



A Framework For

Natural Resources

In Northwest Michigan



**FRAMEWORK
FOR OUR FUTURE**
A REGIONAL PROSPERITY PLAN
FOR NORTHWEST LOWER MICHIGAN

**MICHIGAN PROSPERITY REGION 2
NATURAL RESOURCES CHAPTER: 2015**

A *Framework for Natural Resources in Northwest Michigan* was prepared as part of the *Framework for Our Future: A Regional Prosperity Plan for Northwest Michigan*, a regional resource for local governments, community organizations working to meet local goals. The *Framework* was developed as part of Michigan’s Regional Prosperity Initiative, as initiated by Governor Rick Snyder and signed into law as a part of the FY 2014 budget. The Regional Prosperity Initiative encourages local private, public, and non-profit partners to identify regionally aligned growth and investment strategies for the State of Michigan to support, not the other way around. It also provides the framework for streamlining state services and highlighting the regionally defined goals and strategies that will further Northwest Michigan’s success.

The *Framework for Our Future* includes information and tools that can help stakeholders address issues such as housing, transportation, land use, energy, arts and culture, workforce and economic development, community health, food and farming systems, and natural resources. Data and information will help communities supplement their local deliberation, planning, and decision-making processes, and will help

to identify the steps a community can take to address a local issue, if desired.

The *Framework for Our Future* was developed by Networks Northwest with input and partnerships from a variety of community stakeholders and members of the public. An intensive community outreach process featured a wide variety of opportunities for participation from the public: events, surveys, focus groups, online forums, and public discussions were held region-wide throughout the process. Outreach activities and engagement opportunities included a series of community dialogues, interviews, and other events designed to obtain input from individuals with disabilities, minorities, youth, those in poverty, and others that have historically been underrepresented in planning processes. Public input was used to identify priority community issues and concerns, and to help develop goals, strategies, and actions.

The goals, strategies, and actions included in the *Framework* were built upon public input heard throughout the process, as well as on existing and adopted goals from local plans and planning initiatives. Strategies are not intended as recommendations, nor do

they supersede and local government decision-making. Moreover, the *Framework* is not intended for, nor shall it be used for, infringing upon or the taking of personal property rights enjoyed by the residents of Northwest Michigan. Rather, the information included in the *Framework* is instead intended to serve as a compilation of best practices to help guide local decision-makers who would like to address the issues identified in the *Framework*.



FRAMEWORK FOR OUR FUTURE

A REGIONAL PROSPERITY PLAN
FOR NORTHWEST LOWER MICHIGAN



Networks Northwest

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➔ A Framework for Natural Resources: Introduction

Northwest Michigan contains some of North America's finest and most valuable natural resources. The region boasts vast forests, hundreds of miles of Great Lakes shoreline, hundreds of inland lakes, and miles of pristine rivers. In addition to providing important habitat for countless plant and animal species, these resources are also a key element of its residents' quality of life. Clean air, water, and land resources offer a healthy living environment and endless opportunities for outdoor recreation, while the scenic beauty of the region's environment is treasured by residents and visitors alike: regional surveys and locally-adopted master plans show almost universal agreement that the preservation of these resources is of primary importance to the region's quality of life.

In addition, Northwest Michigan's natural resources act as a cornerstone of its economy. The outdoor recreation opportunities and scenic beauty beloved by its residents also drive much of the region's thriving tourist industry, and its forests, lakes, fields, and mineral resources provide jobs and exports in the timber, agriculture, commercial fishing, and mining industries.

Residents throughout the region recognize that the preservation and protection of these high-quality natural resources is paramount to maintaining our quality of life and economy. Yet, a number of conditions and trends pose threats to the region's environmental quality. Invasive species are changing the ecology of the region's lakes, wetlands, and forests. Stormwater runoff adds nutrients and toxins to water resources, and development pressure in rural areas is fragmenting important networks of green infrastructure, while impacting scenic views and beauty.

Individuals, governments, and community organizations all have a hand to play in addressing these threats to Northwest Michigan's most



In Northwest Michigan, natural resources such as beaches and natural areas are a draw for residents and a cornerstone of its economy.

cherished assets, and the region is home to a wide range of dedicated environmental stakeholders that are working to meet these challenges. Nonprofit organizations work to monitor and address water quality concerns, permanently protect lands with important conservation benefits, and promote environmental education and stewardship. Local governments, meanwhile, protect and preserve natural resources through the creation of natural areas and parks, while zoning offers local tools to protect sensitive natural resources in the development process. Many of these activities enhance and/or act in concert with state and federal initiatives, programs, and laws affecting natural resources. State and federal organizations regulate emissions, protect land, offer incentives for the cleanup of polluted sites, regulate development in sensitive areas, and monitor and maintain land, wetlands, and water quality. These public agencies are primary partners in natural resource management and protection, forming the foundation for many local and regional initiatives.

All of these stakeholders, initiatives, and regulations are a piece of the puzzle in preserving the value of the region's natural resources for future generations; and continuing to engage all parts of the community is a principle challenge in protecting these assets. Planners, community leaders, and others must understand the condition and aspects of these resources and the overlying challenges posed by human pressures on the environment, in order to plan and implement initiatives that most effectively address the region's environmental threats. A Framework for Natural Resources in Northwest Michigan compiles basic information to the diverse stakeholders engaged in preserving and protecting the region's natural resources.

Because of the strong commitment to environmental quality on the part of many community organizations throughout the region, an abundance of information resources, planning examples, and tools are available to communities as they work to protect and preserve natural resources. In addition, an extensive set of regulations at the

state and federal level come to bear on environmental protection and related natural resource issues. Rather than duplicate or inventory these resources, A Framework for Natural Resources in Northwest Michigan is intended to compile a brief overview and summary of some of the issues facing Northwest Michigan's land and water resources,

while highlighting some of the best practices and tools available to most effectively protect and preserve the prosperity, economic benefits and high quality of life provided by the region's land and water resources. Assistance in developing the Framework for Natural Resources was provided by the Great Lakes Environmental Center; and

the strategies and actions included in this document were derived from goals developed by the Grand Vision Natural Resources Network, a diverse, regional group of stakeholders that shares information and collaborates on region-wide natural resource issues.

Natural Resources: Enhancing Economic Prosperity

Northwest Michigan's economic prosperity depends in large measure on the quality of its natural resources:

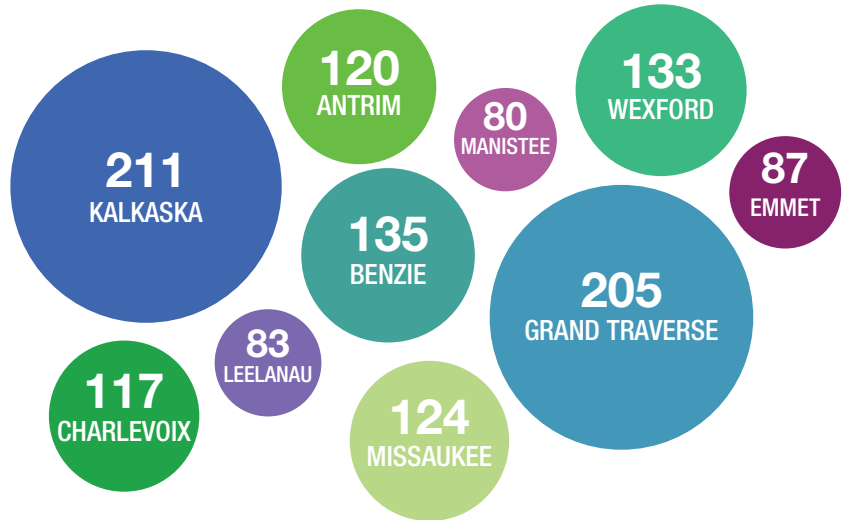
- The scenic beauty and recreation opportunities offered by the region's natural resources draw new residents and businesses that are seeking a high quality of life and place.
- Much of the region's important tourism industry is focused on access to the region's natural resources.
- Raw materials from the region's natural resources, such as timber, fish, sand, gravel, oil, and gas, provide jobs and exports.



The rivers, inland lakes, and Lake Michigan coastline of Northwest Michigan are among the region’s most prized—and recognizable— features. The ten-county region boasts over 440 miles of Lake Michigan shoreline amongst its bays, beaches, and islands, along with hundreds of inland lakes— some of which are among the state’s largest and best-recognized—while important blue-ribbon trout streams course throughout the region.

Many or most of these resources feature high water quality, clear waters, and scenic vistas that are recognized statewide and nationally, making them critical economic assets that act as a primary draw for the region’s recreation and tourism industries. They are also a foundation of Northwest Michigan’s high quality of life, and many residents live in or move to the area to take advantage of the region’s access to water. Yet, the quality of these water resources is threatened by a variety of pressures arising from development, invasive species, and climate changes.

1295 INLAND LAKES* IN NORTHWEST MICHIGAN



**Lakes over one acre in size.*

Source: State of Michigan Department of Management and Budget, Center for Shared Solutions & Technology Partnerships



Inland Lakes, Rivers & Streams

Nearly 1300 lakes are scattered across the region's landscape.¹ Many of these lakes are of significant size and value as recreation destinations and fisheries, providing plentiful opportunities for fishing, boating, and swimming. Six of Michigan's 20 largest lakes—Torch, Charlevoix, Crystal, Leelanau, Elk, and Glen Lakes—are found in Northwest Michigan. All boast high water quality, brilliant blue waters, scenic views, and superior water clarity. In addition, rivers in Northwest Michigan include some of the state's most valuable cold water fishery rivers and streams, including all or significant portions of the Manistee, Boardman, Jordan, and Betsie Rivers, all of which have been designated into Michigan's Natural Rivers System and/or Wild and Scenic Rivers program.

All of these lakes and rivers support a diversity of fisheries and a thriving fishing industry. The state's sportfishing industry alone is estimated to bring in well over \$2 billion annually and Northwest Lower Michigan supports an

especially diverse sports fishery.² Some of its most prized and heavily fished species include steelhead, lake trout, and salmon from Lake Michigan; pike, walleye, and sunfish from the inland lakes; and brook, brown, and rainbow trout from colder water streams.

Two-thirds of the state's commercial fishing licenses are held by tribal commercial fishers. Commercial fishing in the region is largely under tribal fishing licenses as there is a limited area where state-licensed commercial fishing is permitted. Under pressure from over-fishing, habitat loss, pollution, and invasive species, fisheries have changed and commercial fishing regulations have been updated to reflect these changes and Native American fishing rights. With limits on species and total allowable catch, the Lake Michigan commercial fishing harvest is now over 99% whitefish.³

Pollution and habitat destruction are two of the main pressures on today's fisheries. Upstream human activities such as land clearing,



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MILES OF LAKE MICHIGAN SHORELINE

development, and road construction can cause sedimentation and nutrient enrichment that eventually pollute downstream fish habitat. Shoreline development can also alter stream flow and destroy nearshore fish feeding, breeding, and nursery areas.

Invasive species may be the most significant threat to the Michigan's fisheries. Significant declines in a

Water Quality for Northwest Michigan Watersheds, 2014

Impairment	Betsie-Platte Watershed	Boardman-Charlevoix Watershed	Manistee Watershed	Muskegon Watershed	Cheboygan Watershed
Notable waterbodies not meeting designated uses	North Lake Leelanau Lake Ann Platte River Betsie River Crystal Lake Portage Lake	Lake Charlevoix Boyne River Ellsworth Lake Six Mile Lake Torch Lake Walloon Lake Lake Bellaire Elk Lake Boardman River Brown Bridge Pond Kid's Creek Mitchell Creek	Manistee River Beaver Creek Pine River Little Manistee River Tippy Dam Pond Manistee Lake	Muskegon River Clam River Lake Mitchell	Crooked Lake Crooked River Pickerel Lake
Prominent designated uses not being met	Fish Consumption Aquatic Life Body Contact Recreation	Fish Consumption Aquatic Life Body Contact Recreation	Fish Consumption Aquatic Life Body Contact Recreation	Fish Consumption Aquatic Life Body Contact Recreation Fisheries	Fish Consumption Aquatic Life
Prominent causes	PCB and mercury in fish tissue Low dissolved oxygen Sewage	PCB and mercury in fish tissue and water column E. coli Dioxin	PCB in water column Mercury in fish tissue and water column	PCB and mercury in fish tissue and water column Chlordane PAHs Sedimentation	PCB in water column Mercury in fish tissue

number of commercial and game fish over the past few decades are linked to non-native species such as the sea lamprey and zebra mussels.⁴

Species and habitat conservation and management, and fishing regulations are some of the ways the Michigan Department of Natural Resources manages fisheries under this myriad of stressors. Stocking programs are one form of conservation and management, and Northwest Lower Michigan is home to three of the state's six fish hatcheries, three of its four weirs, and a number of rearing ponds. By producing species such as rainbow and brown trout, coho and Chinook salmon, and walleye, these facilities help restore, sustain, and enhance fisheries; balance ecosystems; and provide a diversity of fishing opportunities for the region.⁵

Water Quality

Fish populations respond to human activities along shorelines and throughout a whole watershed that impact the quality of fish habitat. Generating pollutants such as sedimentation and nutrient enrichment, upstream activities can have devastating impacts on feeding areas, spawning grounds, migratory routes and nurseries. Fisheries, along with other uses, in many of Northwest Michigan's lakes and rivers are affected by these water quality concerns. Surface waters in Michigan are managed for uses including agriculture, navigation, industrial water supply, warmwater fishery, other indigenous aquatic life and wildlife, partial body contact recreation, fish consumption, total body contact recreation, coldwater fisheries, and public water supply sources. These uses are referred to as "designated uses;" water quality standards exist for each one of these uses to determine whether a particular waterbody "supports" that designated use. Throughout the region, there are about 30 major waterbodies that do not meet water quality standards for designated uses. Causes primarily include the presence of PCBs and mercury in fish or in the water column, along with the presence of various toxins and sedimentation.

Lake Michigan

The Great Lakes, which contain one-fifth of the world's entire supply of fresh water, are some of Michigan's most valuable and sensitive natural resources. In Northwest Michigan, which includes over 440 miles of Lake Michigan shoreline among its bays, beaches, and islands, the Great Lakes form a fundamental element of the region's ecology, economy, and quality of life. The clear blue waters of Lake Michigan represent one of Northwest Michigan's most cherished attributes, and its beaches, views, and fishing opportunities are a principal tourist attraction for the region.

Invasive species represent perhaps the largest threat to Lake Michigan's ecological health. A number of invasive species—including zebra and quagga mussels, lampreys, and alewives—have had major impacts on the Lake's biology (see sidebar, page 10). While community partners, local governments, and state and federal agencies work continuously to address challenges posed by invasive species, many of the factors involved in both the introduction and management of certain invasives makes them especially difficult to control.

Other Great Lakes-related concerns include changing water levels. Changes in Great Lakes water levels can have a profound impact on ecosystem and community services provided by the lakes; and over the last several years, Northwest Michigan communities located along the Lake Michigan shoreline have struggled with fluctuating water levels. When water levels are too low, commercial shipping, recreational boating, and hydropower facility capacity are impaired. When levels are extremely high, coastal erosion and flooding become widespread.

Long-term changes in regional precipitation and evaporation rates drive seasonal, inter-annual and decadal water level fluctuations, and can lead to periods of extremely high or low water levels. Water levels on the Lake Michigan and Huron system have been below their long term average for over a decade, and the winter of 2012-2013

marked the lowest point and longest stretch of continuous low water levels since records began to be kept in 1918.⁶ The future of Great Lakes water levels are highly uncertain, and the challenge to adjust to them is intensified, as they could rise again to extreme highs or could drop further. There is no way to be certain how the hydrologic dynamics of evaporation, precipitation, runoff, discharge, and inflow that control lake levels will balance out in coming years.

The Lake Michigan food web is a dynamic system affected by weather and climate; exotic and invasive species; management activities such as stocking; and water and habitat quality affected by natural and human activity. The abundance of prey fish (those that are preyed upon by larger predators for food) is an indicator of ecosystem stability and health, and has been monitored by state and federal agencies on an annual basis since the 1970's. Recent surveys indicate that prey fish abundance is low, and in some cases near record lows. In light of this information, all state natural resource agencies bordering Lake Michigan decreased salmon stocking lake-wide by 50% beginning in 2013 and continuing until 2015.⁷ The results will be monitored and assessed by state, federal, and tribal resource agencies over the coming years.

Watersheds

A watershed is an area of land in which all surface waters drain to a common outlet. All of Michigan's watersheds drain into the Great Lakes; however, watersheds exist within watersheds, with surface water draining to major lakes and rivers before eventually emptying into the Great Lakes. The major watersheds overlying the ten-county region are the Betsie-Platte, Boardman-Charlevoix, Manistee, Muskegon, and Cheboygan watersheds. A small portion of the Pere Marquette-White watershed overlies the southwest corner of Manistee County and a small portion of the Au Sable watershed overlies the southeast corner of Kalkaska County.

As water drains from a watershed, the water that runs off the land picks up pollution—such as nutrients, toxins,

Best Practice: Low Impact Development

Low-impact development (LID) is an approach to development that works with nature to manage stormwater as close to its source as possible. LID preserves and recreates natural landscape features and minimizes imperviousness to create functional and appealing site drainage that treat stormwater as a resource rather than a waste product. There are many practices that can be used in this approach, including bioretention facilities, rain gardens, vegetated or green rooftops, rain barrels, and permeable pavements. By using LID principles and practices, water can be managed in a way that reduces the impact of built areas and promotes the natural movement of water within an ecosystem or watershed. LID also promotes the idea that almost all elements of a site plan can be used for stormwater control. Parking lots can be made of pervious surfacing materials that allow stormwater to drain through the pavement and recharge groundwater sources, while rooftops can be used as planting areas, soaking up rainwater and reducing runoff.

Similar to low impact development is the concept of green infrastructure, which weaves natural processes into the built environment in order to provide stormwater management, flood mitigation, air quality management, and other benefits.

This approach uses vegetation and soil to manage rainwater where it falls, versus single-purpose gray stormwater infrastructure, which uses pipes to dispose of rainwater. The approach describes an array of products, technologies, and practices that use natural systems – or engineered systems that mimic natural processes – to preserve natural resources and provide utility services. Applying green infrastructure principles to land use planning enhances the value of natural resources and has real economic value. An example of a natural system as green infrastructure are forests which can provide stormwater control, carbon sequestration, higher air quality, and thermal and wind control. The ability of a wetland to filter contaminants and control runoff can be easily monetized when compared to the cost of an artificially engineered system or gray infrastructure that performs similar essential functions. Green infrastructure can be used at a wide range of landscape scales in place of, or in addition to, more traditional stormwater control elements.

These techniques may cost less to build than traditional closed designs, primarily by keeping stormwater on the ground rather than building infrastructure underground to handle it.



and phosphorus—and deposits it in streams and rivers as it drains the watershed. The network of streams and rivers that drain watersheds and carry water pollution ultimately empty into inland lakes and Lake Michigan, thus concentrating all of the pollution that was in the rivers into these other bodies of water.

Because water picks up sediment and other pollutants as it travels across the land, managing water quality involves addressing land uses and sources of pollution throughout the watershed. However, many local efforts to address water quality issues occur at a local government level, which typically includes only a small portion of a given watershed, often leading to fragmented efforts to control the sources and impacts of water pollution. In order to effectively address water quality issues, watershed management must occur in a collaborative fashion across multiple government and jurisdictional boundaries.

Sedimentation

When rain and snowfall hit the ground, they naturally filtrate through the earth and recharge groundwater. However, hard or paved surfaces—known as impervious surfaces—prevent the filtration of rain or snow into the ground. When precipitation hits impervious surfaces, it instead flows over the ground, picking up soils, debris, chemicals, and other pollutants. Runoff then flows into a storm sewer system or directly into a lake, stream, river, or wetland, where it is discharged, untreated, into the water that is used by the community for swimming, fishing, and drinking.

Excessive sedimentation is one of two primary pollutants affecting water bodies in Northwest Michigan. Sediment and sand enter surface waters through stormwater that washes from roads, parking lots, driveways, and other impervious surfaces, carrying with it nutrients and other pollutants. Sediment and sand smother the habitat that aquatic organisms need to survive and reproduce, causing a variety of ecological impacts.



Sediment and pollutants are carried through watersheds by rivers, streams, and rain off into the Great Lakes.

Because of the impact of impervious surfaces on stormwater, the amount of developed land or impervious surface coverage in a watershed is directly connected to the quality of its water resources. Impacts can occur once 10% or more of the land within a watershed is covered with impervious surfaces, especially when those impervious surfaces are located adjacent to water resources. When the percentage of impervious cover exceeds 25%, most watersheds experience severe habitat and water quality issues.⁸

Riparian buffers are plant buffers adjacent to rivers and lakes that help to prevent soil erosion and act to filter stormwater runoff before it enters water resources. However, many of these riparian buffers are removed during the development process, further contributing to erosion and sedimentation in our region's lakes and rivers.

Nutrient Pollution

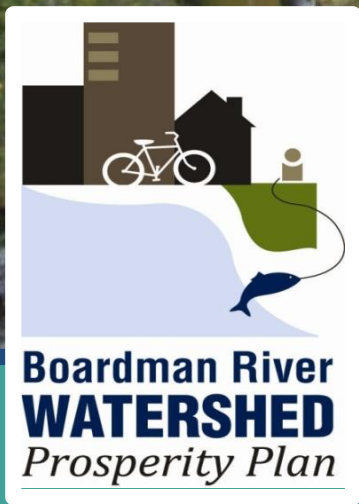
Nutrient pollution is a form of water pollution that refers to contamination from excessive quantities of nutrients, such as nitrogen or phosphorus. Nutrient pollution creates imbalances

in oxygen supplies, subsequently stimulating weed and toxic algae growth, affecting the food web, and contaminating drinking water. Its effects are common problems in the ten-county region in all types of water bodies.

Nutrient pollution often enters water from upstream waters like creeks and streams, then flows into larger bodies of water like lakes, rivers, and bays. Nutrients often attach to soil particles, thus linking sedimentation to nutrient pollution.

Wastewater from sewer and septic systems do not always operate properly or remove enough nitrogen and phosphorus before discharging into waterways. In Northwest Michigan, failing and leaking septic systems, along with agricultural runoff from excess fertilizer and animal manure, are the greatest sources of nutrient pollution. Other sources of nutrient pollution include:

- Stormwater runoff from surfaces like rooftops, sidewalks, and roads
- Fossil fuels entering the air through electric power generation, industry, transportation, and agriculture



Boardman River Watershed

The **Boardman River Prosperity Plan** expands on traditional natural resource and watershed planning to include cultural and economic factors across a 291-square mile watershed. The Plan represents an important intergovernmental approach to natural resources planning. It considers and plans for impacts that occur across government boundaries and service sectors. Participation from business, conservation, service, and other partners, along with local, county, state, and federal stakeholders, drove the process, ensuring a comprehensive approach

to natural resource planning that recognized the close connections between a region's natural resources and its economy. Its focus is the long-term protection of the natural assets within the watershed, taking into account historic dam removal and restoration activities, as well as business and job creation. The planning process has featured extensive civic engagement to identify priorities and concerns, and includes specific zoning and other recommendations for various regions and communities located within the watershed.

- Home fertilizers, yard and pet waste, and certain soaps and detergents that contain nitrogen and phosphorus and can contribute to nutrient pollution if not properly used or disposed of

Reports conducted by a number of state and regional environmental agencies show evidence of nutrient pollution creating issues such as significant algae growth in lakes throughout the region.⁹

Pathogens

Water and human health are also threatened by the presence of pathogens in surface waters throughout Northwest Michigan. Pathogens are disease-causing organisms that include various types of bacteria, viruses, protozoan parasites, and other organisms.

Excess levels of pathogens commonly lead to beach closures. A number of locations along the Grand Traverse Bay shoreline have experienced repeated issues related to *E. coli*, leading to beach closures due to the potential for public health risk.

Primary causes of pathogen contamination in Northwest Michigan include failing or undermaintained septic systems; poor urban, agricultural, or rural storm water management; overflowing sewer systems; and animal waste, including that from geese and ducks along shorelines that is washed into nearby waterbodies.¹⁰ Summer storm events, which flush large volumes of stormwater into waterbodies, typically raise the potential for pathogen-related issues in regional waterbodies.

Groundwater

Groundwater makes up about half of the total water consumed by humans for drinking, agriculture, and other purposes; and can also serve as a major source of water to lakes, rivers and wetlands.

When groundwaters are consumed or extracted, a process known as “groundwater recharge,” involving precipitation, infiltration, and percolation replenishes them. The potential for groundwater recharge depends on an area’s climate, soils, vegetation, and

land use. Recharge can be reduced or threatened by development that increases impervious surface coverage.

In addition to impacts from development, groundwater quality can be threatened by activities like the storage and subsequent leaking of hazardous materials. Even small traces of contaminants discharging into the ground can have enormous effects on groundwater quality.

Loss of Habitat

Lake Michigan and inland lakes throughout the region have relatively low levels of water pollution, due in large part to the presence of large acreages of forested and undeveloped lands and sandy soils throughout the region. Yet, rapid development and sprawl have the potential to disrupt these undeveloped acreages, resulting in habitat loss and fragmentation. Habitat loss is a primary concern for waterbodies throughout Northwest Michigan.

Habitats can be lost by the removal of native vegetation or other human interference, such as the filling of wetlands. These conditions affect wildlife populations and water quality, as natural pollutant filtrations are removed, creating issues associated with stormwater runoff, sedimentation, and other concerns. Habitat can also be degraded or lost due to overuse of recreation resources, or by the installation of shoreline hardening devices (such as seawalls or rock walls) by riparian property owners, the removal of vegetation along the river, and/or the removal of important in-stream woody debris along the banks of shoreline properties.

Invasive Species

Invasive species are plant or animal species that are not native to an area and cause negative effects on that area’s environment, health, or economy. In Northwest Michigan, a number of invasive species present a significant threat to the integrity of native plant and animal communities and the regional ecosystem. They present varying threat levels, but certain high profile invasive species are especially prolific

and present the greatest disruptions to the ecosystem. These include Purple Loosestrife, Phragmites, Eurasian Water Milfoil, the Round Goby, and Quagga Mussels (see sidebar, page 10). These species are outcompeting many native species and are significantly disrupting the food chain and ecology of Lake Michigan and many inland lakes.

Some of the factors that introduce invasive species into regional ecosystems, such as ballast water discharges from sea-going vessels, have their roots in multi-state and -national issues, and will continue to be problematic in the coming years. Others are caused by common environmental stressors, such as climate change. Climate change is a long term stressor that is linked to invasive species, since certain invasives are more resistant to changes in zonal temperatures than native competitors.

In addition to these wider contributing issues, nutrient pollution can also exacerbate the spread of invasives, as exotic plant species like Eurasian Watermilfoil and Purple Loosestrife can better compete with native plants when nutrients are abundant.

Regional conservation and planning efforts must consider actions that may contribute to invasive species prevention, mitigation, and/or adaptation in order to preserve both vital ecosystem services and biological diversity.

Invasive Species: Wetlands & Water

Invasive species present varying threat levels, but several species are particularly prolific and present significant disruptions to the region's ecosystems. Some of the most impactful invasive species are detailed below.

Purple Loosestrife

Purple loosestrife is a wetland plant from Europe and Asia that is now present in every state except Florida. Purple loosestrife invades marshes and lakeshores, replacing cattails and other wetland plants. It can form dense, impenetrable stands which are unsuitable as cover, food, or nesting sites for a wide range of native wetland animals. Many rare and endangered wetlands plants and animals are placed at risk by purple loosestrife encroachment.

Phragmites

Phragmites is one of the highest-threat invasive species in Northwest Michigan. It grows up to 14 feet tall, forms dense extensive stands, and harms native habitat by crowding out native plants. It limits water access, damages property values, blocks and viewsheds. Phragmites is prevalent on beaches, along roads, drainage ditches and canals, and on agricultural lands, and is difficult to control once well-established.

Eurasian Watermilfoil

Eurasian watermilfoil spreads quickly and smothers native plants by forming thick, tangled strands of stems underwater and vast mats of vegetation on the water's surface. It causes environmental and economic problems, including impairments to water-based recreation, navigation, and flood control systems; it also causes the degradation of water quality, fish and wildlife habitats, and accelerated filling of lakes and reservoirs.

Round Goby

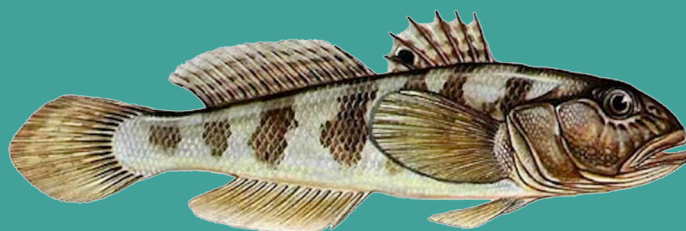
The round goby is an invasive fish from the Black and Caspian Sea region most likely introduced through ballast water discharges. They are present in Lake Michigan and many inland lakes and prey on small native fish, while also outcompeting native fish for food and spawning habitat.

Quagga Mussels & Zebra Mussels

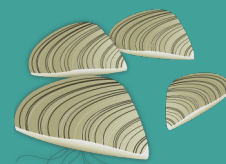
Quagga mussels are similar to the zebra mussel—another invasive species that is now being displaced by quagga mussels—but is larger, more tolerant of cold temperatures, more prolific, and has a longer life span. Quagga mussels are by far the most dominant invasive mussel in the Great Lakes, with the heaviest population concentrations in northern Lake Michigan. As filter feeders, both quagga and zebra mussels have removed much of the nutrients, phytoplankton, and zooplankton from the Lake Michigan water column and caused the benthification of the food web, sequestering all food in the lake bottom in mussels. This in turn reduces food sources for game fish, impacting the entire food web to the top predators. These mussels also appear to promote the growth of bacteria responsible for type E botulism, contributing to thousands of water bird deaths; clog water treatment and generation facilities; impact Great Lakes sports fisheries; and create algal blooms that close beaches and limit recreational opportunities.



Zebra Mussels



Round Goby



Quagga Mussels

Opportunities: Water

Addressing threats to water quality involves long-term efforts on the part of many state, federal, and local organizations. Local governments and community partnerships are key players in these efforts, with zoning and other policy tools available to protect and preserve the region's prized natural resource assets.

Watershed management at a multi-jurisdictional level can help to more effectively address a variety of water pollution issues. Because water picks up sediment and other pollutants as it travels across the land, watershed management focuses primarily on land use as a means to preserve and enhance water quality. Watershed planning and management involves a regional approach based on the movements of water and pollutants as defined by natural boundaries rather than political jurisdictions.

At a more local level, zoning can affect or reduce stormwater runoff, by limiting impervious surface coverage. Because

certain types or extents of development. Other communities are reconsidering their existing stormwater management systems or infrastructure to lower costs and more effectively treat stormwater before it enters nearby water resources, through low-impact design features such as "daylighting" streams, installing scrubbers or filters in drains, and planting vegetative buffers of native plants. Low impact development is an approach to development and stormwater management that works with nature to manage stormwater as close to its source as possible. It preserves and recreates natural landscape features, and minimizes impervious surface coverage in order to create functional stormwater management systems. Low impact design techniques can be required or encouraged through zoning or other local policies.

In order to ensure adequate groundwater recharge, areas that offer the best recharge potential should be protected through the limitation of development and other activities that impede infiltration or negatively affect water quality in

Local governments can use zoning to encourage the use of greenbelts to mitigate and address runoff, erosion, and other water quality issues.

roads or parking lots make up the majority of a community's impervious surface coverage, narrower road widths, shared parking, flexible or reduced parking requirements, pervious pavement, and other creative parking and design features can help to minimize stormwater runoff.

A number of development practices use creative approaches to lot design and development in order to limit impervious surface coverage and minimize disturbances to natural ecosystems and loss of habitat or open space. Conservation design and sliding scale zoning work to preserve large acreages of undeveloped land while allowing for residential development,

Local governments can also use zoning to encourage or require the use of greenbelts, or riparian buffers, in order to mitigate and address runoff, erosion, and other water quality issues. Greenbelts are strips of natural vegetation planted along the shoreline that can work to stabilize stream banks, thus preventing erosion, filtering stormwater, and keeping sediment and nutrients from reaching lakes, rivers, and streams.

Stormwater management is addressed by communities in a variety of ways. Soil erosion ordinances have been enacted throughout the region, requiring erosion control for

those areas. In addition, some areas in Northwest Michigan have municipal well fields. Recharge areas for those well fields are known as "wellheads," which should be identified and protected similar to groundwater recharge areas.

To address concerns related to failing or inadequately managed septic systems – one of the primary causes of water pollution in the region – some communities have established septic inspections ordinances. These ordinances, which have been passed at both county and township levels, require that all septic systems be inspected upon the sale of a property, in order to identify and address systems that may be failing.

Regional conservation and planning efforts must also consider actions that may contribute to invasive species prevention, mitigation, and/or adaptation in order to preserve both vital ecosystem services and biological diversity. Addressing nutrient pollution is one action that communities can take, while community-led initiatives and partnerships can, and have been, successful in addressing invasive species issues. Networks of volunteers and environmental organizations work to identify and remove invasives from public properties. These groups and networks may partner with communities to ensure that priority sites are addressed.

Northwest Michigan's fields, forests, rolling hills, open spaces, and stunning views together compose an iconic rural landscape that offers residents and visitors lifestyle-related assets that contribute to a high quality of life and a strong economy. Its soils provide unique and diverse agricultural opportunities; timber and minerals provide important resources for industry; and open space, forests, and coastal lands provide both important habitat and highly-valued recreational opportunities. Its scenic beauty, meanwhile, contributes to a tourism-based economy that brings visitors to the region from throughout the country. Preserving these resources has been identified by communities as being of utmost importance: locally adopted master plans throughout the region universally prioritize the preservation of natural resources, while regional surveys show strong support for natural resource preservation and protection. As the region continues to face rapid development pressure that changes the face of its landscape, preserving this quality landscape and the diverse ecosystems that comprise it becomes an increasingly important challenge for many communities.

Land Cover & Use

Land use in Northwest Michigan is primarily rural, with a high proportion of state and federally owned parcels. Just over half of the region's land cover is comprised of forestlands, followed by rangeland or open land, agricultural land, wetlands, and water. Only 5% of the region's land area was considered to be "urban" or developed land at the time of the 1978 land cover analysis.¹¹

Rapid population growth since 1970 has contributed to development pressure and sprawl throughout the region. Much of that development pressure has occurred in rural areas, outside of villages and cities, due in part to a desire for rural lifestyles. As residents move to rural areas, large parcels are subdivided and converted to residential uses. Because

3

NORTHWEST
MICHIGAN COUNTIES
RANKED AMONG THE
STATE'S TOP 5 GAS
PRODUCERS

1,000

EMPLOYEES
WORKING IN
OIL & GAS

50%

MICHIGAN'S WELLS PRODUCING
VIA HIGH-VOLUME HYDRAULIC
FRACTURING THAT ARE LOCATED
IN KALKASKA COUNTY

woodlands and wetlands function best when they exist in large, continuous acreages, with benefits including wildlife habitat, flood control, and water quality, land fragmentation can significantly impact natural resource systems.

It's difficult to identify precise changes in land use or land cover over time, due to the variety of land use classification systems that have been developed and used since the 1978 land cover analysis. Land cover change analysis is occasionally conducted at the county or township level as part of planning efforts, but regional analysis of land cover patterns is prevented by the lack of consistent mapping systems currently available. However, individual county analysis can present some insight into how development pressure has impacted land use and land cover in the region. For instance, the Emmet County Master Plan indicates that the amount of vacant or undeveloped land between 1968 and 2007 declined by 33%, or over 93,000 acres, while the amount of

land used for single-family residential in 2007—nearly 20,000 acres—was more than 5 times higher than single-family residential acreage in 1969. The Antrim County Master Plan, meanwhile, indicates that agriculture and grass/shrub lands decreased by 23%, or nearly 30,000 acres, while the amount of urban or developed lands nearly doubled between 1978 and 1998. Trends in these counties, which have experienced population and development changes that reflect regional trends, are likely to be representative of land cover change throughout the region.

Geology

Glacial actions that took place thousands of years ago covered Northwest Michigan in thick deposits of sands, gravels, and clays. These glacial deposits are responsible for the upland areas of moraines; dunes along Lake Michigan; coastal areas and lakebeds; and glacial channels and outwash that characterize Michigan's topography.¹²

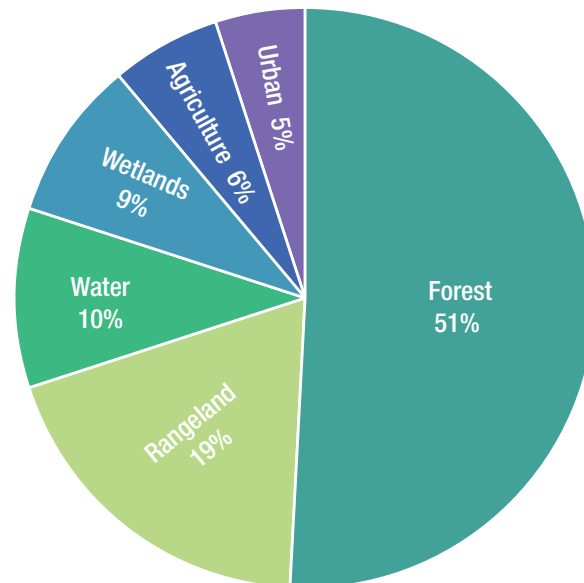
Mining for glacial sediments is common in Northwest Michigan, and sand and gravel are the most widely available non-fuel minerals in Northwest Michigan. As important materials in construction and road building, the local availability of these minerals benefits local economies especially by keeping the cost of transportation down. Sand and gravel are accessed through surface mining activities that use pits and quarries. Unlike oil and gas production, the state and federal government do not have regulatory authority over operations on private lands located at least two miles inland from Lake Michigan. However, local regulations can be applied, and communities with large sand and gravel mining operations have precedent of regulating these operations through zoning.

Below the surface, Michigan's Lower Peninsula is located in the center of a giant basin filled with layers of sedimentary rocks. Trapped within these layers are pockets of oil and natural gas. Over the past 100 years, more than 50,000 wells have been drilled for oil and gas reserves throughout the state. Extraction in Northwest Michigan has been especially productive with Manistee, Kalkaska, and Grand Traverse counties ranked among the state's top 5 gas producing counties.¹³ Oil and gas production make substantial contributions to the region's economy and provide close to 1,000 jobs across the ten counties.¹⁴

The Antrim Formation and the Niagaran Reef Trend have been the region's top producing geologic formations to date. Running up through Manistee and Benzie and east across the state from Antrim County, the Antrim Formation ranks among the top gas producing fields in the nation. The Niagaran Reef Trend is actually a series of overlapping fields that stretches between Manistee and Presque Isle counties.¹⁵ Unlike the shallow layer of shale that makes up the Antrim Field, much of Northwest Michigan's oil and gas reserves are located several thousand feet below the surface. Companies are utilizing horizontal drilling and hydraulic fracturing methods to access and maximize the

Northwest Michigan Land Cover, 1978

Source: Michigan Resource Inventory System (MIRIS)



output of these hard-to-get-to minerals. High volume hydraulic fracturing is a process that uses 100,000 gallons of water or more along with sand and chemicals to force out minerals trapped at great depths (some over 10,000 feet below the surface). As of July 2014, half of Michigan's wells producing via high volume hydraulic fracturing were located in Kalkaska County.¹⁶ Environmental concerns over this process and general oil and gas development are generally related to how wells are constructed, well testing before production, and the quantity and disposal of water throughout the process.

Soils & Sediment

The types of soil in a community determine development potential, erosion hazards, agricultural suitability, drainage conditions, and the effectiveness of septic tank sewage disposal. Soils vary throughout the region, but because much of the region was covered by ice in the latest Wisconsin glacial age, the parent materials of many soils are largely of glacial origin. Soils are also influenced by the cool, moist climate created by the region's proximity to Lake Michigan, as well as the historic forest cover of northern hardwoods, mixed hardwoods, and pine and oak. Many soils in the region are sandy, acidic,

and low in fertility; while areas along or near the Lake Michigan shoreline are uniquely suited to growing fruit crops.¹⁷

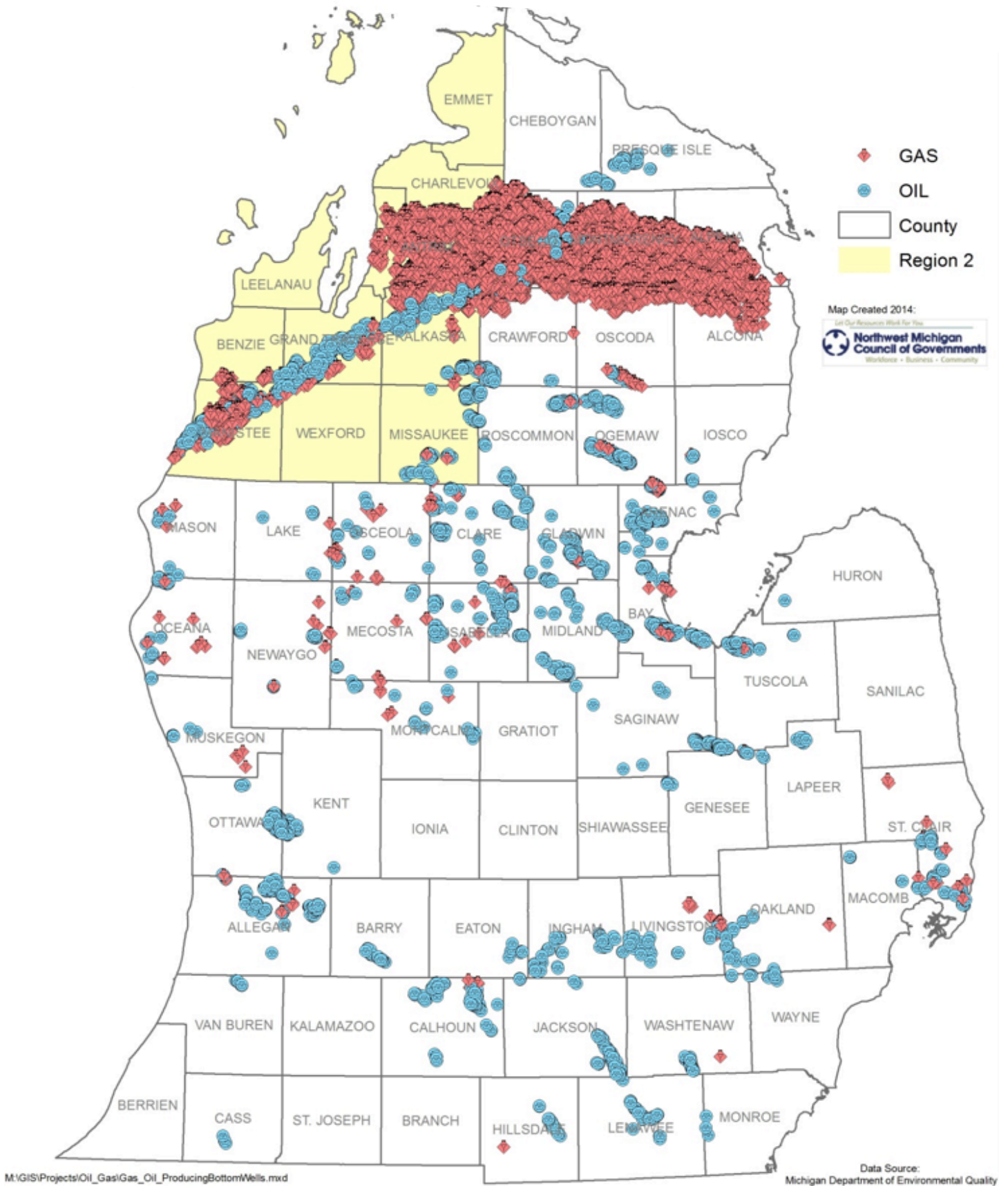
Great differences in soil properties can occur within short distances. Some are too unstable to be used as a foundation for buildings or roads, while others are seasonally wet or subject to flooding. Soil surveys for each county describe the different characteristics for each soil type in each county, with information on the impacts of specific uses for each soil.

Green Infrastructure

Natural features provide significantly more benefits if they are maintained in larger units, such as in a complex, interconnected system of woodlands, wetlands, rivers, open spaces, fields, parks, and streams. Larger, connected systems, often referred to as green infrastructure systems, are more successful at maintaining ecological diversity and integrity. Green infrastructure systems maintain ecological processes, sustain air and water resources, and contribute to the health and quality of life for the region's communities and people.

Green infrastructure provides a variety of community benefits, both economic and ecological. Because

Active or Producing Gas & Oil Wells



greenway spaces like trails and natural areas are often seen as more valued amenities by residents than even golf courses or swimming pools, green infrastructure can increase the value of nearby property, with corresponding increases in tax revenues. Studies have found that every \$1 invested in securing public ownership of lands can provide up to \$7 in economic value in natural goods and services.¹⁸

Further, continuous systems of forests, wetlands, and other open areas reduce the risk of flooding by controlling stormwater runoff, and also provide protection from storm damage and erosion in coastal areas. Green infrastructure systems also provide invaluable wildlife habitat and foster ecological diversity.

Open space and forestland cover about three-quarters of the region's land area, and a significant portion of that area is publicly owned and preserved. Approximately 30% of the region's land area is comprised of public lands, including county, city, village, and township-owned parks, Michigan state parks and forests, the Huron-Manistee National Forest, and lands within the Sleeping Bear Dunes National Lakeshore.

The many public lands, parks, trails, and preserves in the region link people to natural resources and buffer those resources from encroaching development. They play a major role in protecting natural resources and providing access to nature, while also helping to preserve the view sheds that make Northwest Michigan a desirable place to live and visit.

Forestland

Forested lands comprise the single largest land cover category in Northwest Michigan. At the time of the statewide 1978 land cover analysis, forest lands made up 51% of the region's landcover. Forest coverage has grown continually since lumbering and wildfires wiped out Michigan's forests in the nineteenth and early twentieth centuries. Most of the region's forests are now second growth, with the most common types consisting



Forests provide wildlife habitat, protect air quality, stabilize soils, and help manage stormwater.

of the maple/beach/birch group (38%), oak/hickory, red/white/jackpine, aspen/birch, and the spruce/fir group.¹⁹

Forests provide wildlife habitat, protect air quality, stabilize soils, and help manage stormwater. By controlling erosion and absorbing excess nutrients and sediments, trees play an especially important role in protecting the region's water resources.

Of the 2 million acres of forestland in the region, 95% is timberland. To qualify as timberland, a forest must be capable of producing timber for industrial purposes and not be prohibited from doing so by statute or regulation. Timber is harvested in all ten counties, with some of the largest annual harvests occurring in Missaukee and Kalkaska counties. Along with harvesting operations, timber processing and the manufacturing of wood products supports nearly 200 businesses and 2,000 jobs in Northwest Michigan.

The greatest threats to forest health and productivity are fragmentation and biological factors such as invasive species and diseases. The continuity of

the region's forests are at risk of being subdivided for development purposes, as regional growth and the demand for rural lots result in the subdivision of many large parcels of land. By reducing the continuity of the region's forests, fragmentation leads to a loss of wildlife habitat, recreational opportunities, and other forest resources.

Invasive species also influence forest health and composition (see sidebar, page 16). For instance, the Emerald Ash Borer, which has been documented in all ten counties, is killing ash trees at alarming rates, coming at a cost to communities and landowners who have to remove and replace dead trees, and having yet unknown consequences to forest ecosystems.

Over 40% of the region's forests are in state or federal ownership, within both the Pere Marquette State Forest and the Manistee National Forest, where sustainable forest management is required by law. These state and federal forested areas provide recreation opportunities and wildlife habitat; and the limitations on development in these areas contribute to the high quality

Invasive Species: Forests & Open Space

Invasive species present varying threat levels, but several species are particularly prolific and present significant disruptions to the region's ecosystems. Some of the most impactful invasive species are detailed below.

Baby's Breath

With a deep taproot and uncanny seed-spreading ability, Baby's Breath thrives in Northwest Michigan's coastal dune environment. Once established, it over-stabilizes dunes and displaces native plants.

Common Buckthorn

Introduced as an ornamental shrub, common buckthorn now aggressively invades a wide variety of environments due to its tolerance of many soil types and light conditions. The shrub forms dense stands, crowding out and replacing native vegetation. Its saplings then create thick understories that prevent native species from regenerating.

Garlic Mustard

Garlic mustard is an herbaceous plant that spreads into high-quality woodlands upland and floodplain forests. Invaded sites undergo a decline on native herbaceous cover, and habitat suitability for native insects is altered, thus affecting birds and mammals.

Emerald Ash Borer

Feeding on all native ash tree species, the Emerald Ash Borer is having devastating impacts across the region. Ash trees are prevalent in forests, urban areas, and agricultural lands, and their decline affects forest composition and ecosystem processes. Economically, industries, municipalities, and landowners are being affected by the loss of valuable timber, the cost of removing and replacing trees, and quarantine costs.

Spotted Knapweed

Spotted knapweed thrives in old fields, pastures, and roadsides; once established, it can invade undisturbed areas nearby. It outcompetes native plants, reducing livestock and wildlife forage. Colonies can also increase soil erosion and water runoff, thereby degrading soil and water quality.

of water bodies within the region. However, with the majority of the region's forests under private ownership, forest conditions vary significantly across the region. To help mitigate disjointed management and prevent fragmentation, incentive based programs exist to encourage private forestland owners to develop forest management plans that implement sustainable forestry practices.

Coastal Land & Dunes

Great Lakes dunes comprise the most extensive freshwater dunes in the world. They are home to federally threatened and endangered plant, bird, and insect species, and act as important transition zones from Great Lakes to inland areas. In addition, they are beloved places for their beauty and recreation opportunities. In Northwest Michigan, the region's extensive coastal lands and dunes are some of its most valued and cherished resources.

These coastal areas are a particularly fragile and sensitive resource. Dunes, in particular, are prone to movement and erosion more than other geographic areas because of their formulating factors, and because sand is easily impacted by development or construction. In recognition of these sensitive features, and because it found that "critical dune areas" are a unique, irreplaceable, and fragile resource with significant recreational, economic, scientific, scenic, and ecological benefits, the State of Michigan regulates development within designated "critical sand dune areas" of the state. 20 townships within Northwest Michigan, located in Manistee, Benzie, Leelanau, Antrim, Charlevoix, and Emmet counties include areas designated as critical dunes. In these areas, the alteration or use of critical dunes is permitted only when the protection of the environment and ecology is assured. However, state law does not regulate dune systems in their entirety, but only on a parcel-by-parcel basis. As such, protection of these important, fragile resources is often inconsistent or piecemeal, offering only limited protections.

In addition to critical dune areas, the State of Michigan also regulates

high-risk erosion areas in coastal communities. The DNR defines high-risk erosion areas as the shorelands of the Great Lakes and connecting waters where erosion has been occurring at a long-term average rate of one foot or more per year. The erosion can be caused from one or several factors, including high water levels, storms, wind, ground water seepage, surface water runoff, and frost. State high risk erosion area regulations establish required setback distances for various construction activities. 26 townships in Northwest Michigan along the Lake Michigan coast include shoreline areas designated as high risk erosion areas.

Inappropriate development of coastal and shoreline areas disrupts the natural process of beach creation and replenishment, and may expedite or exacerbate erosion and other hazards. The proximity to open water also makes shoreline development more likely to contribute pollutants directly to the Great Lakes from stormwater runoff, agricultural and residential lawn nutrient loading, limited septic fields, outdated wastewater treatment facilities, and soil erosion.

Wetlands

Wetlands – often called marshes, swamps, or bogs – are areas where water is found, either on or near the surface, at any time during the year. These areas are invaluable natural resources for a variety of reasons: engineered wetlands offer important wildlife habitat, along with opportunities for recreation such as fishing, hunting, boating, and birdwatching. They improve water quality by removing and sequestering excess nutrients and sediments found in rivers and streams; and they reduce the potential for floods by acting as natural “sponges,” slowing down flood and storm waters. Wetlands make up about 9% of the region’s total land cover.

Despite their many ecological benefits, wetlands face a number of threats related to development and land use. Many wetlands have been dredged, drained, or filled in order to create more or improved development opportunities.

In addition, wetlands are subject to receive pollutants from stormwater runoff from nearby development.

While state regulations require that wetlands over a certain size be replaced or restored, they rarely provide the same groundwater recharge functions as naturally occurring wetlands. In addition, while certain wetlands are regulated by state and federal law, many smaller, isolated or non-contiguous wetlands lack protections from development or pollution.

Floodplains

Rivers, streams, lakes, or drains sometimes overflow onto the surrounding banks, inundating or flooding adjacent land areas with flood water. The land that is flooded after a storm is defined as a floodplain.

Floods are a natural process which occurs wherever there is a waterbody. However, the damage that results from a flood is dependent on what type of development has occurred in or near a flood-prone area. As such, development in floodplains is regulated under state and federal law. Many Michigan communities have mapped designated flood risk areas and have adopted regulations to conform to federal law.

Viewsheds

Northwest Michigan’s scenic beauty is one of its most prized assets. Rolling hills, lakes and rivers, forests, fields, and open spaces offer tremendous views throughout the region and act as a defining characteristic of the region’s sense of place. However, as scattered development patterns extend throughout Northwest Michigan’s rural areas, many of these views are threatened by development. Residential development is frequently in highest demand in areas with scenic views, exacerbating challenges in preserving these assets.

Another viewshed less frequently considered is that of the night sky. The Northwest Michigan region boasts unique opportunities in night sky viewing: rural areas throughout the region offer clear views of the night sky that are treasured by residents and

visitors. In addition, the International Dark Sky Park in Emmet County – one of only six such parks in the United States – and the Joseph H. Rogers Observatory owned and operated by Northwestern Michigan College offer opportunities to participate in educational astronomy-related activities. Yet, these views of the night sky are compromised by poorly-designed lighting in many areas. Light pollution from development throughout the region negatively impacts the nighttime environment as a view shed resource, and can also impact nocturnal species habitat and energy efficiency.

Superfund Sites

“Superfund sites” are lands that have been contaminated by hazardous waste and identified by the US Environmental Protection Agency (EPA) as a candidate for clean-up because it poses a risk to human health and/or the environment. The EPA maintains a National Priority List of Superfund sites slated for remediation and clean-up. Superfund sites in Northwest Michigan include the closed Grand Traverse Overall Supply in Leelanau County; and the Charlevoix Municipal Well site in Charlevoix County.

Threatened & Endangered Species in Northwest Michigan

A threatened species is a plant or animal that is at high risk of becoming endangered. An endangered species is a plant or animal that is threatened by extinction. Management efforts are required by law to protect the listed species as well as the ecosystems they depend on. Some of the region's most imperiled species are detailed below.

Pitcher's Thistle • *Cirsium pitcheri*

Federal status: *Listed Threatened*

State status: *Threatened*

This rare perennial thistle grows in open sand dunes and beaches along the Great Lakes shoreline. Pitchers thistle only blooms once in its lifetime after maturing over a five to eight year non-flowing period. The species is threatened because it grows in coastal dune environments where increased commercial and residential development, road construction, and recreational use have removed, fragmented, or altered dune habitats.

Counties: *Antrim, Benzie, Charlevoix, Emmet, Grand Traverse, Leelanau, Manistee*

Kirtlands Warbler • *Setophaga kirtlandii*

Federal status: *Endangered*

State status: *Endangered*

The Kirtlands Warbler is a small songbird with a bluish gray back and yellow underside. It has a particularly limited breeding habitat, as it requires homogenous jack pine forests composed of trees ranging from 1-5 meters in height and less than 20 years old. Due to human fire suppression, jack pine stands have not been able to regenerate naturally and provide this habitat. The parasitic cowbird is an additional threat to the species. Without a defense mechanism to protect its nests from the cowbird, the success of warbler fledglings is limited. Intensive management is therefore essential to the survival of the Kirtland's warbler; populations depend on cowbird removal and the continuous regeneration of jack pine habitat.

Counties: *Benzie, Charlevoix, Emmet, Leelanau, Manistee*

Piping Plover • *Charadrius melodus*

Federal status: *Endangered*

State status: *Endangered*

This small, stocky shore bird with sandy-colored plumage inhabits sandy, wide, open beaches along the Great Lakes shoreline and some extend into nearby micro-habitats such as interdunal wetlands and small rivers. Piping plovers breed in Michigan and migrate south for the winter. Breeding areas, the quality of foraging and roosting habitats, and the reproductive success of the birds have all suffered from increases in shoreline development, shoreline recreational use, and fluctuations in lake levels. Habitat protection and public education are critical for the survival of this species.

Counties: *Benzie, Charlevoix, Emmet, Leelanau, Manistee*

Indiana Bat • *Myotis sodalis*

Federal status: *Listed Endangered*

State status: *Endangered*

The small and social Indiana bat requires very specific cave conditions for hibernating. Hibernating for six months in large numbers, bats huddle in groups of up to 500 per square foot. The limited availability of suitable caves coupled with the social nature of these bats makes them a highly vulnerable species. Any disturbance to a cave can be devastating for the overall Indiana bat population. Caves must be protected to ensure that hibernating conditions remain stable. Protecting the forests where the bats summer is also important for survival of the species.

Counties: *Manistee, Benzie*

Lake Herring • *Coregonus artedii*

Federal status: -

State status: *Threatened*

Also known as cisco, this member of the salmon family inhabits deep inland lakes and the waters of the Great Lakes. Once one of the Michigan's most productive and important commercial species, Great Lakes populations were depleted by over-fishing and invasive species. On the inland lakes, pollution has been the greatest threat. Eutrophication caused by nutrient enrichment forces the species out of its cold water habitat, making it susceptible to summer kills.

Counties: *All of the region's coastal counties except Emmet.*



Opportunities: Land

Many activities that affect our region's natural resources are regulated by state and federal law. However, gaps in these state and federal regulations leave many opportunities for local policies to provide further protection of wetlands, coastal areas, forestland, and other important natural areas

Setting aside buffers of naturally growing grasses, shrubs, and trees has been shown to protect the health of streams, wetlands, rivers, or lakes. These buffers must be large enough to capture surface runoff and must be permanently preserved.

When land is permanently protected by local or regional conservancies, the benefits of large areas of green infrastructure are maximized. Communities can use open space or cluster zoning to encourage the preservation of large tracts of undeveloped land, and can also work with partners such as land conservancies to consider conservation programs that protect these areas in perpetuity.

Many local master plans have prioritized the preservation of the region's scenic views. These communities may conduct

Setting aside buffers of naturally growing grasses, shrubs, and trees has been shown to protect the health of streams, wetlands, rivers, or lakes.

Some communities use overlay districts in coastal areas to add an extra layer of land use considerations in areas that are of special concern. Site plan review and design standards, along with provisions for setbacks, native landscaping, and impervious surface restrictions, can be used to mitigate the impacts of development in coastal areas.

viewshed protection studies in order to set priorities and make recommendations concerning the need for additional policy and/or regulations. Zoning protections to achieve these objectives can include limitations on the height of structures in view corridors, ridgeline development ordinances, screening or landscaping requirements for various development types, and site plan review with design guidelines for development in priority viewsheds.



➔ Local Implementation Checklist: Natural Resources

Planning and zoning are important implementation tools for communities that are working to preserve and protect natural resources. The Local Implementation Checklist identifies some examples of how communities in Northwest Michigan and other parts of Michigan have addressed natural resources protection in their local policies. Communities may consider this language, and/or Framework for Our Future Strategies, when updating their own local policies.

Master Plan Goals and Objectives

A master plan is a guide that's intended to shape local decisions about managing resources, directing growth, and how development should be designed. Master plans help the community understand current conditions, build a vision for the future, make recommendations about actions to take on various community issues, and act as the foundation for zoning ordinances.

Master plans region-wide call for the preservation of natural resources. Some include general statements, while others include specific supports for water quality, land preservation, or stormwater-related issues. Basic environmental master plan language may include goals and objectives such as:

Maintain, improve, and protect the quality of surface and groundwater resources

- Identify watersheds, lakes and rivers, groundwater recharge areas, wetlands, and other sensitive natural areas.
- Develop and implement stormwater management plans
- Consider zoning changes to establish minimum setbacks from and vegetative buffers around water bodies
- Consider zoning changes that minimize impervious surface coverage in new development
- Consider zoning changes that encourage or require innovative stormwater management systems that incorporate low-impact development features in order to minimize runoff and preserve water quality
- Consider ordinances requiring point-of-sale inspections of septic systems
- Consider development and implementation of groundwater wellhead protection plans
- Encourage the use of community wells/ water systems where appropriate
- Consider zoning or other policies to regulate activities contributing to the spread of invasive species

Maintain, improve, and protect the community's habitat, forestland, and green infrastructure assets

- Inventory and identify sensitive natural features that should be preserved and protected
- Consider zoning incentives for preservation of natural features or open space within a green infrastructure network
- Work with community stakeholders to ensure that both public and privately-owned lands implement careful forest management and innovative development techniques that enable an economic use of the land while preserving key features and areas
- Work with community stakeholders and nonprofits to ensure that large and interconnected areas of green infrastructure lands are preserved and maintained
- Consider environmental protection overlay ordinances to protect environmentally sensitive areas such as dunes, steep slopes, and wetlands
- Consider zoning changes to encourage cluster development and/or low impact design regulations

Protect, preserve, and enhance scenic beauty

- Identify and prioritize significant viewsheds and develop alternative approaches to preserve them while permitting reasonable use and development of privately-owned lands
- Consider zoning changes to protect ridgelines and viewsheds
- Consider lighting ordinances that protect dark skies

Local Implementation Checklist: Natural Resources

Zoning Ordinance Elements

Zoning ordinances are local laws that regulate land and buildings in order to protect the health, safety, and welfare of all citizens. It helps define how properties are used, what new buildings look like, and how much development can occur in a community.

Zoning is an important tool for communities that are working to preserve and protect water quality, green infrastructure, and other natural resource component. Communities throughout Northwest Michigan have adopted ordinances that regulate development in sensitive areas. Many of these ordinances recognize the implications with state or federal legislation governing natural resources to complement or fill in the gaps of these laws. Elements might include zoning regulations that:

- Include the preservation of natural resources as a standard for review of special use permits and/or planned unit developments (PUDs)
- Require coordinated permits from all local, county, state, and federal permits
- Limitations on impervious surface cover (15% is a commonly used maximum)
- Require riparian buffers
- Establish minimum setbacks for shorelines and wetlands
- Provide cluster development/open space zoning options that include provisions for flexible site design, networked green infrastructure, and low impact development features
- Prohibit invasive and exotic species from being used in riparian buffer zones
- Establish keyholing requirements to manage lake access
- Encourage shared or shorter driveways
- Allow for flexible parking to minimize impervious surface coverage
- Require landscape and stormwater management requirements for parking
- Establish site plan review approval standards to address stormwater/groundwater impacts
- Protect viewshed and ridgeline protection ordinances
- Require dark sky lighting requirements to shield light from neighboring property owners
- Provide incentives for use of low-impact development techniques to mitigate the impacts of impervious surface coverage, in return for a larger building footprint.

➔ Framework Strategies

As a resource for communities in Northwest Michigan, the *Framework for Our Future* identifies a number of strategies and actions that communities can take locally to address their specific needs. Because each community identifies their own goals, through public input, local discussions, and need analyses, the strategies and actions identified in the Framework are not intended as recommendations for any communities to implement or adopt. Rather, they are provided as a resource list of potential actions that, if desired, can be taken locally and/or used as model language for local master plans, organizational strategic plans, and other policy documents, to address various community needs.

The strategies and actions in the Framework were developed from public input and local, regional, statewide, and national sources. Many are based on public input obtained during the *Framework for Our Future* process in events, focus groups, interviews, online discussions, and community dialogues, and were also drawn from or based on master plan language from existing adopted master plans within and outside the region. Others reflect state or national best practices designed to address specific issues.

Strategies are grouped around four major themes that reflect needs and potential actions for each community issue.

Education, Data & Outreach. Often, taking action on a community need requires a solid understanding of the need, as well as public consensus on the appropriate course of action. *Education, Data, & Outreach* strategies address data gaps, outreach needs, and educational opportunities that can help to improve community understanding and awareness around a particular issue.

Planning & Policy. Many community issues can be addressed in part by local policy, such as master plans and zoning ordinances. *Planning & Policy* strategies identify broad policy goals and specific changes to master plans or zoning ordinances that can impact a particular issue.

Financing & Incentives. Communities can use funding and incentive tools to encourage private, public, and nonprofit initiatives and activities that meet local goals. *Financing & Incentives* strategies identify opportunities that can enhance organizational capacities, as well as incentives that may help communities work with the private sector and others to meet local goals.

Development & Implementation. Goals for each community issue center around programs, development or initiatives that directly and tangibly impact community needs. *Development & Implementation* goals include

specific strategies designed for on-the-ground activities and bricks-and-mortar implementation.

Each strategy includes additional information intended to aid in implementation, including:

Why?

Each strategy is designed to address a certain issue. Information is provided to detail specific community needs that might be met through implementation of the strategy.

Actions

To implement each strategy, communities can consider taking action in a number of ways. This section identifies some specific actions that communities might consider to reach local goals.

Tools & Resources

A number of existing tools or resources are available to partners that are interested in taking action on a particular strategy. This section identifies, and provides links to, tools and resources such as:

- Research or background studies that can help communities identify specific community needs in order to develop appropriate policy or initiatives
- The *Framework for Our Future* Action Guide, which provides details and implementation guidance for planning and zoning actions identified in the Framework
- Guidebooks and workbooks that provide step-by-step information on actions and the implementation process
- Examples of where the action has been implemented regionally
- Local, regional, state, or national reference documents that can provide additional guidance

Links to all resources are available online at www.nwm.org/rpi.

Measures

Communities can track progress toward these goals and actions by benchmarking data identified in this section. While some measurement data will be locally generated and tracked, many indicators can be accessed on the regional data portal www.benchmarksnorthwest.org.

Natural Resources: Data, Education & Outreach

Improve awareness, knowledge, and understanding of the needs and capacities of the region's natural environment

Strategy 1	Provide and promote natural resource educational & stewardship opportunities for residents and visitors	
Why?	Because individual actions have the potential for substantial impacts, public understanding of those impacts is key in protecting natural resources. Providing education and outreach to citizens and visitors will foster understanding and engagement in natural resource protection.	
Actions	Develop educational programs and resources for students in partnership with schools and other stakeholders	Expand collaboration among education organizations and agencies to provide a continuum of environmental experiences for all ages
	Encourage and support the development of a regional hub for place-based education	Develop outreach resources and materials for residents and visitors
	Develop systems and opportunities for engaging volunteers in resource management and education	
Tools & Resources	Grand Vision Natural Resources Network	
Measures	Survey results	
Strategy 2	Develop and regularly update data and resources to facilitate sound decision-making about natural resources	
Why?	Planners and community leaders must understand how local activities impact the region's natural resources in order to most effectively protect these resources. Accurate, up-to-date, and relevant data about water quality, land use patterns, and economic impacts of natural resources can help decision-makers enact and enforce policies that are effective in addressing specific challenges and in meeting local environmental goals.	
Actions	Develop accessible, site-specific and landscape-scale baseline and trend information about fish and wildlife resources and their habitats	
Tools & Resources	Benchmarks Northwest	Michigan Department of Environmental Quality
	Michigan Department of Natural Resources	
Measures	Number of local governments receiving data/resources	

Natural Resources: Data, Education & Outreach

(continued)

Strategy 3	Raise awareness among developers, property owners, and local units of government of natural resource protection needs	
Why?	Development, construction, and other activities occurring on private property have far-reaching impacts on our ecosystem. Ensuring that those involved in the development process have access to information and tools that can minimize impacts to and encourage remediation of the natural environment is critical in preserving and enhancing the region's natural resources.	
Actions	Provide technical assistance to aid developers, builders, and landowners in addressing natural resource issues	
	Work with state and regional partners to provide/participate in regular workshops, presentations, and free and convenient education opportunities such as webinars on natural resources needs and protection techniques/tools	
Tools & Resources	<i>Watershed Center Low Impact Development Design guidebook</i>	<i>Low Impact Development Manual for Michigan: A Design Guide for Implementers and Reviewers (SEMCOG)</i>
	Filling the Gaps: Environmental Protection Options for Local Governments, 2nd Edition	<i>Planners Moments</i>
	<i>New designs for growth Guidebook</i>	
Measures	Number of property owners served by environmental resource organizations	

Natural Resources: Planning & Policy

Coordinate policies, plans, and ordinances that protect, preserve, and enhance natural resources

Strategy 1	Consider plans, programs, and ordinances that address water quality needs and issues	
Why?	The region is defined in large measure by its water resources, which provide critical fish and wildlife habitat as well as the basis for tourism, recreation, and development. Local policies can help to protect help to ensure continued high quality of life, economic prosperity and environmental quality by protecting and preserving these resources.	
Actions	Consider zoning to establish minimum setbacks from waterbodies	Consider zoning changes to reduce impervious surface coverage for driveways, parking lots, sidewalks, and roads
	Consider zoning changes to provide for vegetative buffers or greenbelts around water resources	Consider zoning changes to encourage or require low impact development techniques
	Develop, update, and implement watershed management plans	Consider ordinances requiring point-of-sale inspections of septic systems
	Consider development and implementation of groundwater wellhead protection plans	
Tools & Resources	Filling the Gaps: Environmental Protection Options for Local Governments (includes model ordinances)	Watershed Management Plans – Local examples include Tip of the Mitt, Boardman River, Crystal Lake, etc
	Tip of the Mitt Watershed Local Ordinance Gap Analyses	
Measures	Number of plans with water quality protection goals	Number of plans with water quality protection goals
Strategy 2	Consider plans, programs, and ordinances to protect and preserve environmentally sensitive lands	
Why?	State law regulates some development on environmentally sensitive lands, but protections may be piecemeal. Local governments can further protect high-value environments through a number of policy tools that allow for development options while mitigating its negative impacts.	
Actions	Inventory and identify sensitive natural features or high-quality environments that should be preserved and protected	Consider zoning incentives for preservation of natural features or open space within a green infrastructure network
	Consider environmental protection overlay ordinances to protect environmentally sensitive areas such as dunes and wetlands	
Tools & Resources	<i>New Designs for Growth Green Infrastructure</i>	Emmet County High Risk Erosion a Areas and Bluff Protection Ordinances
	Filling the Gaps: Environmental Protection Options for Local Governments	
Measures	Number of plans with environmentally sensitive areas goals	Number of zoning ordinances with environmentally sensitive areas regulations

Natural Resources: Planning & Policy

(continued)

Strategy 3	Consider plans, programs, and ordinances that preserve green infrastructure	
Why?	Large, interconnected networks of greenspace and waterways provide numerous ecological and economic benefits. However, development pressure has the potential to break up these networks. Communities can provide tools to encourage development patterns that protect large acreages of open space in order to realize their maximum benefits.	
Actions	Consider zoning changes to encourage cluster development/low impact design regulations	
Tools & Resources	<i>New Designs for Growth Guidebook</i>	<i>Watershed Center Low Impact Development Guidebook</i>
Strategy 4	Consider plans, programs, and ordinances that preserve the region’s scenic beauty and viewsheds	
Why?	Northwest Michigan’s scenic beauty draws new residents, business, and tourism; but rapid or unplanned development can detract from scenic views. Some regulations can work to minimize the impacts on the region’s scenic qualities by establishing standards for siting and design in viewsheds.	
Actions	Consider zoning changes to protect ridgelines and viewsheds	Consider lighting ordinances to ensure “dark skies”
Tools & Resources	Leelanau Township Ridgeline Ordinance Emmet County Scenic Resource District	Emmet County Viewshed Protection Overlay Dark Skies Model Ordinance
Measures	Number of plans with viewshed protection goals	Number of zoning ordinances with viewshed protection measures
Strategy 5	Consider plans, programs, and ordinances that mitigate invasive species impacts	
Why?	While many factors contributing to the spread of invasive species extend beyond local or regional boundaries, some local policies can slow or mitigate the impacts or spread of harmful invasives	
Actions	Consider zoning incentives that prohibit the use of invasive species in landscaping and/or vegetative riparian buffers	Consider adoption of ordinances that regulate activities contributing to spread of invasive species
	Consider development of forestry management plans that address and mitigate the spread of invasive species	
Tools & Resources		
Measures	Number of master plans and forestry management plans with invasive species management goals	Number of zoning invasive species management measures

Natural Resources: Financing, Incentives, & Partnerships

Support, enhance, and expand nonprofit and private sector engagement in natural resource protection

Strategy 1	Encourage and support private sector engagement in natural resources goals	
Why?	Because much of the region’s land area is privately owned, private property owners and developers have an important role to play in environmental protection. Incentives and outreach can help to foster engagement and action on private properties.	
Actions	Provide or participate in brownfield redevelopment initiatives to address existing sources of contamination	Work with private property owners on riparian buffers
	Develop programs to incentivize private property owner remediation of erosion, stormwater runoff, and other water quality issues	Encourage the use of low-impact design stormwater treatment techniques
	Encourage existing, expanded, and new businesses that are rooted in sustainable business models	
Tools & Resources	<i>Low Impact Development: A Guide for Implements and Reviews (SEMCOG)</i>	Watershed councils
	<i>Watershed Center Low Impact Development Guidebook</i>	
Strategy 2	Support and facilitate community partnerships between natural resources stakeholders and community leaders	
Why?	Partnerships are an important mechanism for building and sustaining capacity among stakeholders. They bring together diverse skills and resources for more effective outcomes that address multi-faceted issues. By making the best use of these resources, partnerships can improve program results and add capacities to existing organizations	
Actions	Build, maintain, and sustain diverse, multi-sector partnerships to work collaboratively on shared goals	Engage local units of government in natural resource partnerships and networks
Tools & Resources	Grand Vision Natural Resources Network	

Natural Resources: Development & Implementation

Protect and preserve the water resources, forests, natural areas, and scenic beauty of Northwest Michigan

Strategy 1	Maintain, improve, and protect the region’s groundwater, surface waters, and related ecosystems	
Why?	The region is defined in large measure by its water resources, which provide critical fish and wildlife habitat as well as the basis for tourism, recreation, and development. Communities can take a number of important steps to ensure the quality of these resources for generations to come.	
Actions	Enhance, improve, and increase wetlands	Remove, manage, and mitigate the impacts of invasive species
	Include vegetative shoreline buffers in new property development	Conduct stream restorations/reduce erosion on identified priority sites
Tools & Resources	Filling the Gaps: Environmental Protection Options for Local Governments (includes model ordinances)	Tip of the Mitt Watershed Ordinance Gap Analyses
	Boardman River Townships Action Plans	
Measures	Number of waterbodies meeting DEQ water quality standards	
Strategy 2	Maintain, improve, and protect the region’s habitat, forestlands, and green infrastructure assets	
Why?	Well-connected green infrastructure systems maintain ecological processes, sustain air and water resources, and contribute to the health and quality of life for the region’s communities and people. A number of local practices can prevent the fragmentation of these resources in order to ensure they provide maximum benefits.	
Actions	Improve plant and wildlife habitat and connectivity	Encourage native vegetation in open spaces
	Remove, manage, and mitigate the impacts of invasive species	Practice development techniques that preserve large acreages of forestland and open space
	Support a greater and more sustainable forest products economy	
Tools & Resources	<i>New Designs for Growth Guidebook</i>	Invasive Species Network
Measures	Percent change in forest and open space land cover	

Natural Resources: Development & Implementation

(continued)

Strategy 3	Ensure access to natural areas while balancing access with natural resource protection goals	
Why?	Outdoor recreation is a beloved and profitable element of life in Northwest Michigan, but it requires a high-quality natural environment. Continuing to enhance opportunities for outdoor recreation and public access while preserving that environment provides an environmental and economic win-win.	
Actions	Improve, expand, and enhance parks and trail systems	Identify and inventory priority lands for public access and conservation
	Improve, expand, and enhance public fishing and hunting opportunities	
Tools & Resources	<i>New Designs for Growth Green Infrastructure Guidebook</i>	
Measures	Number of parks, natural areas, and miles of trails	
Strategy 4	Protect and enhance the region’s scenic views and beauty	
Why?	Scenic views of lakes, forests, fields, and shoreline are beloved by residents and also drive much of the region’s tourism. Preserving this asset is critical to economic development and quality of life.	
Actions	Use development practices that mitigate impacts to viewsheds	Prioritize scenic views and viewsheds in land preservation efforts

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Revisions

The **November 2016 Addition** has been edited for formatting issues, image additions, pagination, and grammatical errors. The substantive content of *A Framework for Natural Resources in Northwest Michigan* is as approved by the Networks Northwest Board on December 8, 2014.



In 2014, the Northwest Michigan Council of Governments (NWMCOG) adopted a new name to more clearly identify itself and the services it offers to businesses and organizations in northwest Lower Michigan. As such, NWMCOG became Networks Northwest. The Networks Northwest name represents the collaborative nature of the work that goes on within the organization and among the many businesses, organizations, and units of government which it serves.

The name change coincided with Governor Snyder's Regional Prosperity Initiative, which puts a new emphasis on centering many state programs and services around common geographic regions. In response to that initiative and to streamline operations, NWMCOG's two governing boards voted to start meeting together and operating as a single board. That board now operates under the Networks Northwest name.

Network Northwest facilitates and manages various programs and services for the 10 county region. These programs include Northwest Michigan Works, Prisoner Reentry Program, Small Business Development Center, Procurement Technical Assistance Center, Global Trade Alliance of Northern Michigan, various business services, and many different regional planning initiatives in response to our communities' requests and needs.

Network Northwest member counties (Michigan's Prosperity Region #2) are: Antrim, Benzie, Charlevoix, Emmet, Grand Traverse, Kalkaska, Leelanau, Manistee, Missaukee, and Wexford.



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