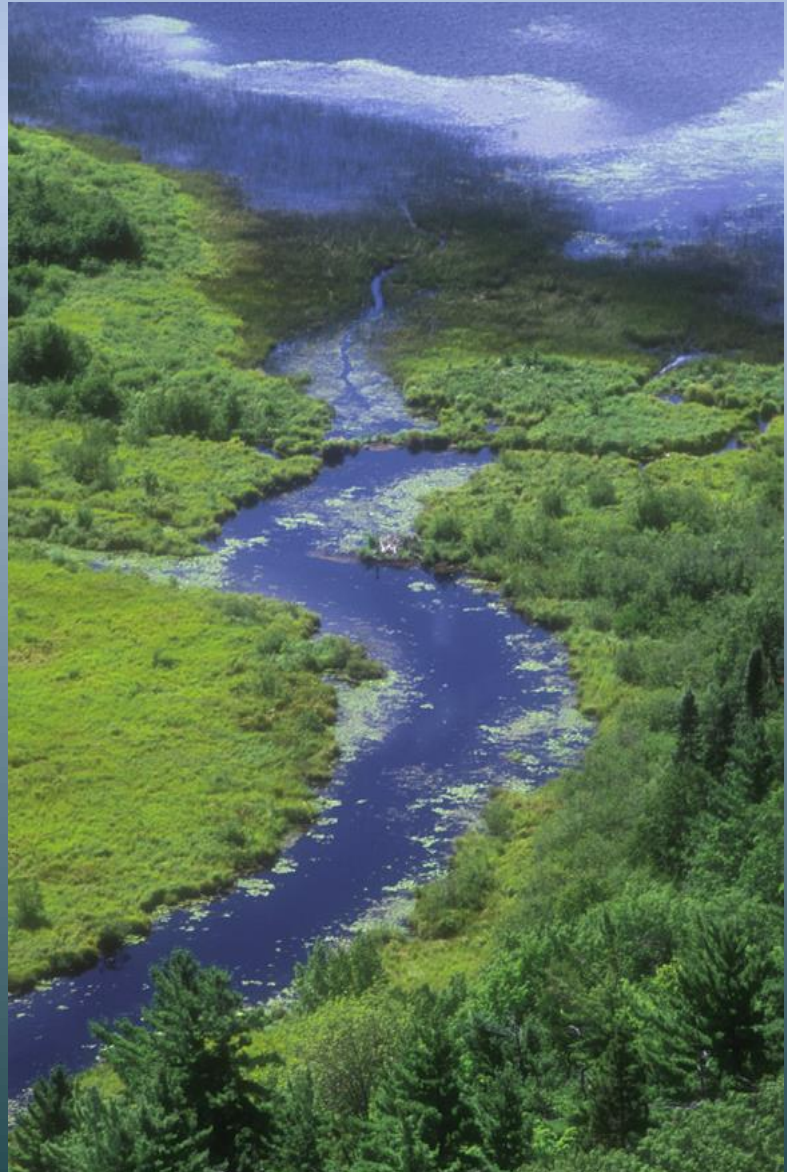




# *Land Use Strategies to Conserve Riparian Resources*

## *Upper Peninsula, Michigan*



*Superior Watershed Partnership / Model Forest Policy Program*  
*February 2015*



# Acknowledgements

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The Superior Watershed Partnership and Land Trust (SWP) is a non-profit conservation organization dedicated to the protection and restoration of Michigan’s Upper Peninsula. Formed in 1999, SWP provides creative, science-based solutions to environmental challenges. Its staff of biologists, planners, technicians and educators has successfully implemented a wide range of projects through education, public policy, and on-the-ground activities.



The Model Forest Policy Program (MFPP) is a national nonprofit that builds the capacity of communities nationwide to be climate resilient by sustaining water resources, productive forests, citizens’ wellbeing, and thriving economies. Recognizing the vital role that forested watersheds play in mitigating climate impacts on vulnerable communities, MFPP facilitates *Climate Solutions University: Forest and Water Strategies (CSU)* with the Cumberland River Compact. Launched in 2010, CSU is a community-based, virtual curriculum that builds capacity through a rigorous, science-grounded, planning and implementation process.

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# I. Introduction

## Issue, Purpose, and Audience

The Upper Peninsula (UP) of Michigan and its watersheds are significant to the health of the entire Great Lakes. People living and working every day in the UP, together with the tourists who visit in each distinct season, all share the economic, environmental and social value of its clean water and healthy lands. This common benefit is the fundamental reason why it is important to protect and maintain the ecosystems of this unique region.

Recognizing how healthy the waters of the UP are today – we want to keep it that way! To do that, there are some tools that **ONLY** local government decision makers can implement. In addition, local governments can provide resources and connections to private landowners to improve management. Desired uses like fishing, boating, swimming and community events on our lakes, rivers and wetlands can be maintained using these actions.

This guide opens with a brief history of the Upper Peninsula that brought about the landscape we have today. A summary of the benefits provided by the UP's many wetlands and streams leads to a conclusion of the need for more focused conservation of these waters.

A description of the current governance options for protecting waterways follows. It recommends a watershed approach. This method starts by considering the flow of water and the land use patterns within the entire drainage of a river or inland lake to find the most important and effective locations for protection. Targeted use of planning, zoning, and land use measures is critical. The Appendices includes sources for further information.

This project will describe the series of steps local officials can take to protect their areas for both the short term and long term. You will learn how to make conservation of riparian resources a reality in your community.



**Figure 1: Two-Hearted River.** Photo Credit: Tom Buckhoe, courtesy Superior Watershed Partnership

## II. The UP's Environment and Governance Options

### A. Environmental Conditions

The five Great Lakes make up the largest freshwater system in the world. Michigan's Upper Peninsula sits among three of them, Lakes Superior, Michigan and Huron. The UP makes up 15% of the Great Lakes watershed within the United States. Situated in such an important location, the UP is vital to the functioning of the entire Great Lakes system. The UP's geography reflects the path of the glaciers that left less than 10,000 years ago. Enormous chunks of ice melted, forming many of its ponds. Wetlands fill the low regions that were scraped flat by moving ice. Rivers follow cuts in the rocks or trace sandy washes. Development over the past 170 years has changed both the number and the health of these waterways.

#### 1. History

Before European settlement, the Upper Peninsula was entirely forested. Its woods and extensive network of rivers, lakes and wetlands were shaped primarily by natural forces. The people living here, the Anishinaabe (Ojibwe), burned the edges of some clearings and practiced some agriculture. With the discovery of iron and copper ore in the 1840s, Europeans began to move to the Upper Peninsula. The mines, the camps and towns that grew up around them, and the transportation network (harbors, roads and railroads) built to connect them fundamentally changed the UP landscape. In addition, the logging industry moved from the lower peninsula of Michigan to the Upper beginning in the 1850s. Michigan led the nation in lumber production in the 1880s and 1890s. By the 1920s, all but a very few isolated forested stands had been logged. In less than one hundred years, these actions resulted in the loss of almost all of the original forest and considerable loss of wetlands.<sup>1</sup>

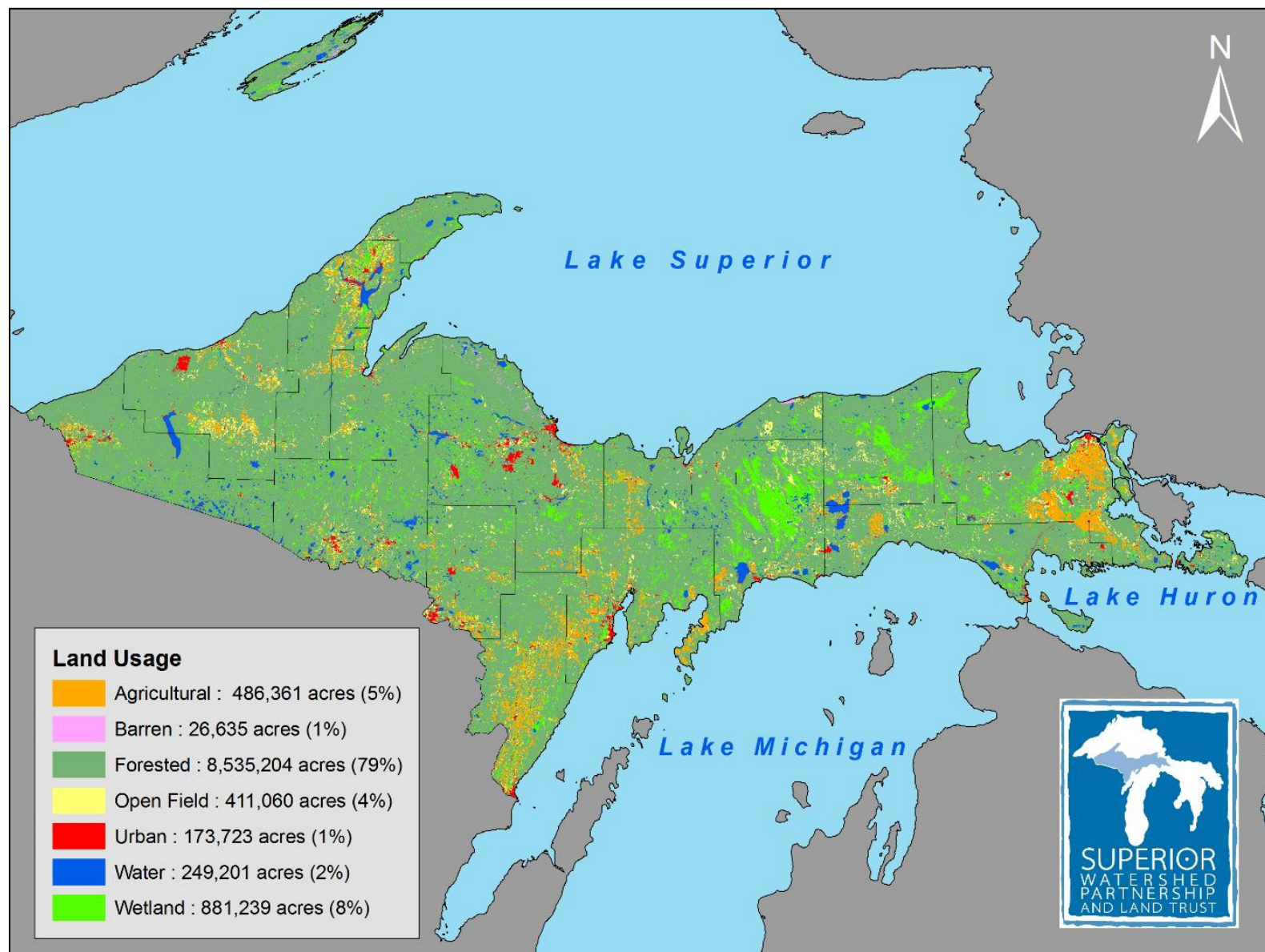
#### 2. Today

Current conditions reflect the impact of these historical land uses and are now mostly a mix of forestry, agriculture and small cities and towns. As of 2014, approximately 79% of the Upper Peninsula is forested, and 5% is in agricultural production<sup>2</sup> (see map next page). While there are only a handful of operating mines, the iron and copper ranges of the western and central UP contain abandoned equipment, tailings piles and mine shafts that may redirect and or pollute waterways. In addition, one new underground mine (nickel), and a proposed gravel mine are part of a pattern of increased mining in or near the Lake Superior basin.

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<sup>1</sup> [http://www.michigan.gov/dnr/0,4570,7-153-10370\\_22664-61596--,00.html](http://www.michigan.gov/dnr/0,4570,7-153-10370_22664-61596--,00.html) Michigan Department of Natural Resources DNR > Wildlife & Habitat > Natural Communities Forests

<sup>2</sup> [http://www.environmentalcouncil.org/mecReports/UP\\_forest\\_ownership\\_change.pdf](http://www.environmentalcouncil.org/mecReports/UP_forest_ownership_change.pdf)



**Figure 2: Upper Peninsula Land Usage.** Source: Michigan Center for Geographic Information.



Although often considered to be pristine, the waters of the northern Great Lakes increasingly suffer from water quality issues, especially near the shore. Pollutants and excess nutrients contributed by the rivers flowing into them and industrial uses at certain harbors have contributed to algal blooms (including recent toxic blooms in Green Bay), turbidity, dead zones, and beach closures from high bacteria counts.

### 3. Future

Forestry (silviculture), agriculture, mining, and other development are likely to continue, and in some cases expand, on the Upper Peninsula, presenting ongoing stresses to watersheds and riparian areas. In addition, climate change is presenting new challenges to efforts to conserve and restore water resources.

In a recent survey of over 400 natural resource managers, 90% indicated that a changing climate is already affecting the Great Lakes region.<sup>3</sup> Their opinions are confirmed by extensive observations.<sup>4</sup> Numerous assessments have documented current trends and potential future impacts on forest resources—including riparian areas—in the upper Great Lakes region, documented by the Forest Service's Northern Institute of Applied Climate Science (NIACS):<sup>5</sup>

“While climate models vary on the degree of change and the regions where it will occur, by the end of the 21st century, northern Michigan is projected to experience a climate that is hotter with more variable precipitation, more moisture stress towards the end of the growing season, and less characteristic winter weather. In addition to conditions becoming less favorable for northern forest species and conditions improving for southern species, the vulnerability assessment finds:

- Soil moisture patterns will change, with drier soil conditions later in the growing season.
- Low-diversity systems are at greater risk.
- Tree species and forest types that are better able tolerate disturbances such as wildfires; floods and pest outbreaks may be favored.”

Rising threats to the health of the UP are extreme weather and changing climate conditions. Record heat in 2012 caused concern first with low Great Lakes levels and high bacteria counts, including closing beaches to swimming for the first time. The very next year, the

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<sup>3</sup> *In Their Own Words: Perceptions of Climate Change Adaptation from the Great Lakes Region's Resource Management Community*, Petersen et al. 2013 (doi:10.1017/S1466046613000446)

<sup>4</sup> *Climate Change in the Great Lakes Region*, GLISA 2014

([http://glisa.umich.edu/media/files/GLISA\\_climate\\_change\\_summary.pdf](http://glisa.umich.edu/media/files/GLISA_climate_change_summary.pdf)). In addition, while not a certainty, evidence strongly indicates that for a number of decades Northern Hemisphere mid latitudes—like the Upper Peninsula—will suffer significant bouts of extreme cold in winter due to the significant reduction in the quantity of Arctic sea ice in the Summer and Fall. *Cold winter extremes in northern continents linked to Arctic sea ice loss*, Tang et al. 2013 (stacks.iop.org/ERL/8/014036); *Robust Arctic sea-ice influence on the frequent Eurasian cold winters in past decades*, Mori et al. 2014 (doi:10.1038/ngeo2277)

<sup>5</sup> *Climate Change Impacts in the United States: The Third National Climate Assessment*, Ch. 18: Midwest, Prior et al. 2014 (doi:10.7930/J0J1012N); *Michigan Forest Ecosystem Vulnerability Assessment and Synthesis: A Report from the Northwoods Climate Change Response Framework Project*, U.S.F.S. General Technical Report NRS-129, Handler et al. 2014; *Forest Ecosystem Vulnerability Assessment and Synthesis for Northern Wisconsin and Western Upper Michigan: A Report from the Northwoods Climate Change Response Framework Project*, U.S.F.S. General Technical Report NRS-136, Janowiak et al. 2014

record cold of the winter of 2013-14 caused millions in damage to water infrastructure and contributed to lakeshore flooding and greatly reduced deer herds the following fall.

To help communities prepare for these new conditions, in the past two years, a series of reports about adapting to climate change have been developed:

- Lake Superior Watershed Climate Change Adaptation Plan - January 2014
- Marquette County Climate Change Adaptation Plan - December 2013
- City of Marquette Climate Change Adaptation Plan - September 2013
- Forest and Water Climate Adaptation: A Plan for Alger County, Michigan - December 2011



**Figure 3: Lake Superior Watershed Climate Change Adaptation Plan - January 2014.**

*Source: Superior Watershed Partnership.*

They document current and anticipated impacts due to climate change. By putting all of this information in one place, some for the first time, communities have tools to better allocate resources. These plans, the Forest Service studies<sup>6</sup> and the Petersen 2013 survey all conclude that protection and conservation of riparian areas is a high priority resource management goal. This current guide is designed to help this work on the Upper Peninsula.

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<sup>6</sup> Also See: *A Practical Approach for Translating Climate Change Adaptation Principles into Forest Management Actions*, Janowiak et al. 2014 (doi:10.5849/jof.13-094)



## **B. Governance—Federal, State, and Local Law and Authority**

Federal, state, and local laws affect conservation and restoration of rivers and other water features directly and indirectly. “Directly” means control over land use and related activities at the local level, such as comprehensive planning, zoning, and subdivision and building permit requirements. These rules apply only after application of, and within the scope of, authority allowed by federal and state law. “Indirectly” means Congressionally enacted natural resource laws such as the federal Clean Water Act, and state laws that mandate local government planning as well as outline the content of resource conservation measures to be addressed in those plans.

A comprehensive list of federal and state laws applicable to Michigan local governments can be found in *Filling the Gaps*<sup>7</sup> (Tables 1.1 and 1.2). Any local government embarking on a program of water resources planning, policymaking, or restoration activities should review this manual for information on what laws and policies apply in different jurisdictions.

### **1. Origins of Township Government – The Key Local Authority**

Township government in Michigan is the result of early federal laws and improvements in transportation that made it easier for people and goods to move from the East Coast to the Great Lakes. Initiated by Thomas Jefferson, the Continental Congress passed the Northwest Ordinances of 1785 and 1787. These laws established a new part of what was to become the United States, the Northwest Territory. Its boundaries were the Great Lakes on the north, the Ohio River to the south and east, and the Mississippi River on the west. Within that region, the primary unit of government would be a township measuring one-mile square. The townships bordering the Great Lakes would deviate from the square sections, depending on the shoreline (Michigan Townships Association). When the Erie Canal opened in 1825, it made it possible to travel by water from Lake Erie to the Hudson River, which flows south, reaching the Atlantic Ocean in New York City. The Great Lakes were now connected to trade with the Atlantic seaboard and Europe. Boats and barges on the river and canal could carry far more goods and people than horse-drawn wagons over land. The Erie Canal brought many settlers from New York to Michigan, who established local governments following New York’s structure, using the Northwest Territory township size.

### **2. Township Types**

The state of Michigan has two different types of townships—general law townships and charter townships. All of the townships are considered to be general law unless they have incorporated as a charter township. Charter townships typically have more powers than general law townships. Townships may want to incorporate as a charter township because it provides more protection against annexation by a city. As of 2011, there are 138 charter townships in Michigan (Michigan Townships Association).

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<sup>7</sup> Ardizzone, Katherine A. and Mark A. Wyckoff, FAICP. *FILLING THE GAPS: Environmental Protection Options for Local Governments*, 2<sup>nd</sup> Edition. Michigan Department of Natural Resources and Environment, Coastal Management Program with financial assistance from the National Oceanic and Atmospheric Administration, authorized by the Coastal Zone Management Act of 1972. December 2010. This document is available at <http://www.watershedcouncil.org/water%20resources/wetlands/wetland-resources/files/document%20the%20filling%20the%20gaps.pdf> and other locations.

### 3. Township Powers

Michigan townships have the power to create and enforce their own ordinances. Many townships commonly use zoning to regulate the use of land. These rules and policies often require that buildings and roads be set back a certain distance from rivers, lakes, and streams. The regulations could also include a buffer requirement, which would prohibit altering the land in its natural condition within a certain distance from a river, lake, or stream.

There are 149 townships in the Upper Peninsula. Out of the 149 townships, 97 (65%) of them have building setback requirements from water and only 49 (33%) have a buffer requirement. The setback requirements range from 10 to 250 feet from the high water mark. The buffer requirements range anywhere from between 15 to 150 feet from the high water mark. Some of the townships have setback and buffer requirements that vary by district, or by the type of water body. If a township has requirements that vary by district, there may be different requirements for each district. If the requirements vary by the type of water body, there may be different requirements for rivers, inland lakes, or Lake Superior and Lake Michigan. The townships that do not have setback or buffer requirements either do not have zoning ordinances or they do not have the requirement within their ordinance.

Some of the townships are governed under county ordinance—which means that all of the townships within that county have the same zoning requirements. The UP townships governed by their county ordinances are in Luce, Schoolcraft and Keweenaw counties. In Delta County, only townships in the eastern half have the same zoning.

In the United States, natural resource management is conducted by different layers of government using laws that have evolved over time since the founding of the nation. In our current federal system, much ultimate authority resides with state governments, which may choose not exercise it. Michigan has a particularly strong history of maximum local control, known as “home rule,” but it has been considerably weakened in recent decades. Nevertheless, while in many states the smallest land use jurisdiction is the county (and incorporated towns and cities), in Michigan the basic unit of authority is still the township. This fractionalized jurisdiction over land and resource management makes riparian and watershed conservation and restoration particularly difficult (**Figure 4**). The consequences of such governance can be seen in the disparate riparian conservation measures across the Upper Peninsula (**Figure 5**).

The Michigan Legislature has imposed natural resource management and land use planning requirements on townships and counties, as well as granted considerable authority to go further than state law requires. Many of these laws were adopted in 1994. Their implication and utility are described in the *Filling the Gaps* report cited above, that:

- Identifies gaps in existing natural resource and environmental protection policy and explains opportunities for local regulation.
- Provides information about planning and zoning tools available to local governments, and how each relates to natural resource management and environmental protection.

- Contains example ordinances.<sup>8</sup>

Comprehensive plans, zoning, subdivision ordinances, and similar provisions are used to regulate the use of land. These regulations can prevent uses that are inconsistent with conservation of riparian and wetland values. Another specific type of land use ordinance are various types of “Watershed Overlays,” such as aerial clearing limitations to ensure that the percentage of a watershed in forest does not drop below a critical level, causing damage to aquatic resources.

Michigan is one of only two states with delegated federal Clean Water Act authority regarding permitting of projects that impact wetlands. In 2008, the U.S. Environmental Protection Agency (EPA) conducted an audit of Michigan’s implementation of its delegated wetlands permitting authority.<sup>9</sup> As a result of that audit, the Legislature created an advisory committee that led to the passage and signature by the governor of significant amendments to Michigan’s wetlands statute in July 2013.<sup>10</sup> The results of that change in state law, along with later rulemaking to implement it, needs to be reviewed prior to conducting projects impacting wetlands.<sup>11</sup>

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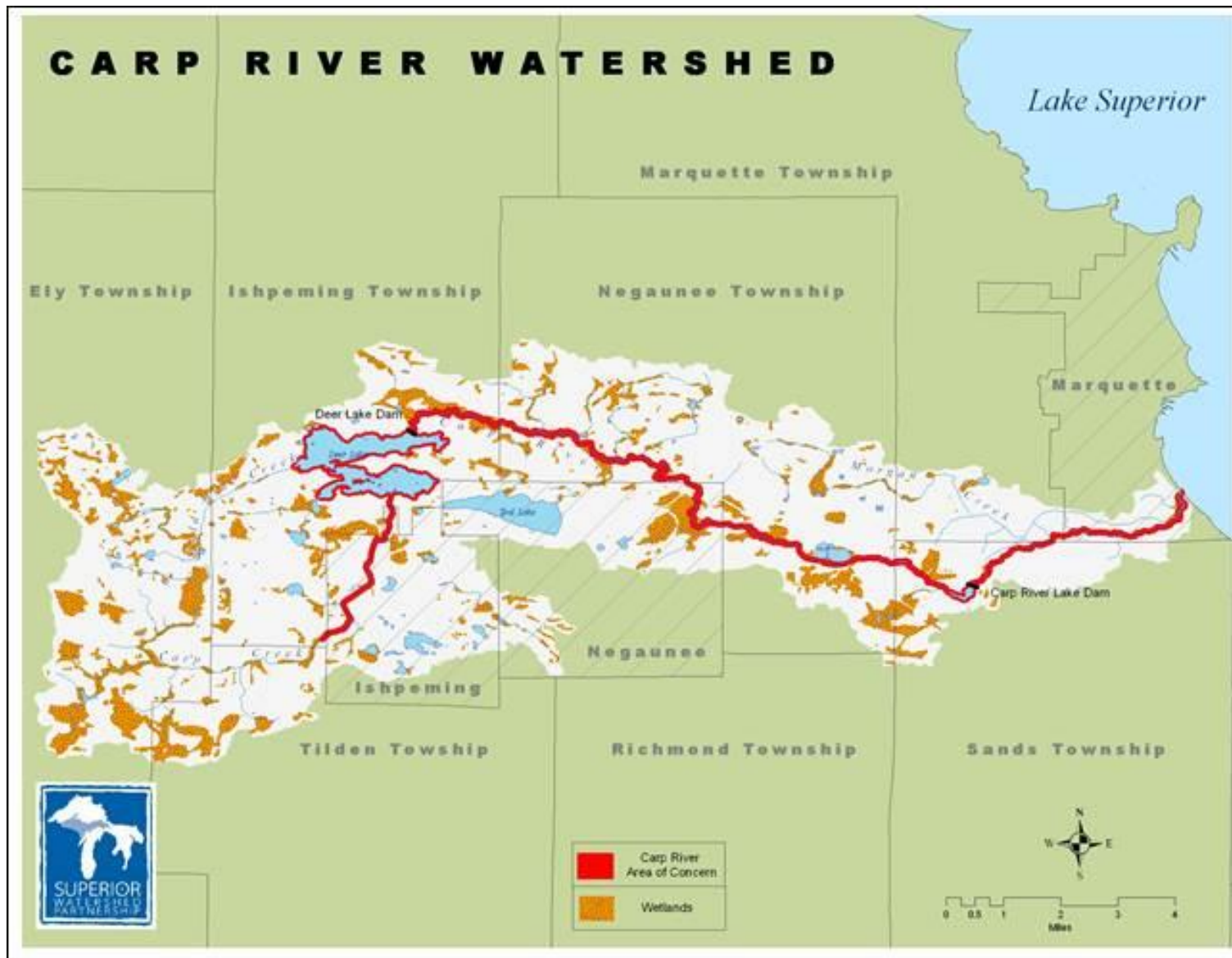
<sup>8</sup> *Filling the Gaps*, Part I, p. 19.

<sup>9</sup> U.S. Environmental Protection Agency, May 2008, *Final Report Results Of The U.S. Environmental Protection Agency Region 5 Review Of Michigan Department Of Environmental Quality’s Section 404 Program*.

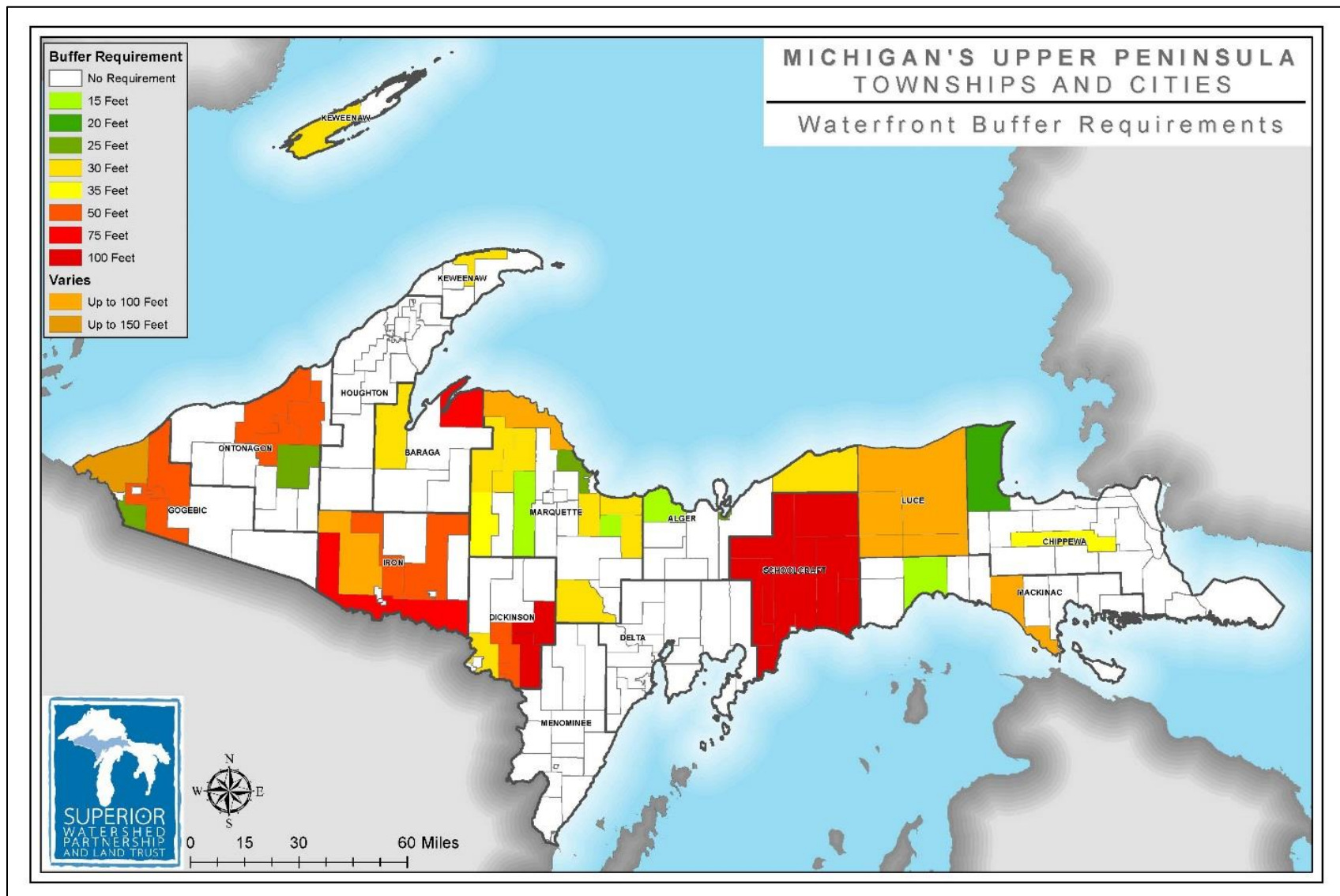
<sup>10</sup> [http://www.michigan.gov/deq/0,4561,7-135-3313\\_3687-229608--,00.html](http://www.michigan.gov/deq/0,4561,7-135-3313_3687-229608--,00.html) (Wetland Advisory Council, final report August 2012; [http://www.michigan.gov/snyder/0,4668,7-277-57577\\_57657-307520--,00.html](http://www.michigan.gov/snyder/0,4668,7-277-57577_57657-307520--,00.html) (“[Governor] Snyder signs wetland protection bill.” July 2, 2013).

<sup>11</sup> As of the date of this document, Michigan’s Department of Environmental Quality does not appear to have updated its guidance for local governments: see [http://www.michigan.gov/deq/0,4561,7-135-3313\\_3687-24312--,00.html](http://www.michigan.gov/deq/0,4561,7-135-3313_3687-24312--,00.html)





**Figure 4: Map showing the Carp River Watershed, Marquette County, Michigan. The Carp River watershed is subject to zoning regulations by three Cities and seven Townships. Source: Superior Watershed Partnership.**



**Figure 5: Michigan's Upper Peninsula: Riparian Buffer Requirements by Township and Incorporated Municipality (Also see Appendix C).**  
*Source: Superior Watershed Partnership.*

## C. Governance—Non-Regulatory Alternatives

Governance is not limited to laws and regulations. It includes any voluntary action that can be taken to impact the use of land and water over time. Beyond typical township planning that is required, local units of government may consider the following to improve their resources.

### 1. *Tax Incentives and Other Financing Options*

Landowners can be offered incentives through the tax code to improve their land management or structures on their property. Under Michigan law, small landowners can get a tax break for managing their forests sustainably: “The purpose of the Qualified Forest Program (QFP) is to encourage private forestland owners to manage their land in an economically viable and environmentally sustainable manner. Landowners receive an exemption from local school operating taxes and/or exemptions from the uncapping of the taxable value of the property in the event of a change in ownership.”<sup>12</sup>

Storm water management tools are in place under federal and state Clean Water Acts. These laws provide for control over run off during rainstorms, to prevent erosion, flooding and pollution and help pay for the planning, building and maintaining of water management measures. As the rain that is not immediately absorbed into the ground or waterbody and snow melt flow over land, it may transport trash, bacteria, heavy metals, and other pollutants from roads, buildings, lawns and agriculture to sewers, streams and eventually the Great Lakes.

Green infrastructure uses vegetation, soils, and natural processes to manage water flows rather than engineering water through pipes and other human-made and maintained controls. The US EPA maintains an extensive website about green infrastructure at [http://water.epa.gov/infrastructure/greeninfrastructure/gi\\_what.cfm](http://water.epa.gov/infrastructure/greeninfrastructure/gi_what.cfm). These tools can be applied by a landowner or by government. They are most effective when applied using the watershed approach considering the flow of water within a specific drainage basin. Local units of government can implement these tools as demonstrations for the community along with encouraging their adoption by residents and businesses.

Best Management Practices (BMPs) are intended to reduce or eliminate the harm to water resources from forest and agriculture practices. The federal government has a variety of programs to support landowners using these BMPs. They range from providing advice and consulting to developing management plans to financing restoration projects. In 2014, the federal Natural Resources Conservation Service consolidated three of its programs – the Wetlands Reserve Program, Grassland Reserve Program and Farm and Ranch Land Protection Program – into the Agricultural Easement Conservation Program.<sup>13</sup> Several Michigan agencies provide similar services, managed separately by department. A listing of these private landowner assistance programs is maintained on Wikipedia (search for Private Landowner

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<sup>12</sup> [http://www.michigan.gov/mdard/0,4610,7-125-1599\\_28740---,00.html](http://www.michigan.gov/mdard/0,4610,7-125-1599_28740---,00.html) Michigan Department of Agriculture and Rural Development.

<sup>13</sup> <http://www.nrcs.usda.gov/wps/portal/nrcs/detail/?cid=stelprdb1242695>



Assistance Programs) and on the federal and state natural resource agency websites.<sup>14</sup> Local units of government can inform their residents and land owners about this program and encourage them to enroll.

## **2. Conservation Easements**

Property owners may donate or sell all or part of the development rights on their land to a land trust or the government, usually in exchange for tax benefits. Conservation easements are often used to protect the riparian values of streams as well as to conserve the forest land base. The Upper Peninsula has one of the largest conservation easements in the U.S., covering almost 400,000 acres of commercial timber land in a number of counties.<sup>15</sup> Successful conservation using conservation easements requires a significant source of funding, such as government agencies, NGOs, and land trusts.

## **3. Ecosystems Services Conservation**

A relatively new mechanism for aquatic resource conservation is payment for ecosystem services, or PES. Ecosystem services are the benefits that users obtain from the natural resources of an area, such as commercial or recreational fishing, clean water for municipal and industrial uses, hunting or other recreation (motorized and non-motorized). As part of its EnviroAtlas suite of mapping tools, the EPA has developed a beta, interactive tool to measure potential ecosystem services by county. It can be accessed at <http://enviroatlas.epa.gov/enviroatlas/atlas.html>

This tool makes sense because it is often cheaper to “buy” the resource to conserve its ecosystem services than to find a replacement if environmental degradation reduces or eliminates the benefits. As ecosystem services become increasingly important, UP communities may wish to explore PES opportunities to increase flows of money into the community to pay for conserving riparian and wetland resources.

## **D. The Watershed Approach**

To be most effective, consider combining regulatory and other approaches within a drainage basin. Because water will flow downhill, geographic boundaries can be drawn following the highest points of land. The result are natural management units that set apart one area of land from another. A watershed is the area of land where all of the water that drains off of it goes into the same place.<sup>16</sup> In other words, a watershed is like a bathtub – the water goes down the sides to one outlet. The health of a river, wetland or lake is determined by more than the water currently within it. The health of a water body is most influenced by what happens on the land around it.

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<sup>14</sup> Michigan Department of Natural Resources Private Forest Land Programs Overview – [www.Michigan.gov/privateforestland](http://www.Michigan.gov/privateforestland). Michigan Department of Natural Resources Wildlife and Habitat Private Lands Programs: [http://www.michigan.gov/dnr/0,1607,7-153-10370\\_36649---,00.html](http://www.michigan.gov/dnr/0,1607,7-153-10370_36649---,00.html). Wikipedia: [http://en.wikipedia.org/wiki/Private\\_landowner\\_assistance\\_program](http://en.wikipedia.org/wiki/Private_landowner_assistance_program)

<sup>15</sup> <http://forestlands.mtu.edu/>

<sup>16</sup> <http://water.epa.gov/type/watersheds/whatis.cfm>

**Riparian** means banks of a river. The riparian zone is the land closest to the water flow. When land is covered by buildings, parking lots, roads or other hard surfaces, rainfall and snow melt cannot be absorbed into the ground. Instead, the water will pick up any contaminants on those surfaces and carry into water bodies. The riparian zone is the last - and most important - line of defense to protect a water body from this contamination.

When riparian land is kept in a more natural state, it serves as a **buffer** that will hold possible contaminations and slow the water down so that it does not erode the stream bank, or add sediment to the stream. Buffers are created to provide high quality drinking water supply, recreation for people, aquatic habitat for plants and animals, and aesthetic value. There are many examples that demonstrate how creating riparian buffers add value to communities.

Assessments of riparian and wetland resources in the Upper Peninsula conclude that there are substantial ongoing risks from both climate change and specific local activities. These risks are summarized in the *Lake Superior Climate Adaptation, Mitigation and Implementation Plan*: “Wetlands and riparian areas are threatened due to inadequate land use planning, zoning, and other policies addressing perched and undersized culverts; sedimentation of spawning gravels; stream channel instability, bank erosion; lack of riparian buffers, railroad crossing failures; run-off from parking areas, highways, dirt roads and ORV trails.”

The June 2010 report, *A GIS-Based Approach to Identifying Environmentally Sensitive Areas in Munising Bay Watershed, Alger County Michigan*, describes the steps to identify a buffer zone and how much land that would cover. This goes beyond the fixed buffer width concept (largely focused on the floodplain), which may not capture all of the diversity and ecosystem function that the riparian areas represent. The land protected is called the “Functional Riparian Zone” and is the area most beneficial to the waterway when it is protected.

Additional objectives of the “*GIS-Based Approach*” project were to identify limitations for development and other land uses based on natural features (soils, slope, etc.) to better inform future land use changes and development. The results of this work can be used by the watershed project, local units of government, state, federal, and tribal agencies, landowners, and the public to increase sustainability and provide for coordinated watershed protection in Alger County.

### **III. Improving Natural Resource Governance on the Upper Peninsula**

The recommendations of this guide are intended to build on those found in the Climate Adaptation plans. This section outlines steps local governments and other community groups can use to improve conservation and restoration of the UP's waters. This process is an adaptive management cycle that can be entered or restarted at any point. Some of the actions may already be partially or largely accomplished in some jurisdictions.

In many places, it makes sense to start with creation of a team made up of employees of relevant local agencies along with representatives of resource management agencies and NGOs working on relevant issues in the area. On the Upper Peninsula, there are excellent resources for both forestry and water resource issues.

Using the watershed as the lens is the most efficient and effective way to manage water issues. As described above, there are many ways to improve natural resource governance, through regulatory actions, outreach and education to residents about incentives and improved partnerships with adjacent units of government within a watershed.

#### **A. Assess the Scope of the Problem**

The first step is to look within your own zoning to find weaknesses in providing needed protections. This assessment will include consideration of land ownership patterns and the history and projected trends of land use and water. Also important is the current governance status: what (if any) measures are already in place to conserve resources, and how well are they working? Who (if anyone) is monitoring and reporting on these various metrics? Specific examples of governance metrics applicable on the Upper Peninsula that need to be considered are included in the appendices.

#### **B. Determine Available Resources and Partners**

It takes time and money to conserve water resources and accomplish restoration projects. It cannot be overemphasized how important the continued involvement of local residents and regional stakeholders is in achieving the goals identified in the assessment. They are essential to ensure the long-term health and sustainability of the UP's natural resources.

Encourage landowners to participate in voluntary programs; this approach can be very effective at lower cost.

General purpose units of local government, such as townships, are often the entities who must make policy and budget decisions needed to implement projects. Local residents, businesses, and NGOs help create a supportive political climate. Natural resource agencies working in your region often can provide knowledge of the specific resources and locations. Having a team that includes numerous community interests and resource stakeholders makes it much more likely that planning will result in proposed actions being implemented. Thus the first step toward success is often the creation of an advisory or planning team.



## C. Evaluate Potential Solutions

In order to make a decision about how to conserve a region's water resources, it is vital to understand the governance and conservation practices already in place. To do this, township officials should review both **Figure 5** above, "*Michigan's Upper Peninsula: Riparian Buffer Requirements by Township and Incorporated Municipality*" and the table found in **Appendix C**, "*Marquette & Alger County Riparian Zoning Requirement (April 2014)*." The **Figure 5** map indicates the waterfront buffer requirements of all Upper Peninsula townships while **Appendix C** lists the current zoning and buffer requirements of each township in Alger and Marquette Counties. Once the current requirements have been identified, the resources previously discussed and those listed in the **Appendices** can be used to determine possible conservation options and the best step forward for the township.

## D. Seek Out and Obtain Funding to Support Selected Activities and Projects

After you have looked at your own local unit of government, consider working with other units of government and/or local landowners and nonprofits within a watershed to identify opportunities of restoration and protection. Most local governments do not have the resources to conduct substantial restoration projects. Combining forces could gather the resources to make larger projects feasible.

There are numerous sources of potential funding to support both one time and ongoing activities, from the U.S. EPA, to state agencies, to numerous foundations and NGOs. The broader the team looking for support, the more likely you will find and obtain needed resources.

## **IV. Conclusion**

The writers of this report have the same goals as you—our intent is to support your desire to improve and maintain the water resources on the Upper Peninsula. If you have questions about any aspect of this document or its guidance, please contact us.

As with all endeavors, the goal of water resource conservation and restoration will be achieved after you take the first step. We encourage you to start today!

# Appendices

## Appendix A: Resources and Definitions

### *How to Implement and Examples of Ideas in the Toolbox Above*

The quantity of resources available about water conservation and restoration is large and can be overwhelming. The following list is intended as a starting point.

#### **1. Ordinance Examples**

- A Guidebook for Community Solar Programs in Michigan Communities, Feb. 2014.  
[http://www.michigan.gov/documents/mdcd/Michigan\\_Community\\_Solar\\_Guidebook\\_437888\\_7.pdf](http://www.michigan.gov/documents/mdcd/Michigan_Community_Solar_Guidebook_437888_7.pdf)
- A Model Riparian Buffer Implement Action Plan, July 2003.  
<http://superiorwatersheds.org/images/riparianbufferreportnew.pdf>
- Chocoday Township Shoreline District. Specialized zoning in coastal areas.  
<http://www.chocoday.org/documents/ordinances/zoningordinance.pdf>
- Community Wind Power: A Guide for Lake Superior Communities, November 2011.  
[http://www.michigan.gov/documents/mpsc/swpcommunitywind\\_394453\\_7.pdf](http://www.michigan.gov/documents/mpsc/swpcommunitywind_394453_7.pdf)
- Michigan Department of Environmental Quality - Wellhead Protection Program. In Michigan, wellhead protection is voluntary and implemented at the local level through the coordination of activities by local, county, regional, and state agencies. This tool could be a model to develop riparian buffers and shoreline districts.  
[http://www.michigan.gov/deq/0,4561,7-135-3313\\_3675\\_3695---,00.html](http://www.michigan.gov/deq/0,4561,7-135-3313_3675_3695---,00.html)
- Model Ordinance for Outdoor And Open Burning: A Guide for Michigan Counties, Cities, Villages and Townships, September 2006.  
[http://www.epa.gov/burnwise/pdfs/mi\\_model\\_ordinance.pdf](http://www.epa.gov/burnwise/pdfs/mi_model_ordinance.pdf)
- MSU Extension two-part article, *With Higher Great Lakes, Review Zoning for Coastal Resiliency*: [Part 1](#) and [Part 2](#).
  - [http://msue.anr.msu.edu/news/with\\_higher\\_great\\_lakes\\_review\\_zoning\\_for\\_coastal\\_resiliency\\_part\\_1;and](http://msue.anr.msu.edu/news/with_higher_great_lakes_review_zoning_for_coastal_resiliency_part_1;and)
  - [http://msue.anr.msu.edu/news/with\\_higher\\_great\\_lakes\\_review\\_zoning\\_for\\_coastal\\_resiliency\\_part\\_2](http://msue.anr.msu.edu/news/with_higher_great_lakes_review_zoning_for_coastal_resiliency_part_2)
- Munising Lake Superior Shoreline District. Specialized zoning in coastal areas.  
<http://www.cityofmunising.org/documents/citydocuments/zoning-ord/zoning-article3.pdf>
- Natural Shoreline Buffers: A UP community that restored natural shoreline.  
[http://msue.anr.msu.edu/news/natural\\_shoreline\\_greeted\\_with\\_enthusiasm\\_by\\_upper\\_peninsula\\_community](http://msue.anr.msu.edu/news/natural_shoreline_greeted_with_enthusiasm_by_upper_peninsula_community)



## 2. *Best Management Practices (BMPs)*

- Evaluating Riparian Management Zones on State Lands, 2004. Manual specifically for state lands provides examples of how to address specific problems.  
<http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0CCAQFjAA&url=http%3A%2F%2Fwww.midnr.com%2Fpublications%2Fpdfs%2Fdivisions%2Fforest%2FForestCertification%2FMyWebsFC%2FDocuments%2FFC-auditRequests%2F6.0FSC%2F6.0G%2FRIPARIANGUIDELINES.doc&ei=LT-zVIP-Go6pyAS104GYBg&usg=AFQjCNGR11MDHN07Rg1qT6QLsGc3vSjC2Q&sig2=oxW7RZThGimQED1jSOIQ1Q&bvm=bv.83339334,d.aWw>
- Guide Book for Rural Best Management Practices. This manual specifically addresses rural water quality, with concrete tasks for local officials.  
[http://www.landpolicy.msu.edu/modules.php?name=Pages&sp\\_id=664](http://www.landpolicy.msu.edu/modules.php?name=Pages&sp_id=664)
- Michigan nonpoint source program. See December 2012 Nonpoint Source Plan.  
[http://www.michigan.gov/deq/0,1607,7-135-3313\\_3682\\_3714---,00.html](http://www.michigan.gov/deq/0,1607,7-135-3313_3682_3714---,00.html)
- MSU Extension, "Sustainable Soil and Water Quality Practices on Forested Land."  
[http://www.michigan.gov/documents/dnr/Chapters9-12-IC4011\\_269906\\_7.pdf](http://www.michigan.gov/documents/dnr/Chapters9-12-IC4011_269906_7.pdf)
- Northern Institute of Applied Climate Science maintains a website with many resources at Forest Adaptation Resources: Climate Change Tools and Approaches for Land Managers. <http://forestadaptation.org/framework-components/forest-adaptation-resources>

## 3. *Watershed Approach*

- Clean Water Myths and Facts. <http://www.americanrivers.org/assets/pdfs/clean-water-/myths-and-facts-about-clean-water-protections.pdf?422fcb&3325e9>
- Green infrastructure and low impact development resources for Michigan.  
<http://www.semcog.org/LowImpactDevelopment.aspx>
- Guide to planning for stronger rains and thunderstorms.  
[http://msue.anr.msu.edu/news/local\\_government\\_and\\_climate\\_change\\_planning\\_for\\_rainfall\\_intensification\\_i](http://msue.anr.msu.edu/news/local_government_and_climate_change_planning_for_rainfall_intensification_i)
- PowerPoint from webcast about incorporating wetlands into watershed plans. It uses Michigan as an example and case study.  
<http://water.epa.gov/learn/training/wacademy/upload/wetlands-supplement-09172013-slides.pdf>
- Riparian Zone Management and Trout Streams: 21<sup>st</sup> Century and Beyond, Michigan Department of Natural Resources, Fisheries Division, 2003.  
[https://www.michigan.gov/documents/RiparianZoneMgmt-TroutStreams\\_64164\\_7.pdf](https://www.michigan.gov/documents/RiparianZoneMgmt-TroutStreams_64164_7.pdf)
- Summary of the EPA's Handbook to Developing Watershed Plans including a lot of basic watershed planning information.  
[http://water.epa.gov/polwaste/nps/upload/watershed\\_mgmnt\\_quick\\_guide.pdf](http://water.epa.gov/polwaste/nps/upload/watershed_mgmnt_quick_guide.pdf)

- Superior Watershed – Plans and Publications. Web site includes links to watershed management, pollution prevention, climate adaptation, water quality plans and publications written by SWP. <http://superiorwatersheds.org/publications/swp-plans>
- Useful listing of riparian and zoning terms:
  - [http://msue.anr.msu.edu/news/modifying\\_your\\_shoreline\\_property\\_check\\_local\\_regulations\\_first\\_part\\_1](http://msue.anr.msu.edu/news/modifying_your_shoreline_property_check_local_regulations_first_part_1); and
  - [http://msue.anr.msu.edu/news/modifying\\_your\\_shoreline\\_property\\_check\\_local\\_regulations\\_first\\_part\\_2](http://msue.anr.msu.edu/news/modifying_your_shoreline_property_check_local_regulations_first_part_2)

#### 4. Other Resources

- Article on rural place making as a way to conserve rivers and streams. [http://msue.anr.msu.edu/news/is\\_there\\_such\\_a\\_thing\\_as\\_rural\\_placemaking](http://msue.anr.msu.edu/news/is_there_such_a_thing_as_rural_placemaking)
- Better Design for Development in Michigan: Putting Conservation in Local Land Use Regulations. <http://lu.msue.msu.edu/pamphlet/Econ/BetterDesignsBrochure.pdf>
- Field Guide for Maintaining Rural Roadside Ditches: Protecting Lakes and Streams through Proper Ditch Maintenance. By Fortin Consulting, Inc.; University of Minnesota Sea Grant Program; and the Natural Resources Research Institute, University of Minnesota Duluth. <http://www.seagrant.umn.edu/downloads/SH14.pdf>
- Two part article on smart growth on a rural scale:
  - [http://msue.anr.msu.edu/news/rural\\_smart\\_growth\\_to\\_reinforce\\_regional\\_placemaking\\_part\\_1](http://msue.anr.msu.edu/news/rural_smart_growth_to_reinforce_regional_placemaking_part_1)
  - [http://msue.anr.msu.edu/news/rural\\_smart\\_growth\\_to\\_reinforce\\_regional\\_placemaking\\_part\\_2](http://msue.anr.msu.edu/news/rural_smart_growth_to_reinforce_regional_placemaking_part_2)

#### 5. Conservation Districts

- Additional Upper Peninsula Conservation District Resources. Delta County and Menominee County Conservation Districts have both developed climate adaptation plan - Delta in 2012 and Menominee in 2014.
  - [http://www.mfpp.org/wp-content/uploads/2013/04/Delta-County-MI-Forest-Water-Climate-Adaptation-Plan\\_2012.pdf](http://www.mfpp.org/wp-content/uploads/2013/04/Delta-County-MI-Forest-Water-Climate-Adaptation-Plan_2012.pdf); and
  - <http://www.menomineecd.com/climate-resilience.html>
- Michigan Association of Conservation Districts. <http://macd.org/>
  - Local County Conservation Districts. <http://macd.org/local-districts.html>

## Appendix B: Case Studies in Marquette & Alger Counties

### Alger County Case Study

Alger County, home to over 9,000 people, has eighty miles of Lake Superior shoreline and is located on the southern edge of the lake in the central Upper Peninsula of Michigan.

#### ***Planning Actions***

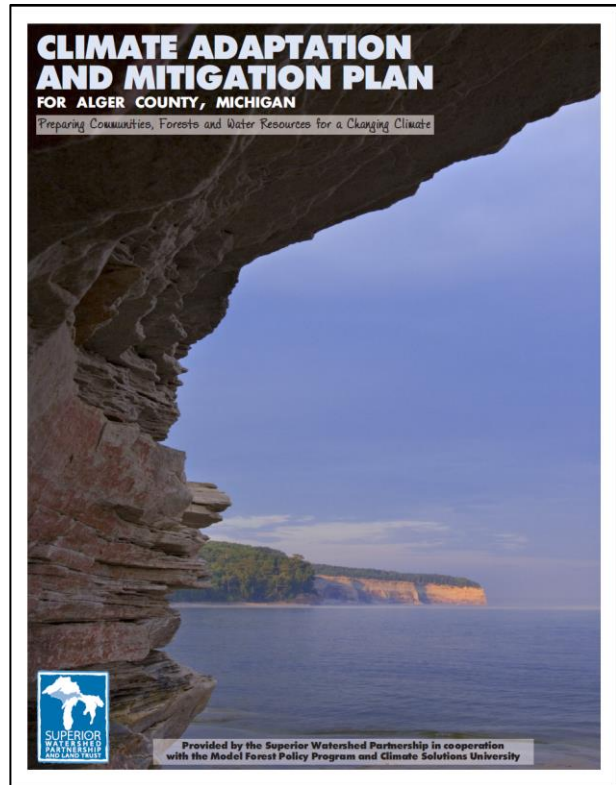
The Superior Watershed Partnership (SWP), in partnership with the Model Forest Policy Program's Climate Solutions University: Forest and Water Strategies (CSU) began working on a climate change adaptation plan for Alger County in Michigan's Upper Peninsula in March 2011

([http://superiorwatersheds.org/admin/wp-content/uploads/2014/06/Alger-County-Climate-Adaptation-Plan\\_March-2013.pdf](http://superiorwatersheds.org/admin/wp-content/uploads/2014/06/Alger-County-Climate-Adaptation-Plan_March-2013.pdf)).

The SWP, a regional leader in freshwater protection, participated in CSU's rigorous course work, gathered and assessed a variety of data, and solicited the help of other regional experts to create a climate adaptation plan for Alger County.

With over a half of million forested acres and a public land to private land ratio of one to one, Alger County is an area whose economic sustainability relies almost solely on the stewardship of its land and water. Significant decline in water or forest quality will impact more than 20 percent of its labor force. As an area that is reliant on these resources, the decline of its natural resource health would prove catastrophic, causing a significant decline to the quality of life for all of its residents - plant, animal, and human - and serve as a large drain on the Upper Peninsula region, the Lake Superior watershed, and the State of Michigan. There is already early evidence of tree species migration. Already endangered species such as the Piping Plover, a migratory bird that nests along the shores of Alger County, will struggle to keep its nesting habitat intact as Lake Superior's turbidity and wave action increases. Globally, the issue of freshwater quality, water rights and ownership will continue to be one of the largest issues of our time. Climate change only increases the urgency and severity of water issues. Alternative energy and fuel continues to drive geo-political policymaking and several emerging markets.

During 2011, SWP and the supporting team conducted an in-depth assessment of the risks and opportunities related to climate change impacts to forest, water and economics of the community. A series of goals and objectives were identified to address the high priority risks and opportunities identified by the community. For each objective, strategies and tasks were



designed to bring climate resilience to the region. A summary of the goals and objectives is provided below.

***Goal # 1: Keep Alger County forests ecologically and economically viable.***

- Objective 1.1: Promote sustainable, climate ready infrastructure to support the local forest products industry. (Promote local forest products industry).
- Objective 1.2: Promote use of locally and sustainably produced forest byproducts.
- Objective 1.3: Encourage forest products industry to plan for changes through development of new methods and products.
- Objective 1.4: Maintain an ecologically healthy and sustainable forest for public enjoyment and wildlife.

***Goal # 2: Promote public education and awareness of effects of climate change.***

- Objective 2.1: Increase resident knowledge and awareness of climate change on the local ecosystems, economy and human wellbeing.
- Objective 2.2: Create synergy between climate adaptation and mitigation increasing resident knowledge and awareness of their personal carbon footprints and move them to take personal responsibility for their reducing own carbon footprints.
- Objective 2.3: Move residents to become citizen stewards who reach out to friends to carry their messages.

***Goal # 3: Support the ecological integrity of Alger County watersheds.***

- Objective 3.1: Use the Munising Bay Watershed Plan (MBWP) as a model for Great Lakes Protection.
- Objective 3.2: Establish and implement a shoreline protection plan for Alger County.
- Objective 3.3: Develop a State of Michigan approved watershed management plan for priority watersheds in Alger County.

***Goal # 4: Identify and promote public awareness of climate – related public health and safety issues through risk assessment and risk management.***

- Objective 4.1: Increase public awareness of health related issues associated with climate change.
- Objective 4.2: Increase public awareness of human safety related issues associated with climate change.
- Objective 4.3: Provide assistance to city, county, and regional planners/officials regarding severe storm event forecasting and adaptation.

***Goal # 5: Identify and capitalize on economic opportunities presented by a changing climate.***

- Objective 5.1: Identify economic opportunities related to tourism industry in Alger County.
- Objective 5.2: Identify economic opportunities related to nontourism businesses in Alger County.
- Objective 5.3: Identify economic challenges, opportunities and other climate change adaptation issues faced by local municipalities and policy makers.



## Implementation Actions

Alger County has eighty miles of Lake Superior shoreline and 47 subwatersheds in two Great Lakes Basins (Southeastern Lake Superior and Northeastern Lake Michigan). The Munising Bay Watershed (Hydrologic Unit 04020201 Betsy-Chocolay) lies within the Lake Superior basin of Michigan's Upper Peninsula in Alger County and encompasses 36,296 acres (56.7 square miles). The Munising Bay watershed refers to all the land area that drains into the Lake Superior waters of Munising Bay including the Anna River which constitutes the largest stream system in the watershed (draining about 20 square miles). The National Fish Habitat Action Plan for Lake Superior identifies the Anna River as a priority watershed. The Anna River is part of the Munising Bay Watershed Management Plan (Davis 2002), which is the only state-approved watershed plan in Alger County.

Historic and present-day land use practices have impacted critical fisheries habitats in Munising Bay Watershed and other areas of Alger County. Problems include perched and undersized culverts; sedimentation of spawning gravels; stream channel instability, bank erosion; lack of riparian buffers, railroad crossing failures; run-off from parking areas, highways, dirt roads and ORV trails. For the last five years the Munising Bay Watershed Restoration Project has been implementing structural best management practices at priority sites. Projects, implemented by the Alger Conservation District and new priority sites identified since the approval of the Munising Bay Watershed Management Plan, include:

PRIORITY AREA (Identified in Watershed Plan)	IMPLEMENTED	FUNDING SOURCE	PRIORITIZED FOR FUTURE IMPLEMENTATION
Anna River	South Branch Culvert Replacement	CMI	North Br. Culvert
	Cox Pond Culvert Replacement	CMI	River Cleanup
	Purple Loosestrife Control	NFWF	Sediment Removal
			Velocity Rocks
			Spawning Gravel
			Riparian Buffer
			Bank Stabilization
			Kimberly Clark Erosion
			Cromell Bridge
			Snowmobile/ ATV crossing
			Impervious Surfaces
City of Munising	St. Martin's Hill Stormwater/ Sediment Reduction	CMI, GLBP SESC	
Hansen Creek	Carr Rd. Culvert Replacement	CMI	Jurmu Road Riprap
Gangeau Creek	Ridge Rd. Culvert Replacement	CMI	
	Christmas motorsports park	CMI	
Furnace Creek	Furnace Lake Outlet Replacement	CMI	Sea Lamprey Barrier
<b>Acronyms:</b> CMI: Clean Michigan Initiative GLBP: Great Lakes Basin Program SESC: Soil Erosion & Sedimentation Control			

<b>PRIORITY AREA (Not Identified in Original Watershed Plan)</b>	<b>IMPLEMENTED</b>	<b>FUNDING SOURCE</b>	<b>PRIORITIZED FOR FUTURE IMPLEMENTATION</b>
Cemetery Hill	Reconstruct drainage	ARA/BIA	Cemetery runoff
Joes Creek (Anna River Tributary)	Brook Street Stormwater Catch Basins	CMI/CITY	Instream Habitat Improvements
City of Munising		SAW	Stormwater Asset Mgmt/inventory
Munising Bay	Functional Riparian Zone study	NFWF	
	Landscape level functional wetlands assessment	NFWF	
Slapneck Creek	Jarvinen Road Culvert Replacement and Stormwater Improvements	NFWF	
AuTrain River	U.S. Army Corps of Engineers Study of River Mouth	USACE	Severe erosion of River Mouth; Freezing and Flooding of upstream residents
Whitefish and Laughing Whitefish Watersheds	Inventory of Fish Passage Barriers at 60 Road Stream Crossings. Results indicate seven complete barriers, 12 crossings where some species and/or life stages cannot swim upstream at most stream flows, and 17 that are barriers at high flows	NFWF	Fish habitat improvements, barrier removal, sediment control
<b>Acronyms:</b> ARA/BIA: American Recovery Act/ Bureau of Indian Affairs CMI/CITY: Clean Michigan Initiative and City of Munising SAW: Stormwater, Asset Management and Waste Water Program for Michigan NFWF: National Fish & Wildlife Foundation USACE: US Army Corps of Engineers			

As a part of the implemented actions listed above, the Superior Watershed Partnership (SWP) conducted a GIS based study of the Functional Riparian Zone (FRZ) for Munising Bay Watershed using methods developed by the SWP and The Nature Conservancy (TNC) for the Two Hearted River Watershed in Luce County (SWP 2008). The purpose of this study was to identify environmentally sensitive areas or portions of the watershed that are most sensitive to environmental degradation and those areas having the most potential to impact surface water quality and designated watershed uses. They include areas that may contribute the greatest amount of non-point source pollutants to the watershed, either now or in the future, and where preservation and restoration efforts will have the most profound results.

Riparian areas have been defined in various ways ranging from a static area extending a fixed distance from a river to a more dynamic and variable width area defined by the ecosystem functions it performs in that particular system. For the purpose of this analysis, a definition closer to the latter example was adopted. As outlined by Ilhardt, Verry,

and Palik (2000), *"Riparian areas are the three-dimensional ecotones of interaction that include terrestrial and aquatic ecosystems that extend down into the groundwater, up above the canopy, outward across the floodplain, up the near-slopes that drain to the water, laterally into the terrestrial ecosystem, and along the water course at a variable width"* (TNC 2007).

Riparian areas are extremely important since they play many different roles both at a local scale (i.e. neighboring aquatic and terrestrial ecosystems) and at a watershed scale. From the aquatic ecosystem perspective, the riparian area provides energy to the system by filtering sediments and absorbing nutrients from the uplands. These services help maintain key aquatic ecosystem functions such as temperature regulation, energy flow, and hydrologic flow (Flaspohler et al. 2002). Riparian areas also provide the vital connection from the aquatic habitat to the upland habitats.

At the watershed scale, riparian areas contain distinct species pools (Sabo, 2005) and support habitat for diverse vegetation and increased species richness due to the diversity of the fluvial landforms (i.e. floodplain, terrace, slope, etc.) (Goebel et al. 2003). When this land is kept in a more natural state, it serves as a **buffer** that will hold possible contaminations and slow the water down so that it does not erode the stream bank, or add sediment to the stream. Buffers are created to provide high quality drinking water supply, recreation for people, aquatic habitat for plants and animals, and aesthetic value. There are many examples that demonstrate how creating riparian buffers add value to communities.

The objectives of the Munising Bay Functional Riparian Zone Study were to:

- Assess natural community condition by conducting a Geographic Information System (GIS) analysis that establishes the Functional Riparian Zone (FRZ) of tributaries to the Munising Bay Watershed based on physical land features (soils, slope, etc.)
- Identify potential critical habitat and areas sensitive to environmental degradation
- Identify limitations for development and other land uses
- Provide the data from this analysis to the Alger County Conservation District for use in the watershed project and distribution to interested parties

Results of the Functional Riparian Zone (FRZ) study indicated that a minimum 50 foot buffer from surface waters would include only 889 acres (8%) of the FRZ (10,300 acres) and a 400 foot buffer would include 3,189 (31%) of the total FRZ area. The remaining 7,136 acres (70%) of land included in the FRZ was greater than 400 feet away from surface waters. In the GIS analysis, all areas within 50 feet of surface waters were not automatically included in the FRZ, however a minimum 50-100 foot buffer (based on site conditions) is recommended for these areas.

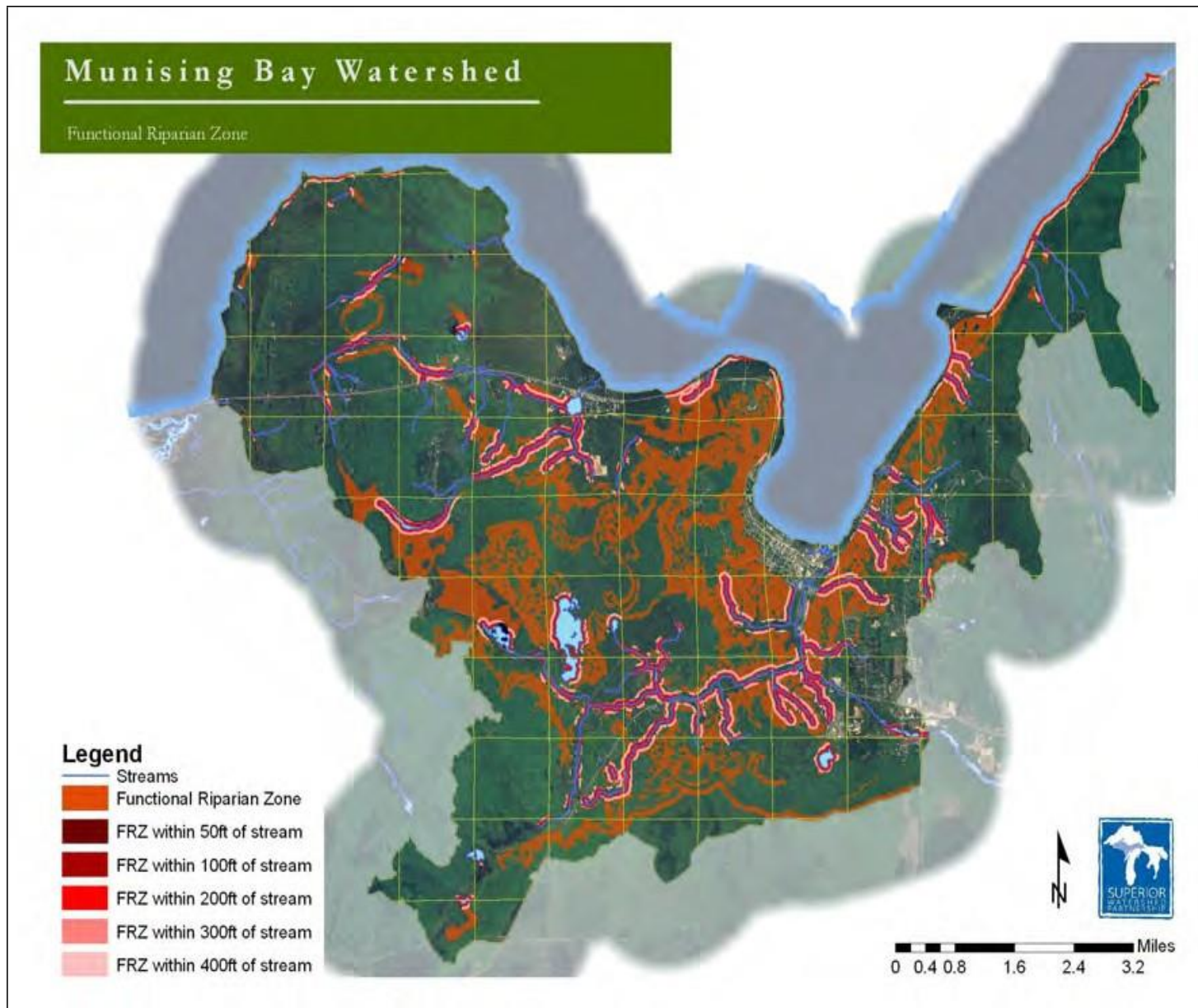


Figure 6: Map showing Munising Bay Watershed. Source: Superior Watershed Partnership.



Recommended management practices for protecting Munising Bay's FRZ include:

- Plan developments, forestry activities and other land disturbing activities based on natural features and site specific limitations
- Implement coordinated zoning across political boundaries (minimum setbacks (buffers), minimum lot sizes, overlay districts, etc.)
- Offer economic incentives to landowners for maintaining buffers
- Encourage the use of conservation easements
- Protect or establish native shrubs, trees, or other vegetation along lakes and streams to help prevent bank erosion, trap sediment and filter other pollutants
- Manage livestock grazing to avoid damage to existing plants
- Avoid mowing or cutting to the water's edge
- Avoid activities that cause soil compaction
- Promote preservation of native long-lived larger trees

The SWP also assisted the Alger Conservation District in developing a wetland component for the Munising Bay watershed plan by: 1) Compiling wetland information on a watershed basis; 2) Creating an inventory of existing wetlands and potential wetland restoration sites within the watershed using wetland related GIS data layers; 3) Conducting a Landscape Level Wetland Functional Assessment (LLWFA) using U.S. Fish and Wildlife Service methodologies to inventory and analyze wetlands and their functions; 4) Developing a wetland restoration strategy, and 5) Developing a wetland protection/preservation strategy. Using the analysis, the District will assess local wetland protection capacity and identify wetland partners and roles, define wetland goals and objectives for the watershed, screen "priority" wetlands for further assessment and field evaluation, and coordinate implementation of wetland elements.

The results of this work can be used by the watershed project, local units of government, state, federal, and tribal agencies, landowners, and the public to increase sustainability and provide for coordinated watershed protection and climate resiliency in Alger County.

### **References:**

*Flaspohler, David J. et al. 2002. Temporal patterns in aquatic and avian communities following selective logging in the Upper Great Lakes Region. Forest Science 48 (2). pp. 339-349.*

*Goebel, P. Charles, Brian J. Palik & Kurt S. Pregitzer. 2003. Plant diversity contributions of riparian areas in watersheds of the northern Lake States, USA. Ecological Applications, 13(6). pp 1595-1609.*

*Ilhardt, Bonnie L., Elon S. Verry, and Brian J. Palik. 2000. Defining Riparian Areas. In the Forestry in the Riparian Zone Conference Proceedings. (pp. 7 – 14).*

*The Nature Conservancy in Michigan. 2007. Two Hearted River Riparian Analysis. 100 pages.*

*Sabo, John L., et al. 2005. Riparian zones increase regional species richness by harboring different, not more, species. Ecology, 86(1). pp 56 – 62.*

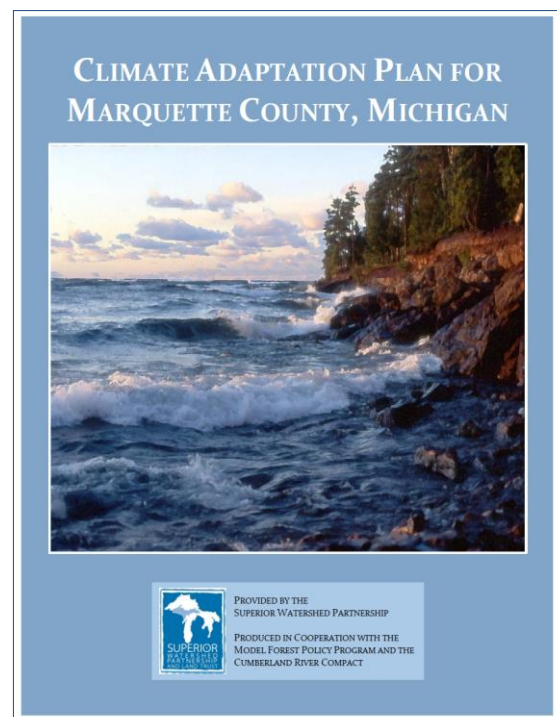
## Marquette County Case Study

Marquette County is one of the largest counties in Michigan with a total area of 3,425 square miles. It is the largest population center in Upper Peninsula Michigan, home to roughly 67,000 people living on the south shore of Lake Superior and inland. County residents depend on a healthy functioning lake ecosystem to sustain livelihoods and maintain a high quality of life. Climate change threatens this quality of life. Following warm, dry years with little snow and lower lake levels, record cold in the 2013-14 winter made snow sports dangerous and the ice delayed Great Lakes shipping, burst pipes and impacted summer tourism. This immediate economic need is the draw for engaging stakeholders in a collaborative visioning and planning activity that will have long term effects on UP communities' capacity to address water management issues and related climate change impacts.

### ***Planning Actions***

In 2012, the Superior Watershed Partnership worked with Climate Solutions University (CSU) (Forest and Water Strategies Program) to produce an adaptation plan that addresses local climate risks while integrating local conditions and culture.

Following public meetings, research and feedback from a variety of stakeholders, the Climate Adaptation Plan for Marquette County was released in December 2013. The report contains analysis of the impacts of climate change on Marquette County's economics, vulnerable populations and environment, particularly its forests and water resources. A series of goals and objectives were identified to address the high priority risks and opportunities identified by the community. For each objective, strategies and tasks were designed to bring climate resilience to the region. A summary of the goals and objectives is provided below.



### ***Goal #1: Assist communities to create water resource resiliency with infrastructure and built environment.***

Objective 1.1: Revise conservation subdivision regulations to create incentives for developers to provide greater densities and community services, while achieving open space conservation.

Objective 1.2: Protect critical watershed features with enhanced land use including planning, zoning, acquisitions and easements especially river corridors and floodplains to preserve vegetation, retain hydraulic features, and ecological services.

Objective 1.3: Promote green storm water management.

Objective 1.4: Adopt shoreline adaptation measures for habitat and infrastructure protection.

***Goal #2: Develop a food security plan and work to increase local food production by working with farmers, protecting soils, and encouraging markets.***

Objective 2.1: Strengthen the relationship between Marquette, the Michigan Food Policy Council, and the Marquette Food Co - op' s regional food hub program.

Objective 2.2: Identify areas within the county that could be used for additional market places and space for community gardens.

***Goal #3: Increase public awareness of health related issues associated with climate change.***

Objective 3.1: Increase and expand current beach monitoring activities to detect pathogens that affect human health.

Objective 3.2: Prepare and implement emergency response plans for extreme storms, floods, heat, disease or poor air quality periods.

***Goal #4: Maintain forest ecosystem integrity, overall health, and resilience.***

Objective 4.1: Determine County forest land holder's risk and vulnerabilities associated with infestations due to climate change.

Objective 4.2: Adopt a County - wide urban canopy goal of a minimum of 40% and implement a program that monitors documented resiliency values delivered by a diverse, healthy urban tree canopy such as heat island effect and air quality.

Objective 4.3: Implement a Marquette County Purchase of Development Rights (PDR) program to secure lands from development.

***Goal #5: Strengthen the county's main economic bases by helping communities minimize negative impacts on the industries while taking advantages of positive opportunities.***

Objective 5.1: Engage economic development organizations and tourism - dependent business in developing an economic development plan specific to tourism with specific goals to help local business minimize economic loss and take advantage of increased tourism opportunities.

Objective 5.2: Invest in optimal harbor improvement/adaptations to maintain access to water resources.

Objective 5.3: Strengthen connectivity between coastal and non - coastal recreational areas to improve resiliency of tourism.

## ***Implementation Actions***

Marquette County encompasses 22 sub-watersheds with the majority of those flowing northward into Lake Superior; some rivers and streams flow south into Lake Michigan. Altogether there are approximately 4,000 miles of streams and more than 1,900 inland lakes in the County, most lying within a forested landscape. In addition, Lake Superior constitutes 70 miles of the northern border of the County. There are 4 State of Michigan/U.S. Environmental Protection Agency-approved Watershed Management Plans in Marquette County (Chocoley River, Lower Dead River, Whetstone Brook/Orianna Creek, and the Salmon Trout River).

Watersheds are extremely complex systems possessing multiple indicators of ecological health, stability and well-being. In such complex systems, the removal of one component has potential to cause cascading damage throughout the ecosystem. In any landscape, but perhaps more dramatically in a forested landscape, vegetated areas adjacent to a stream or lake (riparian zones) are particularly vital for maintaining a variety of ecosystem functions. These include, for example, flood control, groundwater recharge, filtration of runoff to protect water quality, wildlife habitat, a source of large woody material for aquatic habitat in streams, and connective habitat corridors.

Climate change makes it all the more imperative that a landscape perspective is adopted when designing adaptive strategies to protect water resources of the County from the effects of climate change. Adaptations need to rectify shortcomings currently present on the landscape that fail to protect water bodies from pollution as well as proactively “climate-proof” existing riparian zones against possible impacts of climate change (such as the previously discussed shifts in vegetation composition, effects of drought, fire, etc.). In general, the more robust and diverse a riparian ecosystem, the better it can adapt to the changes brought about by a warming climate.

Since the completion of the Climate Adaptation Plan for Marquette County in 2013, the following actions (listed below) have been implemented. Many of these actions also support implementation of recommendations of the individual Watershed Management Plans.

- In 2013, a Climate Adaptation Task Force (CATF) (<http://superiorwatersheds.org/catf.html>) was formed to help prepare local leaders and the general public to think proactively about the effects of climate change and to develop strategies that will make the Upper Peninsula more resilient and effective when dealing with the consequences of climate change.
- The SWP worked with a private land for a voluntary Great Lakes coastal wetland and shoreline restoration project along the Lake Superior shoreline in the City of Marquette. The 15 acre project will be constructed during the 2015 field season and includes a conservation easement on the restoration areas. The SWP will enter into a stewardship agreement with the landowner to manage and protect the property in perpetuity.



- The SWP, its Great Lakes Conservation Corps, and community volunteers completed shoreline restoration (dune grass plantings and invasive species removal) and improved public access along 10 miles of shoreline in the City of Marquette.
- The SWP continued to work on final design and permitting for a ~1 acre coastal wetland project in cooperation with the City of Marquette (Funding from the U.S. EPA Great Lakes Restoration Initiative). The project will be constructed during May 2015 and will reduce bacteria and other pollutants to Lake Superior at public beaches by using native wetland vegetation to bio-remediate bacteria and pollutants before they reach Lake Superior.
- The SWP continued to implement in-stream habitat improvements and sediment control at priority sites in the Salmon Trout River Watershed. The Salmon Trout River is home to one of the last naturally reproducing Coaster brook trout populations on the south shore of Lake Superior. Additional work included monitoring of a newly constructed copper and nickel mine in the headwaters of this watershed including considerations of potential long term climate impacts from mining activities.
- The SWP increased public awareness and engaged local citizens in Great Lakes water quality and habitat issues through information workshops, opportunities for hands-on restoration work through community volunteer events, and local media stories.

## Appendix C: Marquette & Alger County Riparian Zoning Requirement (April 2014)

COUNTY	TOWNSHIP	SETBACK REQUIRED (FEET)	BUFFER REQUIRED (FEET)
Alger	Au Train	50	0
Alger	Burt	75	30
Alger	City of Munising <sup>1</sup>	75	25
Alger	Grand Island <sup>1</sup>	50	0
Alger	Limestone	0	0
Alger	Mathias	50	0
Alger	Munising Township <sup>1</sup>	50	0
Alger	Onota <sup>1</sup>	50	15
Alger	Rock River	75	0
Marquette	Champion	75	30
Marquette	Chocolay	100	30
Marquette	City of Ishpeming <sup>1</sup>	0	0
Marquette	City of Marquette	0	0
Marquette	City of Negaunee	50 <sup>A</sup>	0
Marquette	Ely	50	15
Marquette	Ewing	0 <sup>3</sup>	0
Marquette	Forsyth	1	0
Marquette	Humboldt <sup>1</sup>	1	0
Marquette	Ishpeming	0	0
Marquette	Marquette	75	25
Marquette	Michigamme	50	30
Marquette	Negaunee	50	0
Marquette	Powell <sup>2</sup>	50 <sup>B</sup>	50
Marquette	Republic <sup>1</sup>	1	35
Marquette	Richmond	0	0
Marquette	Sands <sup>1</sup>	100	30
Marquette	Skandia	100	30
Marquette	Tilden <sup>1</sup>	0	0
Marquette	Turin	0 <sup>3</sup>	0
Marquette	Wells	75	30
Marquette	West Branch	50	15

1. Planning documents completed by Central Upper Peninsula Planning and Development (CUPPAD).  
<http://www.cuppad.org/RecentProjects.html>.

2. Projects currently being completed by Central Upper Peninsula Planning and Development (CUPPAD).  
<http://www.cuppad.org/CurrentProjects.html>.

<sup>A</sup> Teal Lake Overlay District.

<sup>B</sup> Environmental Protection Strip of 100 feet will be maintained along the following rivers: Yellow Dog, Big Garlic, Little Garlic, Alder, Wilson, Salmon Trout (Main Branch), Salmon Trout (East Branch), Salmon Trout. Environmental Protection Strip of 50 feet will be maintained along all other permanent bodies of water.

