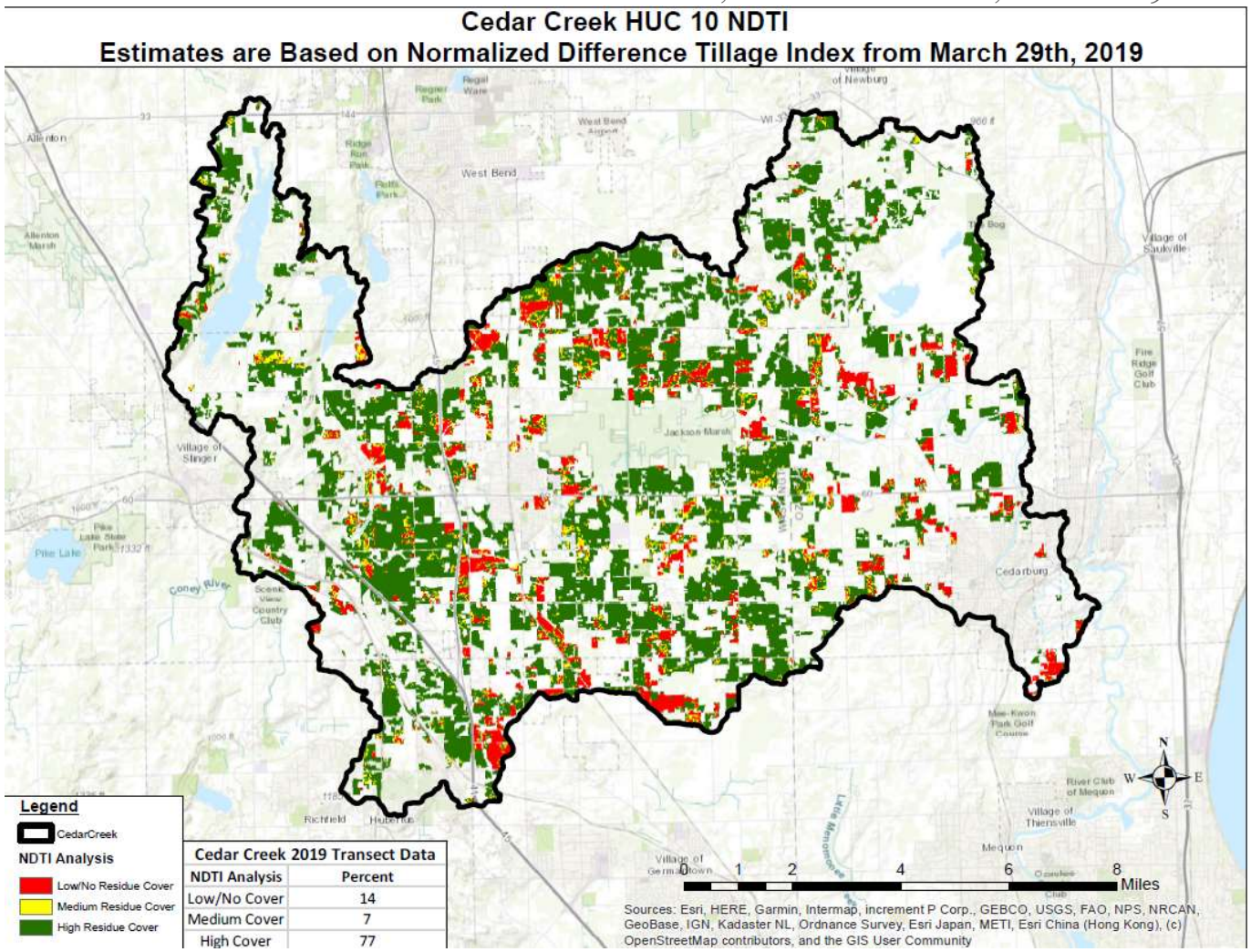


FIGURE 54C: CROP RESIDUE COVER ESTIMATES BASED ON NDTI OUTPUTS, CEDAR CREEK HUC 10, MARCH 2019



Milestone: Continue consulting with WDNR staff to use NDTI tool for the watershed area and incorporate such analyses and recommendations into the plan. Continue using NDTI tool annually to determine crop residue levels across each HUC 12 sub-watershed to guide and evaluate plan implementation. NDTI results shall be shared with watershed stakeholders at planned education and outreach events.

9.4 Prioritization

In addition to using EVAAL, WQ monitoring data, prior reports showing priority areas and analyzing crop residue levels and tillage intensity from readily available satellite imagery to prioritize the identification and implementation of conservation practices on agricultural lands within the HUC 12 sub-watersheds in this plan, there are other tools available. . One model developed by USDA is the Land Evaluation and Site Assessment (LESA) process. This model looks at a variety of factors to assess the importance of particular lands for agricultural production. One-third of the scoring is based upon soil productivity, with the higher quality soils yielding higher scores. Two-thirds of the score is based upon factors such as development pressure, environmental benefits, proximity to roads, and proximity to existing urban areas. This tool has been used to help develop farmland preservation plans in Ozaukee County as well as elsewhere in the country. Although the focus is not specifically on identifying the best area to target agricultural BMPs, it is one lens to view broader landscape level planning efforts. The LESA scores for the planning area are included below.

FIGURE 55 – LESA SCORES FOR THE CEDAR CREEK WATERSHEDS

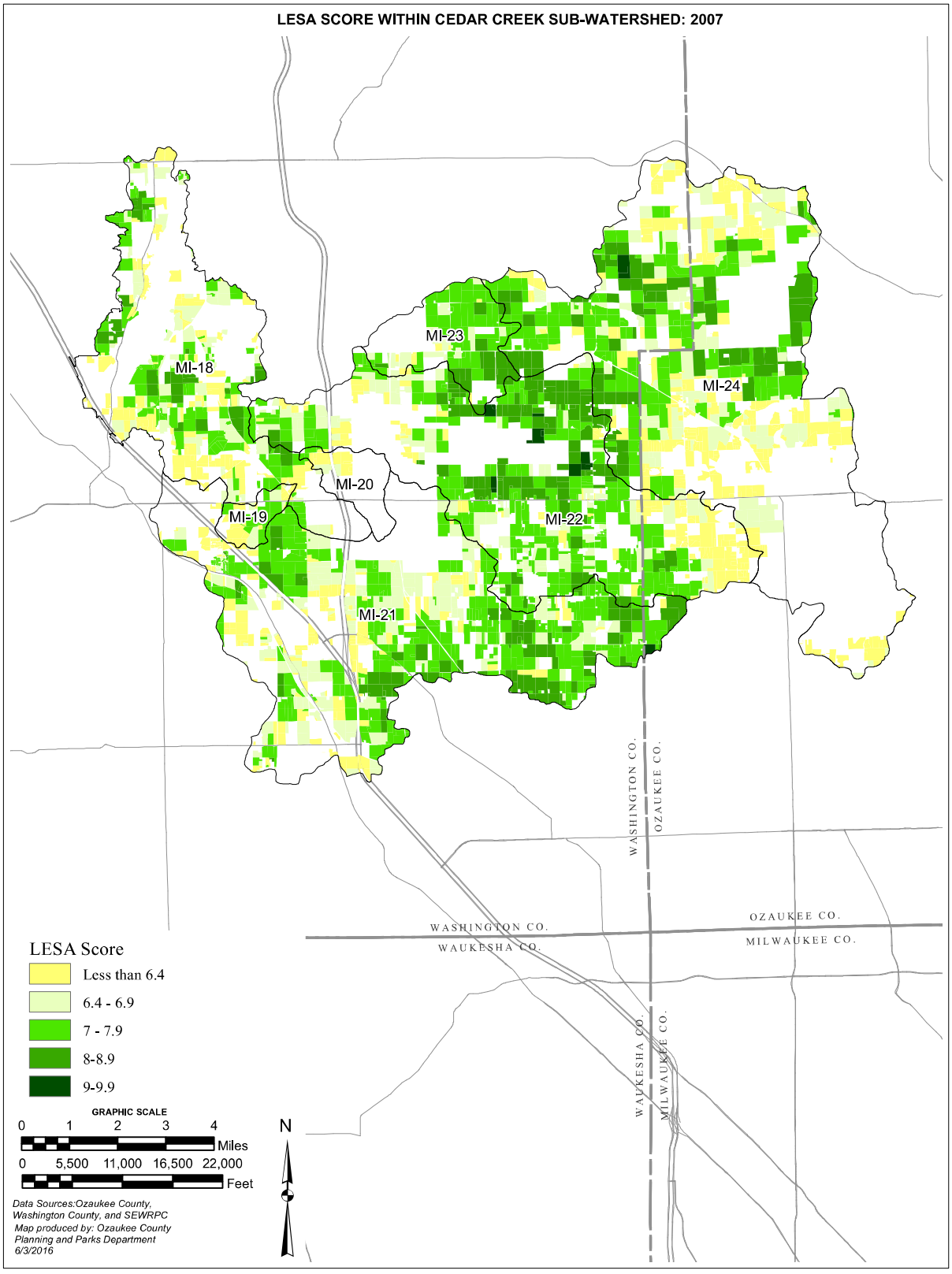
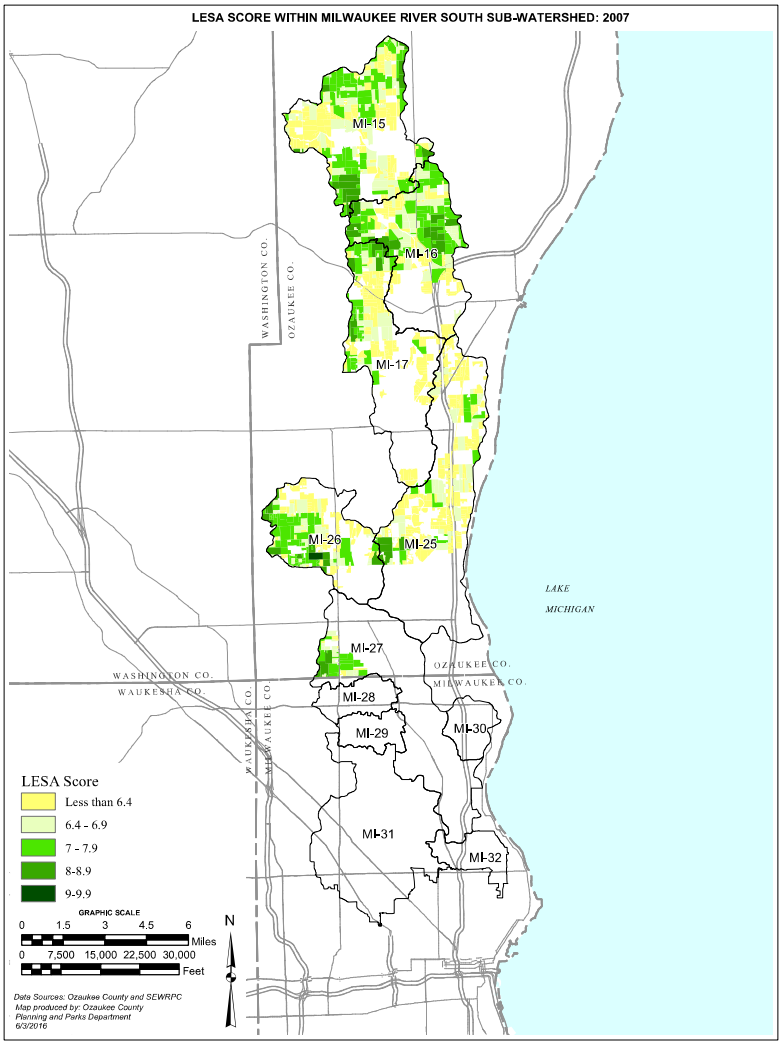


FIGURE 56 – LESA SCORES FOR THE LAKE MICHIGAN FRONTAL, ULAO, PIGEON WATERSHEDS



Another prioritization tool is the Agricultural Conservation Planning Framework (ACPF). ACPF is a tool developed by USDA to assist with conservation planning on a watershed scale. ACPF uses a set of technical tools semi-automated within ArcGIS software to determine areas of high potential soil and nutrient loss. It uses this prioritization to site conservation practices that fit the characteristics of problem area. It can site practices on a field level at a HUC 12 or smaller scale; however, it is generally used as a planning tool for watershed plans, rather than as a prescriptive tool for location of BMPs.

ACPF was run for HUCs 0604 and a portion of 0603 in Ozaukee County. These maps are included below for reference and may be used to identify critical areas within the two HUC 12 sub-watersheds for promotion and implementation of soil health practices on cropland.

FIGURE 57 – ACPF MODELING FOR 0603

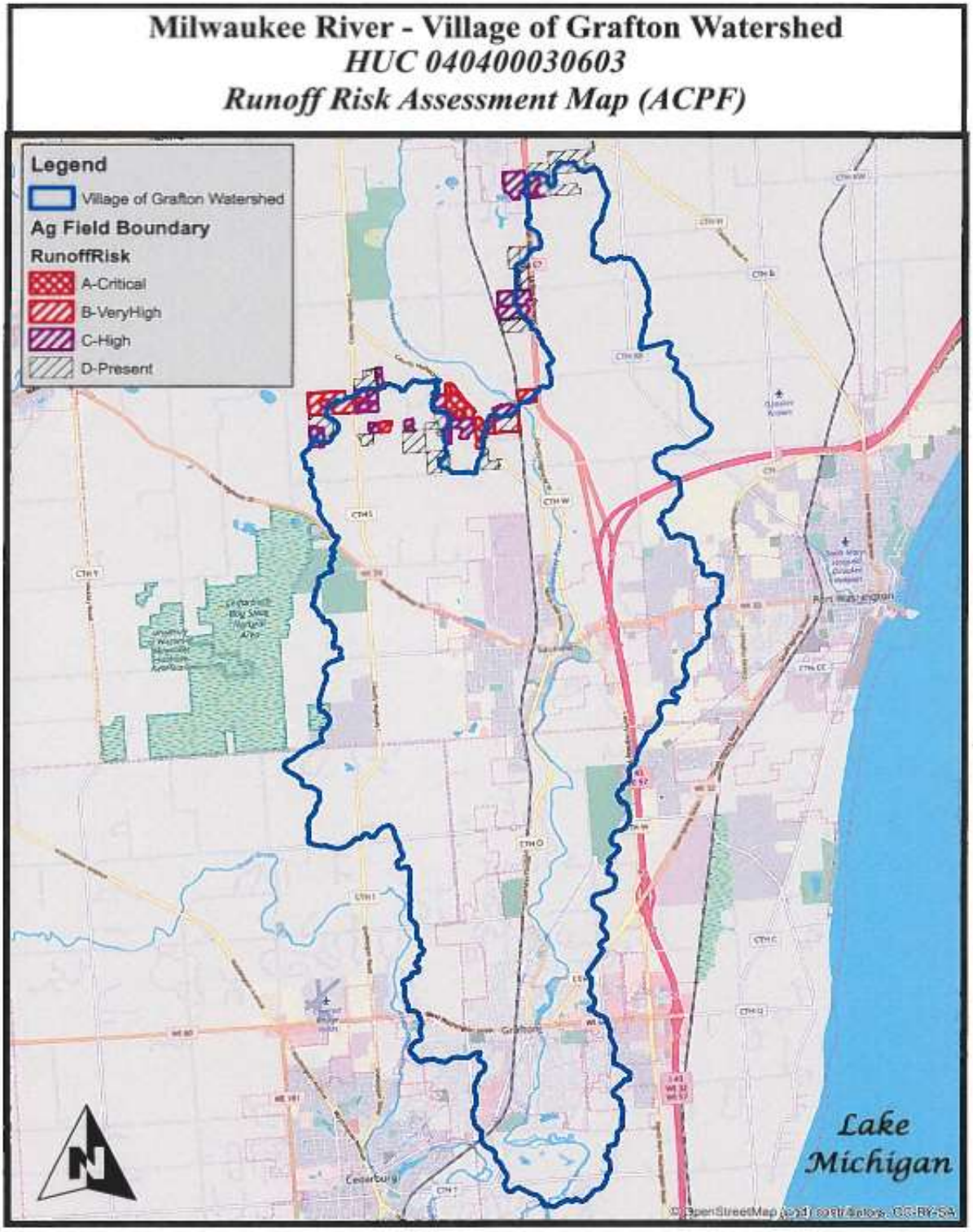
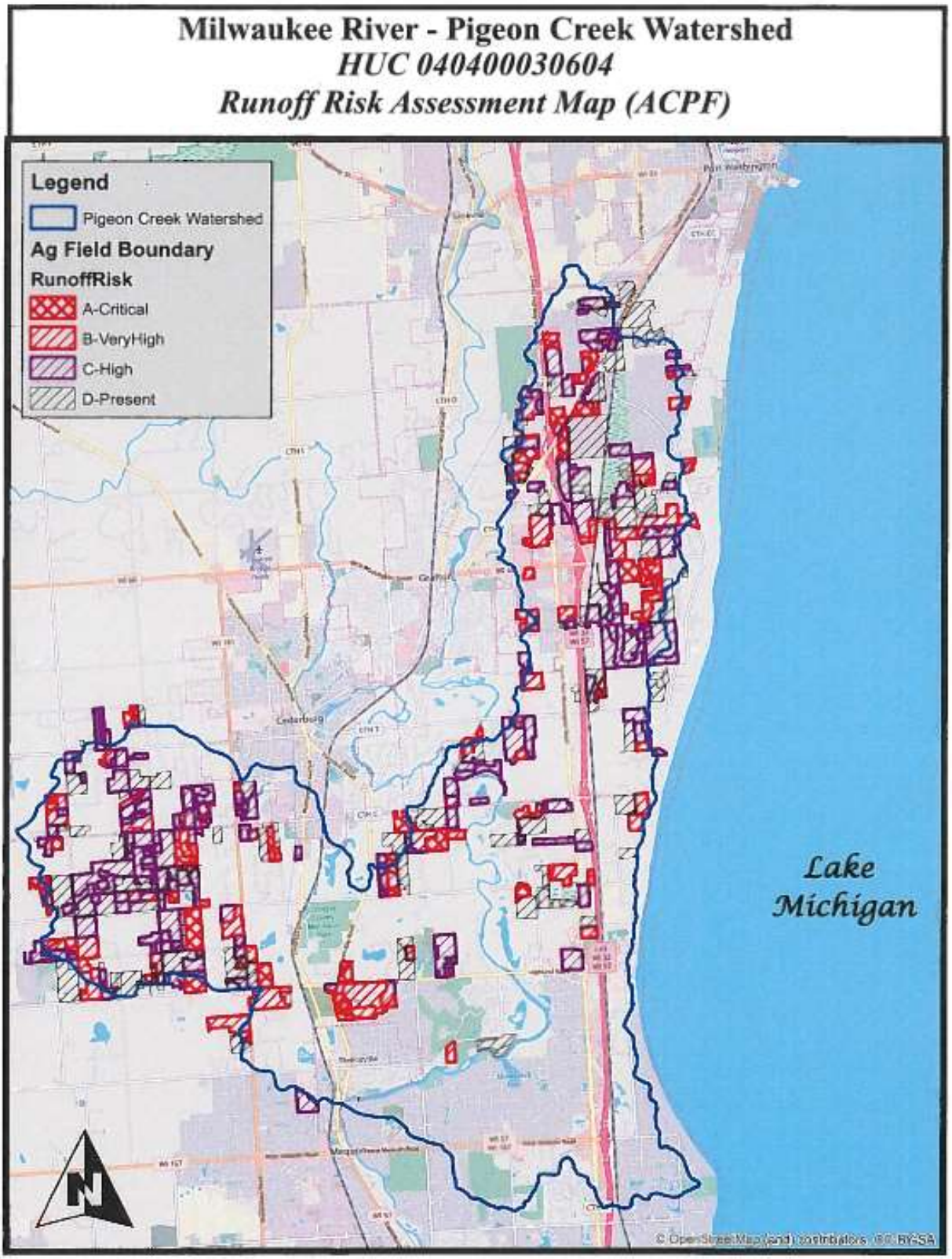


FIGURE 58 – ACPF MODELING FOR 0604



10.0 Information and Education Plan

There are multiple audiences that will need to be addressed as part of this plan. The audiences include producer community, the municipalities, nonprofit organizations operating in the watershed, the public at large, academic, and non-traditional audiences.

Producer audiences:

Given this planning area's rural land use context the primary audience of the information and education plan will be the producer community. Loads from agricultural sources proportionately contribute the largest source of land-to-surface water pollution. Many existing efforts are underway that are yielding strong interest among this community.

Currently, these outreach efforts have been conducted through relatively informal social networks. Going forward, additional recruitment will likely be more challenging as those not already participating may be less amenable to changing their farming practices. A survey of the non-operator farm landlords, regularly a difficult population to engage, is recommended to better understand potential opportunities for engagement in the incentive programs available.

<u>Cedar Creek Farmer-led group (Washington County):</u>

The Cedar Creek Farmers group is a producer led group that was initiated in 2016 as a component of a 5-year Milwaukee River Watershed Conservation Partnership (MRWCP). The group is currently comprised of six farmers who farm 4,150 acres. This peer-to-peer form of outreach is actively educating farmers in the Cedar Creek watershed on best practices to improve soil health. The focus on soil health and cost savings associated with some of the practices such as no-till, has led to significant interest. A component of this outreach involves communicating how these practices have beneficial impacts upon local waterbodies. Currently six farmers are participating but many more are considering adopting a suite of practices that are modeled in the STEPL outputs. The Washington County Land and Water Conservation Department is the lead in providing technical assistance to this group. Current efforts include farm tours and workshops that bring in guest speakers and allow farmers to ask questions of each other about their experiences. Incentive payments offered through the program require less paperwork than similar NRCS incentives and can be combined with other existing NRCS incentive programs. To learn more, visit https://cedarcreekfarmers.wixsite.com/website.

<u>Milwaukee River Clean Farm Families (Ozaukee County):</u>

The Ozaukee County Producer-led group is a similar group that is providing peer-to-peer information and education to the agricultural community in the target watersheds. This group was formed in 2016 and also came out of the MRWCP and has funding for the next 5 years. The outreach is similar to the Cedar Creek group and includes bringing speakers to events to talk about the connection of soil health to watershed health. Cost-sharing opportunities are discussed and explained. Incentive payments offered

through the program require less paperwork than similar NRCS incentives and can be combined with other existing NRCS incentive programs. The development of this 9 Key Element Plan has been an agenda item of numerous Clean Farm Families' Meetings. See Appendix Learn more at https://www.cleanfarmfamilies.com/

Nonprofit audiences:

A number of nonprofit entities have been engaged and will continue to be engaged in the implementation of this watershed plan. Land conservancies and environmental organizations have provided some input into project priorities. This engagement will continue in future years through meetings reviewing project milestones and progress.

Some potential ways the nonprofit community might engage with this plan include targeted acquisition of lands with high conservation or floodplain management value. Specific projects such as stream restoration projects might allow for non-profits to involve their members in the work.

Riveredge Nature Center:

A 379-acre center that focuses on educational opportunities for all ages. Riveredge offers programs and curriculum development assistance to schools and teachers, programs and outreach for the public, and a diverse natural setting for students, groups and individuals to experience our local environmental resources. Their Community Rivers Program plans, designs, and builds projects to keep the Milwaukee River beautiful, and they connect with local residents through educational programming to do so. More information about the center can be found at http://www.riveredgenaturecenter.org/

Milwaukee Riverkeeper:

A non-profit that is part of a larger network of Waterkeeper Alliance organizations. It is focused on water quality, habitat and land management in the Milwaukee, Kinnickinnic and Menomonee River watersheds. Milwaukee Riverkeeper offers many hands-on opportunities for the public to learn about our local rivers and waterways, including participation in annual river clean-ups and in-stream citizen monitoring programs. More information about Milwaukee Riverkeeper can be found at https://www.milwaukeeriverkeeper.org

Mequon Nature Preserve:

A nature preserve that consists of over 400 acres of land being restored to forest, prairie and wetland complexes. The preserve is open to the public to explore and learn about the natural areas and habitats, as well as volunteer to experience hands-on participation, recreational opportunities, and stewardship of the land. Mequon Nature Preserve also researches experimental agricultural practices and conducts research and monitoring appropriate to the preserve. More information about Mequon Nature Preserve can be found at https://mequonnaturepreserve.org/.

Municipal audiences:

Municipalities' primary concern is compliance with MS4 permits that are currently being negotiated. In addition, some municipalities have WPDES discharge permits for their wastewater treatment plants (WWTPs). WWTPs are point sources that may evaluate adaptive management or water quality trading. The recommendation management measures for TP and TSS provided in this plan can provide useful data

for informing these discussions. As a way of better understanding the future responsibilities and to find opportunities to collaborate, the Mid-Moraine Water Quality Collective has formed. The Mid-Moraine Water Quality Collective is a collaboration among 12 twelve communities and two counties to meet impending Total Maximum Daily Load (TMDL) allocations for the Milwaukee River Basin. The Collective includes engineering expertise, non-governmental organization partners for public outreach, regulatory experts, and funding partners to lead communities to meet water quality goals, economic goals, and collaboration goals.

Separate but related to this effort, the village of Grafton is considering a trading relationship with neighboring farmers in order to meet their WPDES permit requirements. This work utilizes existing social networks developed through the producer led groups described above. It also represents a new and potentially long-term source of funding for the agricultural BMPs described in the implementation section.

Depending upon the requirements of future MS4 permits, other municipalities may look to implement some of the practices listed in this plan as a way of meeting their requirements in an adaptive management framework. In this light, the current peer-to-peer outreach networks hold a very important role in recruiting and retaining producers for these types of trading markets.

Sweet Water's Respect Our Waters Campaign:

Respect Our Waters is an education and information outreach campaign that raises awareness about stormwater pollution prevention. The campaign reaches various audiences through paid and unpaid television spots, news interviews, radio interviews, various digital advertising techniques, attending community events, and more. The goal is to education individuals about their role in stormwater pollution and how they are able to prevent pollutants from reaching local water ways. While the program is led by Sweet Water, 37 municipalities in the Milwaukee River Basin contribute to the program. To learn more visit http://www.respectourwaters.org

Related efforts by counties:

Ozaukee County Land and Water Management:

A department of Ozaukee County that works with the community to improve land and water management practices to improve and preserve Ozaukee County's natural resources. They partner with Ulao Creek Partnership to achieve these goals. They also administer sanitary, shoreland zoning, manure storage, and nonmetallic mining ordinances for the County, and provide information about these programs on their website. They have produced a newsletter called 'Ozaukee Dirt' which has highlighted demonstration farms, community clean ups, and other programs going on in the County. They also explain how to protect against floods. Both of these resources are available on their website. For more information, go to http://www.co.ozaukee.wi.us/295/Land-Water-Management

Ozaukee County Parks and Planning:

A department of Ozaukee County that provides an organized framework for local residents and visitors to appreciate and enjoy the natural resources in Ozaukee County through the increased awareness, education, and stewardship of our local ecology. The department has an Ozaukee county fish passage program that restores natural stream functions and habitat, and it has restored over 150 miles of in-stream habitat and thousands of acres of wetland habitat. They include information about this program

on their website and have linked to news stories about this project. More information about this department can be found at http://www.co.ozaukee.wi.us/540/Planning-Parks

The Ozaukee County Parks and Planning Department has developed a GIS based ecological prioritization tool that it has used for the direct Lake Michigan drainage watersheds that are immediately adjacent to the study area. They intend to use this tool to identify areas where restoration or conservation actions can have multiple habitat, floodplain, and/or stormwater benefits. The projects that will be identified will likely be stream restoration or floodplain modification project. Wetland creation or restoration projects will likely be identified as well. It is anticipated that this prioritization will be complete by November 2019. The results of this prioritization will be very applicable to this plan and will be incorporated in future drafts.

Academic:

University of Wisconsin Extension:

UW-Extension in Ozaukee County focuses on Agriculture, Community Development and 4-H & Youth Development programming. There is an inherent connection between these programs and the protection and improvement of waterways. UW-Extension is able to reach out to groups, students and the general public, serving as a valuable partner in the watershed wide water quality and land management initiatives. More information about UW-Extension's presence in Ozaukee County can be found at https://ozaukee.extension.wisc.edu/

Non-traditional audiences:

Ozaukee Washington Land Trust:

A land trust that works to improve the water quality and habitat of waterbodies, waterways, and wetlands and otherwise preserve the scenic and open spaces that define rural Ozaukee and Washington Counties. They promote public awareness of the benefits of land preservation and provide opportunities for nature-based recreation. They have worked with several partners including WDNR, SEWRPC, and Ozaukee and Washington County Land Conservation Departments. They have several preserves across the two counties and host volunteers to give residents of the counties an opportunity to engage in stewardship. They also post articles about their preserves on their website. To learn more, visit https://owlt.org/

Cedar Lakes Conservation Foundation:

A land trust covering the Gilbert, Big Cedar, Little Cedar, Lucas, Silver and Quaas Lakes that has been around since the 1970's. The foundation is involved in over 60 different properties covering more than 2,400 acres through land ownership, conservation easements and deed restrictions. This allows the group to focus on protecting the watersheds that drain to their focus lakes, providing runoff and water quality benefits throughout the area. More information about this land trust can be found at https://www.conservecedarlakes.org/

Some of the most successful watershed restoration efforts have engaged non-traditional partners in an unexpected manner. Engagement of schools that are focusing on Experiential Learning is potential way to involve neighboring or downstream communities in the conservation practices identified in this plan. This engagement helps reinforce the importance of this work to the producer community but also

provides opportunities for students to become engaged in this work. Tangible work such as stream buffer plantings are ones that can be completed by students. The range of agricultural policy issues provides opportunities for students to better understand and engage with these broader issues. The exact practices and outcomes are difficult to determine prior to the initiation of this work but can result in transformative results if proper relationships are fostered and maintained.

For examples of the educational activities and materials mentioned in the above sections, visit Appendices A-D.

Bacteria Identification and Solutions

In 2017, Sweet Water formed a Bacteria Work Group to frame key questions and issues, identify potential solutions, and develop additional tools to address the issue of bacteria in local watersheds. The Bacteria Work Group is comprised of members from Sweet Water's Science Advisory Committee whose professional backgrounds and personal interests complement the Work Group's scope of work. Members include individuals from local and regional non-profit organizations, scientists and water professionals from public and private sectors, engineers, land conservation departments, WDNR, and regional planning staff.

The Bacteria Work Group is working to identify recommendations for feasible steps that partners working to improve water quality can take now, as well as longer-term solutions that will require additional resources to reduce bacteria sources within urbanized watersheds. One focus of the group has been outlining a protocol for identifying and prioritizing sources of bacteria loading in the Milwaukee River Basin. This work, as well as more general recommendations for how to address the problem of bacterial contamination in the Greater Milwaukee Watersheds, will be captured within a Bacteria Whitepaper, that is scheduled for completion in early 2020. For an example of how this work is being communicated to audiences, visit www.swwtwater.org/news/2018/8/16/fecalpollution

Once the Bacteria Whitepaper document is complete in 2020, it will be hosted on Sweet Water's website as well the Wisconsin Department of Natural Resources' Surface Water Integrated Monitoring System (SWIMS) database. The Bacteria Whitepaper will also be incorporated into this plan within 12 months of completion and will be used to discuss and then establish additional milestones, practices or protocols for identifying and then reducing bacteria sources within the HUC 12 sub-watersheds in this plan. This effort will also include re-assessment of septic system failure rates within each sub-watershed.

Bacteria and MS4 Permits

MS4 permit requirements will require municipalities within the watersheds described in this plan to develop plans and implement projects to reduce bacteria loading and meet TMDL reduction goals, over time (see section 7.2 of plan for additional MS4 and TMDL information). Both general and individual permits will contain requirements for ordinance revisions, education and outreach, Illicit discharge elimination, and source inventory, prioritization and reduction plan. While there may be differences between general permit and individual permit requirements, the expectation is that the Permit holders will use an adaptive management approach to their bacteria reduction efforts.

MS4 permittees are already required to implement a public education and outreach program to educate the public on storm water pollution issues and sources. Future MS4 permits will put greater emphasis on

education programs to increase awareness of bacterial pollution problems. This includes potential sources, proper pet waste management, and the impacts of urban wildlife and pests.

Another existing MS4 permit requirement is illicit discharge detection and elimination (IDDE). Many of the individual MS4 permits will contain more clear expectations for the IDDE program. These include new criteria for outfall screening prioritization, screening of non-major outfalls, and developing screening response levels for bacteria which require further investigation. These programs updates should lead to faster identification of the illicit source once an illicit discharge is discovered. Once discovered, permittees are required to remove illicit sources as soon as practicable. If removal of an illicit source will take longer than the specified time in the permit, the permittee must submit a plan of action to the Department and follow that plan of action in an expeditious manner.

Future MS4 permits will require local ordinance adoption or revision to address the following items:

- Proper Pet Waste Management
- Restrictions on feeding urban wildlife
- Requirements for property owners to cooperate in cross connection identification and elimination
- Requirements for property owners to address other potential sources of bacteria that may enter the MS4 system (e.g. refuse management, pest control).

MS4 permits will also require permittees to develop an inventory of potential bacteria sources within their municipal boundary and identify them on a map. This includes sources such as leaking septic systems, zoos, kennels, waste hauling or transfer facilities, and compost sites among many others. Meeting this expectation will also be facilitated by the Fecal Coliform Load Duration Curves by TMDL reaches (Appendix D to the Milwaukee River Basin TMDL) and the Bacteria White Paper. The Fecal Coliform Load Duration Curves help to identify sources at low, mid-range, and high flow periods. High loading in times of low flow likely indicates direct bacterial contamination source(s), possibly by way of illicit discharges. High loading in times of high flow likely indicates that there is fecal contamination in areas that flood regularly. High loading at other times could have a range of sources and identifying these can also be facilitated by the Bacteria White Paper. Use of the Bacteria White Paper in tandem with MS4 permit requirements within the plan's HUC 12 sub-watersheds is an implementation milestone for this plan.

Once potential bacteria sources are identified, MS4 permittees must develop a strategy to address each source and prioritize which sources to address first. Permittees are expected to use an adaptive approach and update prioritization efforts as new information and bacteria reduction BMPs become available. The cost and implementation schedule of BMPs to reduce or eliminate bacteria sources from MS4 annual reports, should be obtained and included in this plan. ,. Via the MS4 methods described above, this plan will help to reduce bacteria sources and achieve load reductions in each HUC 12 sub-watershed over the plan's ten year schedule and will help make progress towards the Milwaukee River TMDL bacteria reduction goals.

TABLE 38 – INFORMATION AND EDUCATION PLAN MATRIX

Education Action	Target Audience	Communications Vehicles	Lead (supporting) Organizations	Schedule	Measurable Indicators/ Milestones	Outcomes, Behavior Change	Estimated Cost*
Adopt-A-River	Community Groups, private owners & public facilities	Media blitz, word of mouth	Milwaukee Riverkeeper (Riveredge Nature Center)	Ongoing	# of River segments adopted, # annual events, attendance, types of participation	Create awareness, activism, and ownership regarding streams and tributaries and their health in the Milwaukee River Watershed.	TBD
Tour of Watershed	Elected officials and residents	Social Media, Local Newsletters, Websites	Riveredge Nature Center (TBD)	TBD	# of stops, # of participants, # of connections generated during and/or after tours	create awareness, inspire action	TBD
Watershed Award	Active volunteers, all stakeholders	Watershed Champion Awards ceremony, social media, annual recognition	Sweet Water	Annually	# of nominations and submissions, # of attendees at annual Clean Rivers Clean Lake Conference	Create awareness of various programs in the watershed, recognizing good to promote good	$500 annually
Educational Seminars (examples: GI workshops, Certified Wildlife Habitat, Rain garden Workshops)	residents, homeowners, landowners	Seminar or presentations on programs available to residents and owners.	Riveredge Nature Center CRP (Milwaukee Riverkeeper, Sweet Water)	Annually	# of GI workshops, # rain garden workshops, # rain gardens installed, Rain barrels installed	Create Awareness/ Engage residents	$150-300/ program
Adventure Programs (examples: Kayaking, Fishing, Tubing)	Residents	Newsletters, websites, social media	Riveredge Nature Center (Milwaukee Riverkeeper)	Seasonally	# of kayakers, # fishermen, # tubers	Create Awareness/ Engage residents	$150-300/ program
Outreach Events	residents, homeowners, landowners	face to face, printed materials, social media	Riveredge Nature Center CRP (Milwaukee Riverkeeper, Sweet Water)	Seasonally		Create Awareness	TBD
Landscape Consultations about green practices for	landowners, homeowners, and businesses	website, Social media, word-of-mouth	Riveredge Nature Center	Ongoing	# of consultations, # of installations	Property landscape improvement, increase in implementing BMP	$75/hr

healthy watershed						to benefit water quality	
Provide NOSD & St. John's (Newburg) with information about the Upper Milwaukee River Watershed as a means to support outdoor curriculum within the watershed's green infrastructure	schools, students, teachers	Support and expand reach of water education program to help integrate basic watershed planning and education into existing elementary, middle and high school science curriculum. (Testing the Waters, Determining Water Quality school programs)	Riveredge Nature Center	Annually	# of student engagements, # of teacher training discussions	Students in NOSD & WBSD watershed will understand the environment in which they live and realize importance of maintaining a healthy place for both people and nature, and understand actions they and their families can take to protect water quality. Learning will be pass on to future generations.	TBD based on hours
Engage Farmland owners & renters about the plan; Encourage and support farmland owners and renters to implement recommended actions within the watershed plan.	Agricultural landowners & farmers	Meetings of farmland owners & renters. Share available funding for projects, purchase of development rights, buffers and the impacts on water quality and role of wetlands.	Washington & Ozaukee Counties (Clean Farm Families), UW Extension,	TBD	County Land and Water Management Plans reference the Fredonia Newburg Plan	Increase awareness of agricultural projects within the watershed that use cover crops and sustainable BMPs. (improve soil health) Increase level of participation in such programs & initiatives.	TBD based on hours
Host soil health and water quality presenta tions geared at improving water quality, reducing soil erosion	Agricultural landowners & farmers	Hold seminar on appropriate NRCS programs, potential funding, and types of project that should be implemented in the watershed.	NRCS (Washington County, Ozaukee County, & Clean Farm Families)	TBD	# of attendees, # of draft designs completed, # of projects completed	Increase level of awareness of NRCS programs and how they relate to land management project s in the watershed and increase level of	TBD

						participation in implementing agriculture projects recommendations.	
Adopt-Your-Drain	Residents, municipalities, general public	Television commercials featured news stories, community events, more	Sweet Water	Ongoing	# of drains adopted, # of events held,	Mapping good behavior, education through various media efforts, "social pressure" via yard signs and word of mouth	$24,000 annually
Respect Our Waters	General Public, municipal staff, contractors, educators, businesses	Television commercials featured news stories, community events, more	Sweet Water	Ongoing	# of impressions, # of events, # of municipal partners engaged	Continuous education for a positive behavioral change regarding stormwater pollution preventions. This is a regional effort that includes ~30 municipalities	$24,000 annually
Treasures of Oz	General Public, municipal staff, contractors, educators, businesses		Ozaukee County	Ongoing	# of attendees, # of education vendors	awareness and attendance at event to raise awareness about the county's valued natural resource assets	$7,500 annually
Mini-Grant Program	Small to medium-sized community organizations, grassroots initiatives, concerned citizens, landowners, schools	Sweet Water website and annual conference, word of mouth, e-newsletters	Sweet Water	Ongoing	# of projects identified for funding, # of applications submitted, # of grants awarded, # of people assisting with grant applications	Practitioner awareness about the program and continue to support grassroots efforts to prevent stormwater pollution through various GI and BMP efforts	$10,000/ year

Inform producers in Cedar Creek watershed about Ag BMPs and soil health	Producers in Cedar Creek watershed	Meetings of farmland owners & renters. Share available funding for projects, purchase of development rights, buffers and the impacts on water quality and role of wetlands.	Cedar Creek Farmer-led group, Washington County Land and Water Conservation	Current to 2021, expected to continue pending funding	# of producers who adopt practices	Producers are knowledgeable about BMPs and issues related to adoption Greater number of producers adopt practices	$5,000/ Year funded through 2021
Inform producers in Ozaukee County portion of Milwaukee River Watershed about Ag BMPs and soil health	Producers in Ozaukee county portions of targeted watershed	Meetings of farmland owners & renters. Share available funding for projects, purchase of development rights, buffers and the impacts on water quality and role of wetlands.	Milwaukee River Clean Farm Families, Technical support from Ozaukee County Land and Water Mgmt. Dept.	Current to 2021, expected to continue pending funding	# of producers who adopt practices	Producers are knowledgeable about BMPs and issues related to adoption Greater number of producers adopt practices	$5,000/ Year funded through 2021
Targeted outreach to farms not participating	Producers not enrolled in conservation practices	Meetings of farmland owners & renters. Share available funding for projects, purchase of development rights, buffers and the impacts on water quality and role of wetlands, word of mouth	Producer led farmer groups (see above)	Ongoing	# of producers approached	Producers not participating will be approached	Covered in above work
Targeted survey of non-operator farm landlords	Non-operator farm landlords	survey	Sweet Water - consultants	2019-2022	% of leased farms enrolled in conservation practices	25% of leased farms enrolled in conservation practices	$5,000
Regular implementation update meetings	Nonprofit community, residents, producers	meetings	Sweet Water to hold meetings	2018-2028		Nonprofit community, public, and producers are aware of progress	$2000/ year

Engage EL programs in schools on restoration efforts	5-12th grade, school districts		Sweet Water or consultants to act as facilitator	2019-2023		EL programs in 1 school district engaged in watershed restoration efforts	$3,500 / year for transportation, material, staff-time
Obtain MS4 annual reports from MS4 permit holders	Nonprofit community, residents, producers	Survey and meetings	WDNR, MS4 municipalities and Sweet Water assemble MS4 information for review/discussion at meetings	2021 2023 2025 2027 2029	Actions taken to ID and reduce bacteria sources # bacteria reduction projects/practices	Reduced Bacteria concentrations and loading	See Respect Our Waters above
Total Cost of Education Activities across HUC10 0404000303, HUC12 040400030603, and HUC12 040400030604 for 10 years: $865,000							

*These costs should be updated as more annual program costs are determined. This milestone should be accomplished within 3 years of plan approval.

11.0 Cost analysis for agricultural BMP implementation

The following costs were obtained through discussions with county Land and Water Management staff. These reflect current incentive payments per acre for the practices modeled in STEPL. Maintenance costs will be borne by the farmers and are not calculated here.

TABLE 39– COST ANALYSIS FOR ALL HUCS

Cedar Creek HUC 12 – 040400030301 cost analysis			
BMP	Cost/unit	# of units	Total cost
Control on barnyards			
Runoff Management systems	$50,000/unit (average)	3	$150,000
Upland controls on cropland			
Nutrient Management Plans (NMP-1)	$40/acre	700 acres	$28,000
Reduced tillage (Con Till-2)	$25/acre	100 acres	$2,500
Grassed waterways (Gullies)	$5/ft	9,000 linear ft.	$45,000
Grass buffers to filter riparian strips	$275/acre	50 acres	$13,750
Nutrient Management Plans (NMP-1) combined with Reduced Tillage (Con Till-2)	$55/acre	600 acres	$33,000
Nutrient Management Plans (NMP-1) combined with Cover Crops (Crop -3)	$103/acre	400 acres	$41,200
Nutrient Management Plans (NMP-1) combined with Grass Buffers (minimum 35 ft wide)	$315/acre	100 acres	$31,500
Reduced tillage (Con Till-2) combined with Cover crops (crop-3)	$78/acre	200 acres	$15,600
Upland controls on pastureland			
Grass buffers (minimum 35 feet wide)	$275/acre	50 acres	$13,750
Grazing Land Management (rotational grazing with fenced areas)		40 acres	
Prescribed Grazing	$50/acre	30 acres	$1,500
Use Exclusion	$50/acre	15 acres	$750
Staff/Technical Assistance to promote/adopt practices			
Washington County Staff/Technical Assistance	$16,500/yr	10 years	$165,000
Total Cost for all Practices in HUC12 – 040400030301			
$541,550			

Cedar Creek HUC 12 – 040400030302 cost analysis			
BMP	Cost/unit	# of units	Total cost
Control on barnyards			
Runoff Management systems	$50,000/unit (average)	3	$150,000

Upland controls on cropland			
Nutrient Management Plans (NMP-1)	$40/acre	265 acres	$10,600
Reduced tillage (Con Till-2)	$25/acre	325 acres	$8,125
Cover Crops (Crop-3)	$63/acre	400 acres	$25,200
Grassed waterways (Gullies)	$5/feet	4,500 feet	$22,500
Grass buffers to filter riparian strips	$275/acre	125 acres	$34,375
Nutrient Management Plans (NMP-1) combined with Reduced Tillage (Con Till-2)	$55/acre	200 acres	$11,000
Nutrient Management Plans (NMP-1) combined with Cover Crops (Crop -3)	$103/acre	130 acres	$13,390
Nutrient Management Plans (NMP-1) combined with Grass Buffers (minimum 35 ft wide)	$315/acre	30 acres	$9,450
Reduced tillage (Con Till-2) combined with Cover crops (crop-3)	$78/acre	75 acres	$5,850
Upland controls on pastureland			
Grass buffers (minimum 35 feet wide)	$275/acre	100 acres	$27,500
Grazing Land Management (rotational grazing with fenced areas)	$300/acre	35 acres	$10,500
Prescribed Grazing	$50/acre	25 acres	$1,250
Use Exclusion	$50/acre	10 acres	$500
Staff/Technical Assistance to promote/adopt practices			
Washington County Staff/Technical Assistance	$9,000/yr	10 years	$90,000
Total Cost for all Practices in HUC12 – 040400030302			
$3,420,240			

Cedar Creek HUC 12 – 040400030303 cost analysis			
BMP	Cost/unit	# of units	Total cost
Control on barnyards			
Runoff Management systems	$50,000/unit (average)	10	$500,000
Upland controls on cropland			
Nutrient Management Plans (NMP-1)	$40/acre	1000 acres	$40,000
Reduced tillage (Con Till-2)	$25/acre	300 acres	$7,500
Cover Crops (Crop-3)	$63/acre	200 acres	$12,600
Grassed waterways (Gullies)	$5/feet	15,000 feet	$75,000
Grass buffers to filter riparian strips	$275/acre	40 acres	$11,000
Nutrient Management Plans (NMP-1) with Reduced Tillage (Con.Till-2)	$55/acre	1,000 acres	$55,000
Nutrient Management Plans (NMP-1) combined with Cover Crops (Crop -3)	$103/acre	800 acres	$82,400

Nutrient Management Plans (NMP-1) combined with Grass Buffers (minimum 35 ft wide)	$315/acre	200 acres	$63,000
Reduced tillage (Con Till-2) combined with Cover crops (Crop-3)	$78/acre	200 acres	$15,600
Upland controls on pastureland			
Grass buffers (minimum 35 feet wide)	$275/acre	200 acres	$55,000
Grazing Land Management (rotational grazing with fenced areas)	$300/acre	50 acres	$15,000
Prescribed Grazing	$50/acre	25 acres	$1,250
Use Exclusion	$50/acre	10 acres	$500
Staff/Technical Assistance to promote/adopt practices			
Washington County Staff/Technical Assistance	$16,500/yr	10 years	$165,000
Total Cost for all Practices in HUC12 – 040400030303			
$1,098,850			

Cedar Creek HUC 12 – 040400030304 cost analysis			
BMP	Cost/unit	Number of units	Total cost
Control on barnyards			
Diversion (roofs/gutters)	TBD	.85 acre	TBD
Upland controls on cropland			
Nutrient Management Plans (NMP-1)	$40/acre	118 acres	$4,720
Reduced Tillage (Con Till-1)	$25/acre	100 acres	$2,500
Reduced Tillage (Con Till-2)	$25/acre	100 acres	$2,500
Cover Crops (Cover Crop -2)	$63/acre	100 acres	$6,300
Grassed waterways (Gullies)	$5/ft	3,960 linear feet	$19,800
Nutrient Management Plans (NMP-1) combined with Reduced Tillage (Con Till-1)	$55/acre	100 acres	$5,500
Nutrient Management Plans (NMP-1) combined with Reduced Tillage (Con Till-2)	$55/acre	100 acres	$5,500
Nutrient Management Plans (NMP-1) combined with Cover Crops (Crop-2)	$103/acre	100 acres	$10,300
Nutrient Management Plans (NMP-1) combined with Grass Buffers (minimum 35 ft wide)	$315/acre	32 acres	$10,080
Upland controls on pastureland			
Grass buffers (minimum 35 feet wide)	$275/acre	100 acres	$27,500
Grazing Land Management (rotational grazing with fenced areas)	$300	1 acre	$300
Prescribed Grazing	$50/acre	25 acres	$1,250

Use Exclusion	$50/acre	10 acres	$500
Staff/Technical Assistance to promote/adopt practices			
Washington County Staff/Technical Assistance	$1,000/yr	10 years	$10,000
Total Cost for all Practices in HUC12 – 040400030304			
$106,750*			

*This number should be updated when the cost of diverting downspouts is determined

Mole Creek HUC 12 – 040400030603 cost analysis			
BMP	Cost/unit	Number of units	Total cost
Control on barnyards			
Diversions (roofs/gutters)	TBD	0.82 acres	TBD
Upland controls on cropland			
Nutrient Management Plans (NMP-1)	$40/acre	775 acres	$31,000
Low disturbance manure injection	TBD	1,075 acres	TBD
Grassed waterways (Gullies)	$5/ft	5,000 linear feet	$25,000
Nutrient Management Plans (NMP-1) combined with Reduced Tillage	$63/acre	1,250 acres	$78,750
Nutrient Management Plans (NMP-1) combined with Cover Crops (Crop -3)	$103/acre	1,000 acres	$103,000
Grass buffers (minimum 35 feet wide)	$275/acre	439 acres	$120,725
Upland controls on pastureland			
Staff/Technical Assistance to promote/adopt practices			
Ozaukee County Staff/Technical Assistance	$8,000/yr	10 years	$40,000
Total Cost for all Practices in HUC12 – 040400030603			
$438,475*			

*This number should be updated when the cost of diverting downspouts and using low-disturbance manure injection is determined

Pigeon and Ulao Creeks HUC 12 – 040400030604 cost analysis			
BMP	Cost/unit	Number of units	Total cost
Control on barnyards			
Diversions (roofs/gutters)	TBD	13.7 acres	TBD
Upland controls on cropland			
Nutrient Management Plans (NMP-1)	$40/acre	300 acres	$12,000
Reduced Tillage (Con Till-1)	$25/acre	50 acres	$1,250
Reduced Tillage (Con Till-2)	$25/acre	50 acres	$1,250
Cover Crops (Crop-2)	$63/acre	25 acres	$1,575
Nutrient Management Plans (NMP-1) combined with Reduced Tillage (Con Till-1)	$55/acre	350 acres	$19,250
Nutrient Management Plans (NMP-1) combined with Reduced Tillage (Con Till-2)	$55/acre	250 acres	$13,750

Nutrient Management Plans (NMP-1) combined with Cover Crops (Crop-2)	$103/acre	250 acres	$25,750
Grass Buffers (minimum 35 ft wide)	$275	32 acres	$8,800
Upland controls on pastureland			
Critical Area Planting	TBD	50 acres	TBD
Grass Buffers (minimum 35 ft wide)	$275/acre	12.8 acres	$3,520
Heavy Use Area Protection	TBD	2 acres	TBD
Streambank Stabilization with Fencing	TBD	12.8 acres	TBD
Staff/Technical Assistance to promote/adopt practices			
Ozaukee County Staff/Technical Assistance	$16,000/yr	10 years	$160,000
Total Cost for all Practices in HUC12 – 040400030303			
$247,145*			

*This number should be updated when the cost of diverting downspouts, critical area planting, heavy use area protection, and streambank stabilization with fencing is determined

Total costs for all watersheds
$5,853,010

Some incentive programs are available to help offset costs of implementation. Natural Resources Conservation Service offers incentive programs to help landowners and producers offset the costs of implementing land and water management practices. For Example, the Environmental Quality Incentives Program (EQIP) provides up to 70% of the initial costs for implementation of many measures. NRCS also provides staff technical assistance to design alternative land management scenarios to assist landowners in resource management. To be eligible for the incentives, NRCS must document there is an environmental concern according to its planning criteria. Example incentive rates through NRCS EQIP are provided for reference and are subject to change.

TABLE 40 – EXAMPLE INCENTIVE RATES THROUGH NRCS EQIP

Eligible Practices- NRCS Environmental Quality Incentives Program	Incentive amount($)	Unit	Estimated Cost
Cover Crop-(overwinter: Rye, Triticale, Wheat) Cost includes: Seed, Seeding,termination) A forage may be made on Cover Crops	51.2	acre	$ 65
Cover Crop (Fall termination)	30.25	acre	$ 45
Grassed Waterway(includes facilitating practices such as Tile, Erosion Blanket)	8.29	ln/Ft	$ 11
Nurient Management Plan Development; includes soil testing	1,800-3,000	operation	
Nutrient Management Implementation	6.24	acre	$ 8
Harvestable Filter Strips	130	acre	$ 100
Residue Management No-Till	16.66	acre	$ 25
Prescribed Grazing Plan Implementation (3 years of incentive payment to follow a less than 3 day residency)	53.85	acre	
Grazing Facilatation Pratice Incentives (conversion of Cropland to Pastureland: Fence, Pipeline, Watering Tanks, Seeding, Lanes)	$750	acre	$ 1,000
Roof and Covers (building a roof over barnyards that are close to a surface water source; maximum incentive per landowner $150,000)	$10.26	sqft/roof	
Roof/Ground Gutters	$7-14	ln/Ft	

Another NRCS compensation opportunity is through the Conservation Stewardship Program (CSP), which inventories the producer's operation. Based on the level that they are already managing water, soil, plant, animal, and energy resources landowners can earn a yearly incentive for maintaining a high level of conservation on the operation. Some of the practices that we would assess on the operation include: nutrient management plan, keep sod in concentrated flow areas, maintain grass vegetation adjacent to ditches and stream, and are willing to adopt a higher level of conservation to the operation.

11.1 Operation & Maintenance

This plan will require some land owners to agree to a 10-year maintenance period for practices such as vegetated buffers, grassed waterways, water and sediment control basins, treatment wetlands, wetland restoration, barnyard runoff control, manure storage, streambank stabilization including crossings and fencing, and concentrated flow area seedings. A 10-year maintenance period is also required for implementation of strip cropping and prescribed grazing. For practices such as conservation tillage, cover crops, nutrient management, and prescribed grazing landowners are required to maintain the practice for each period that cost sharing is available. Upon completion of the operation and maintenance period, point sources may be able to work with operators and landowners to continue implementation of the BMP's under a pollutant trading agreement (non EPA 319 monies). Members of Farmer Led Councils within some HUC 12 watersheds in this plan will also help adopt and maintain soil health practices in the watershed without use of annual or 10-year maintenance requirements.

12.0 Measuring Plan Implementation and Success

Monitoring of plan progress will be an essential component of achieving the desired water quality goals. Plan progress and success will be tracked by water quality monitoring, , tracking progress of best management practice implementation, and by participation rates in public awareness and education efforts within each HUC 12 sub-watershed.

Sections 7, 9.2, 10 and Appendices F, G, and H comprise the framework and supporting information for a monitoring and evaluation strategy for this plan. Continuing WQ monitoring within each HUC 12 sub-watershed and comparing results to 2017-19 baseline values shown in Appendices F and I will be a key method by which the plan partners will measure the success of implementation. HUC 12 sub-basins that meet, or make substantial progress towards meeting, practice milestones will be a priority for WQ monitoring. HUC 12 sub-basins that make little or no progress towards practice milestones will be lower priority for WQ monitoring.

Appendix F, Tables 42-44, contain WQ monitoring milestones for Phosphorus, Sediment and bacteria concentrations. Appendix D. Section 9.2 contains milestones for implementing multiple practices on both cropland and urban acres within each HUC 12 sub-watershed. Section 10 contains milestones for completing education and outreach and tracking landowner understanding and participation in meeting plan reduction goals.

Over the plan's ten-year schedule, WQ monitoring results, records of BMP implementation and satellite imagery will be compared to determine if water quality improvement is being made, over time, or if other factors (e.g., legacy P sources, changes in climate/rainfall events that influence runoff and stream flow volumes) may be masking WQ improvement The process for modifying implementation will be an iterative one.

County Land and Water Conservation staff will record implementation of conservation practices as part of their normal work. Funding amounts and funding sources will be tracked. Additionally, verification of the installed practices will occur as per requirements of the particular funding source used. WQ modeling of watershed conditions, to reflect adoption of new/additional practices, and use of satellite imagery to evaluate crop residue levels within each HUC 12 sub-watershed, will be two other methods used to assess plan implementation.

12.1 Plan Milestones and Evaluating Progress

This plan contains several milestones (see sections 9.2 and Appendix J) that will be carefully tracked and monitored over time to determine if enough progress is being made to meet plan goals/pollutant reductions. The criteria shown below is a summary of the how plan implementation will be evaluated and/or determine if plan milestones and reduction goals should be revised due to minimal progress achieved.

Progress and success of this plan will be tracked by the following five components:

1) Information and education activities and participation
2) Pollution reduction evaluation based on BMP's installed
3) Water quality monitoring
4) Administrative review
5) Minimum Progress Criteria

Ozaukee and Washington County Land Conservation Department will be responsible for tracking progress on reducing agricultural pollutant sources. Permitted MS4s, WDNR staff and annual MS4 reports will help track progress on reducing urban pollutant sources in the watershed. Each Land Conservation department will need to work with NRCS staff and other partners to track progress and implement cropland-based practices. Reports will be completed annually, and a final report will be prepared at the end of the project. Please refer to section 8 of this plan for how the five components described above will be used within each HUC 12 sub-watershed within this plan. Farmer Led Council members within some HUC 12 sub-watersheds in this plan may also agree to help track progress via adoption of soil health or other practices.

12.2 WQ monitoring and Evaluating Plan Implementation

This plan recognizes that estimated pollutant load reductions and expected improvement in water quality or aquatic habitat may not occur immediately following implementation of practices due to several factors (described below) that will need to be taken into consideration when evaluating water quality data. These factors can affect or mask progress that plan implementation has made elsewhere.

Consultation with the DNR and Water Quality biologists will be critical when evaluating water quality or aquatic habitat monitoring results. If the target values and goals for water quality improvement for the milestone period are not being achieved, the water quality targets or timetable for pollutant reduction will need to be adjusted as necessary.

The following criteria will be evaluated when water quality and aquatic habitat monitoring is completed after implementation of practices:

- Changes in land use or crop rotations within the same watershed where practices are implemented. (Increase in cattle numbers, corn silage acres, and/or urban areas can negatively impact stream quality and water quality efforts)
- Location in watershed where land use changes or crop rotations occur. (Where are these changes occurring in relation to implemented practices?)
- Watershed size, location where practices are implemented and location of monitoring sites.
- Climate, precipitation events and soil conditions that occurred before and during monitoring periods. (Climate and weather patterns can vary significantly and alter growing season, soil conditions, runoff frequency/duration and water quality)
- Frequency and timing of monitoring
- Percent of watershed area (acres) or facilities (number) meeting NR 151 ag performance standards and prohibitions.
- Percent of watershed area (acres) that is meeting MS4 permit requirements.
- Percent of watershed area (acres) or facilities (number) that maintain implemented agricultural practices over time.
- Percent of watershed areas (acres) that discharge to MS4 system in the watershed and proximity to WQ monitoring station(s).
- Number and spatial extent of illicit discharges to MS4 system in the watershed
- Extent of gully erosion on crop fields within watershed over time. How many are maintained in perennial vegetation vs. plowed under each year?

- Amount and spatial extent of crop residue levels within watershed, over time. How many acres are maintained in > 30% residue, 30-70% residue and > 70% residue? Does the number of acres with > 30 % residue in the watershed increase or decrease over time?
- Stability of bank sediments and how much this sediment may be contributing P and TSS to the stream
- How "Legacy' sediments already within the stream and watershed may be contributing P and sediment loads to stream?
- Does monitored stream meet IBI and habitat criteria but does not meet TMDL water quality criteria?
- Are the plan targets reasonable? Are the plan's estimated load reductions overly optimistic?

13.0 Summary

The implementation of this watershed plan will naturally require extensive effort from both the agriculture producers but also the county staff who will be conducting the bulk of the assessments. The two farm producer groups described in this plan will have an important role in disseminating the results and speaking of the promise of various conservation tillage practices. Nonprofits and other coordinating organizations such as Sweet Water will have coordination roles as the plan moves forward and new projects are identified. The WDNR will have the role of assuring that any future trading or adaptive management tools meet the stated goal of the agreement. Funders will have a role in finding catalytic opportunities to bring new practices or approaches to the forefront.

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