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UNIVERSITY OF MICHIGAN

Environmental Planning Guidebook for Michigan's Great Lakes Coastal Communities

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Michigan Engaging Community through the Classroom (MECC)

This project was completed as part of the University of Michigan's Michigan Engaging Community through the Classroom (MECC) program. MECC is a teaching initiative that combines multi-disciplinary teams at UM and other universities with stakeholder-based community engagement efforts. MECC has worked within communities all around the state of Michigan, identifying community needs, engaging in stakeholder collaboration, and running projects from development through completion typically within a single semester.

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1: Introduction and Overview

The Manistee/Chikaming Township's Lakeshore Erosion MECC project worked with several partner communities located along Michigan's Lake Michigan coastline - the City of Manistee and Chikaming Township - to develop this environmental planning guidebook, which is intended to help Michigan's Great Lakes coastal communities better prepare for incorporating environmental planning principles into their local planning efforts. The key community stakeholders who participated in this effort included David Bunte, Township Supervisor, and Douglas Dow, Project Manager, Chikaming Township, and Thad Taylor, City Manager with the City of Manistee. Participating faculty and students included teams from the University of Michigan's Taubman College of Architecture and Urban Planning, the UM School of Law, and the UM School for Environment and Sustainability, along with a team from Michigan State University's Department of Geography, Environment, and Spatial Sciences.

Introduction

The state of Michigan truly is the Great Lakes State, with more than 3,000 miles of Great Lakes shoreline representing more than 60 percent of the total U.S. Great Lakes coast.[1] While federal and state coastal programs play an important role in managing the development and use of those shorelines, local governments play an especially important role, acting through their community planning, zoning, infrastructure service, and other development management efforts.[2] That means, in turn, that each of the almost 300 Michigan counties, townships, cities, and villages that touch Great Lakes waters has an important role to play.[3]

The purpose of this report is to provide a guide for Michigan's Great Lakes coastal communities seeking to better incorporate environmental planning strategies into their local planning and development management efforts. While not addressing exhaustively everything a community might do toward that end, we have compiled useful information on what environmental planning is, focusing especially on issues most relevant for coastal communities; how landscape form can affect planning efforts; and how a community can integrate environmental analyses, goals, and policies into their local master planning efforts thoroughly and effectively. The key aspects of environmental planning addressed in detail by this guidebook include the following:

Water: Communities should ensure that they have adequate access to fresh surface waters and groundwaters for consumption and to protect natural resources, as well as to ensure they are taking adequate steps to keep those waters clean.

Land: Communities should ensure that their urban and rural landscapes, wetlands, natural habitats, and working landscapes are appropriately developed and conserved in environmentally and economically sustainable ways.

Hazards: Coastal communities especially should use their planning to identify and address risks such as high-energy waves and inundation along their Great Lakes shorelines, along with long-term shoreline recession and riverine flooding.

Energy: Finally, communities should understand where their energy supplies come from and how energy conservation and green energy production might be undertaken within their jurisdiction to lower overall energy costs and to help mitigate the impacts of climate change.

What is environmental planning and why is it important to Michigan's Great Lakes coastal communities?

Environmental planning is a process that can benefit a community by guiding its efforts to protect and improve air and water quality, conserve long-term supplies of water, produce and use energy efficiently, and conserve working, natural, and other open spaces. Communities can also use planning to increase their resiliency by reducing exposure to natural hazards, maintaining natural features, and adding green infrastructure. Environmental planning is a continuous process, and if engaged effectively it can produce a natural and built environment that is highly livable and sustainable to maintain.

The environmental planning process helps inform decision-making, with a particular emphasis on achieving sustainability and its attendant environmental, social, and political goals. At the most fundamental level, this means making decisions that protect landscapes and their resources so they are available for generations to come. There are a variety of mechanisms through which communities can implement their planning efforts to enhance resiliency and sustainability, including taxation, laws, regulations, financial incentives, and infrastructure spending.[4] When communities engage these efforts to guide local development, they are expressing a commitment to the natural world both for its own sake and for the long-term benefits it provides for residents. Environmental planning, when done well, guides decisions that are mindful of the importance of sustaining a certain level of environmental protection, while also pursuing development paths that are socially just and economically sound.

Urban planners and public officials may encounter challenges in fully addressing environmental issues in their work, whether due to a lack of training, ever-changing conditions in the natural world and society, or continually improved scientific knowledge of those changing conditions.Through this guidebook, we hope to expand the capacity of communities for environmental planning as a means towards improving economies, increasing social equity, and protecting the environment.

Who is this Guidebook For?

This guidebook is designed specifically to assist coastal communities that are preparing to adopt local master plans or to update their current plans by identifying and briefly explaining key environmental topics that should be folded into those planning efforts. The guidebook should be most useful to local elected officials, planning commissioners, and planning staff as they scope out the topics to engage and methods to employ in an impending master plan update effort.

In addition to describing important environmental planning topics and methods in general, the guidebook engages with two case-study communities to help illustrate those topics and methods. It is important to note that while our research focuses on those two case studies, cities around the Great Lakes all face the need to plan for hazard mitigation, habitat restoration, and other

climate-related influences particular to the Great Lakes. Several coastal cities have already taken steps proactively to address such environmental concerns. For example, according to the Great Lakes Coastal Resilience Planning initiative, both Ozaukee and Brown Counties in Wisconsin, as well as St. Joseph in Michigan, have utilized land use planning and zoning decisions to help with hazards from coastal flooding to shoreline erosion.[5] Following from those kinds of initiatives,this guidebook should be helpful to inform similar strategies holistically and more broadly for determining the best needs of your community going forward.

As part of updating master plans, we want to highlight the importance of community engagement. This allows meaningful community input into and feedback on environmental initiatives, and it serves as an educational opportunity for planners to present the co-benefits associated with various planning initiatives. This process is especially important because, while adding to the efforts required to produce a plan up front, it can deter potential obstacles for achieving planning goals throughout the plan's adoption and implementation by garnering the support of the community. One way planners can practice community engagement, for example, is by establishing "green teams" that are made up of government officials, residents, and other stakeholders from the community. Many cities across Michigan such as Traverse City and Grand Rapids have established green teams that serve in this capacity. Similarly, the City of Manistee, one of our case-study communities, developed a green team as part of a 2010-2011 grant program that served an important role in developing their 2011 Energy Efficiency and Renewable Energy Action Plan.

Overview of Chikaming Township and City of Manistee, and their current environmental work

We engaged with two communities directly as case studies for this work, including Chikaming Township and the City of Manistee (see Figure 1.1 for locations), both located on the shores of Lake Michigan. We engaged with those communities because of the work they have already taken in areas related to this guidebook, given their willingness to work with us for this project, and because the settings and issues they face are representative of many of Michigan's Great Lakes coastal communities. We use these communities especially to help illustrate the important environmental planning topics we address and how the planning methods we describe might be applied to enhance local master planning efforts.

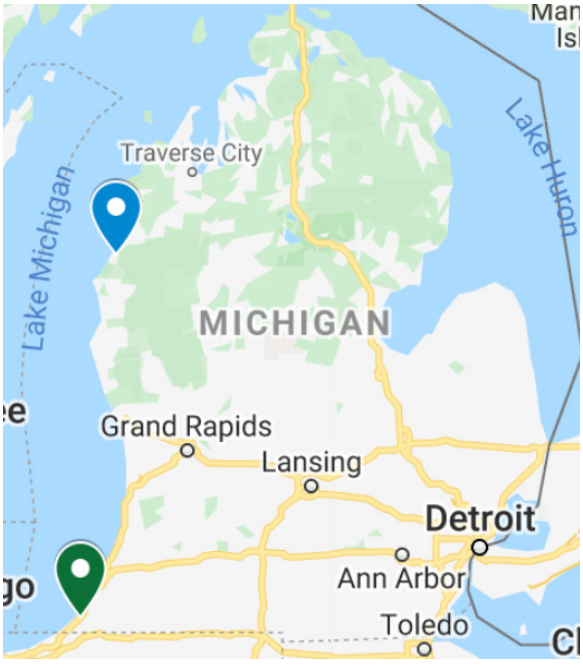

Figure 1.1: Location of Chikaming (Green) and Manistee (Blue). Retrieved from Google Maps.

Chikaming Township

Chikaming Township is located in far Southwest Michigan, about 10 miles north of the Indiana border. The most recent population of the township was 3,091 residents, according to the 2019 American Community Survey (ACS) estimates.[6] The township contains several unincorporated communities, including Sawyer, Harbert, and Lakeside. Like many other Michigan lakeside townships, Chikaming Township is primarily rural in character, although there is a fair amount of residential development near and along the shoreline. The current zoning of the township reflects this (see Figure 1.2). Areas west of I-94 toward the lake are zoned primarily either for residential or commercial uses, while those east of I-94 are zoned primarily for agriculture. The strip along the lakefront is mostly zoned and built-out for homes, although there are several public beaches and free access points for all residents and visitors to access the shoreline.

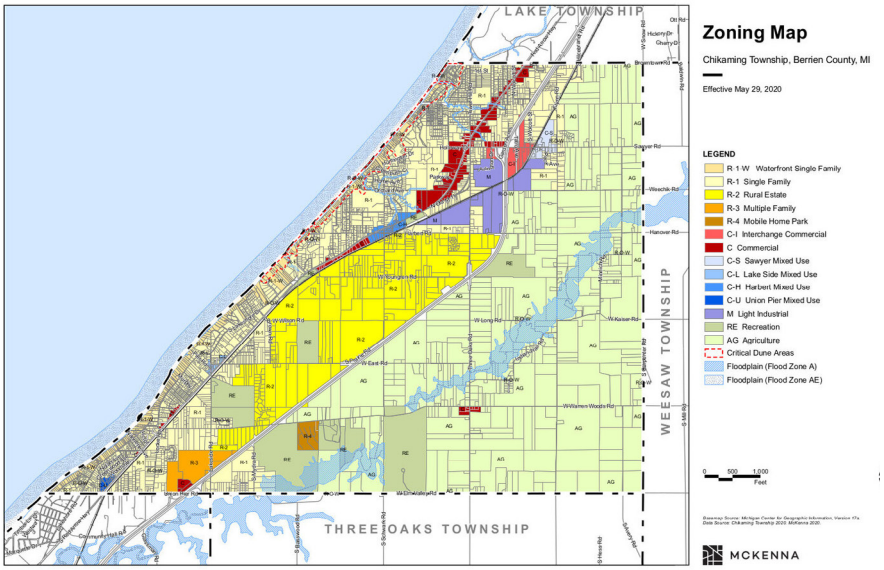

Figure 1.2: Zoning Map of Chikaming Township.
Retrieved from the Chikaming Township website.

Chikaming Township and the surrounding environs currently have plans, policies, and resources with an environmental focus. Berrien County's 2015 Master Plan, within which Chikaming Township is located, specifically touches on green infrastructure. Goals include utilizing watershed plans to guide the development and improvement of stormwater, protect natural resources, and pursue Low Impact Development (LID) strategies, among others.[7] Additional policies and guidelines are currently administered by the Southwest Michigan Planning Commission (SWMPC), which encompasses Berrien County, as well as nearby Cass and Van Buren Counties. In addition to being a repository for information on environmental topics ranging from LID to water conservation, the SWMPC also coordinates a Regional Sustainability Committee, helps provide resources for grants for communities, assists with recreation plans, and conducts informational workshops for communities on topics like wetlands.[8] Chikaming Township, in particular, is currently working on addressing issues of shoreline erosion. The township recently passed an ordinance prohibiting the installation of permanent hardened shoreline armoring.[9]

City of Manistee

The City of Manistee is located on the Northwest shoreline of the Lower Peninsula of Michigan. It is the fourth largest city in the region, with a population of about 6,083 residents, according to the 2019 ACS estimates.[10] Historically, the city had upwards of 14,000 residents in the early 1900s during a boom era for both lumbering and salt mining.[11] The city is mostly urbanized and built out within its boundaries, with perhaps the exception being the southwest area of the city, part of which encompasses the Manistee Golf and Country Club. The city is currently zoned primarily for residential and commercial development, with a bit of light industrial located along the north end of town (Figure 1.3). The Lake Michigan shoreline within the city is composed of sandy beaches with some moderately high bluffs, as well as an historic lighthouse and operational coast guard station.

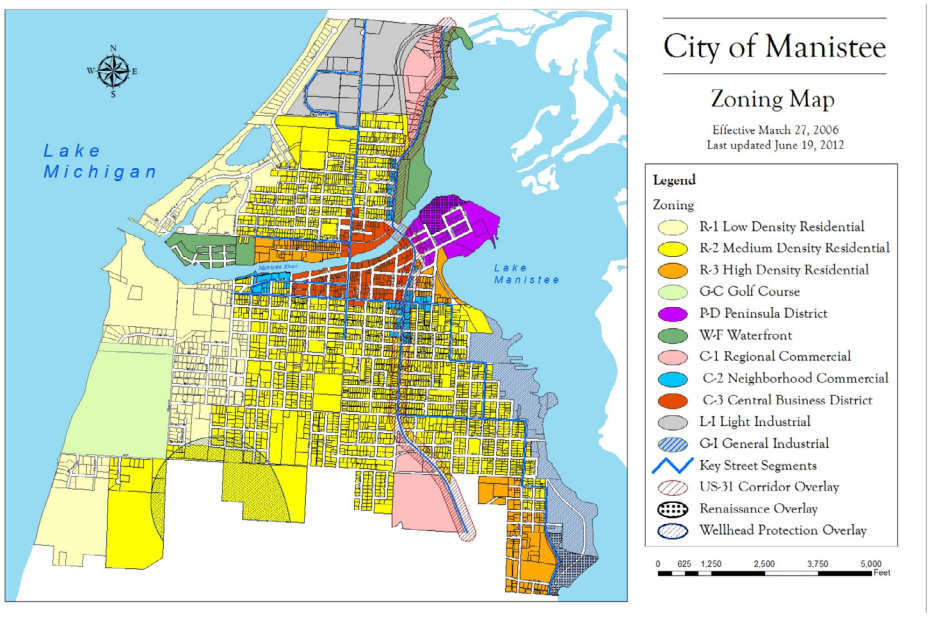

Figure 1.3: Zoning Map of City of Manistee.
Retrieved from the City of Manistee website.

Both the City of Manistee and Manistee County have given thought to planning for the environment in their plans. In the City of Manistee's current master plan, water quality, in particular, is mentioned as an important environmental issue, given the use of Manistee Lake and River and Lake Michigan as both industrial and transportation resources as well as a recreational resource.[12] This emphasis on water quality protection also extends to wellhead protections for drinking water.

Environmental concerns are also addressed by Manistee County's Master Plan (2008), particularly through a discussion of "Issues of Greater than Local Concern." Three of the four topics addressed relate directly to the environment, including watersheds, the Lake Michigan shoreline, and federal forests.[13] The county master plan also presents environmentally focused goals, including the reduction of environmentally contaminated lands, establishment of a county-wide recycling program, maintenance of natural resources, advocacy for the utilization of alternative energy sources, and encouragement for local communities to establish their parallel guidelines.[14]

Report overview

The remainder of this report focuses on the applicability of the environmental topics concerning water, land, hazards and energy. For each of these topics, we provide a background on the topic and identify some key goals for coastal communities to consider. For Water, we focus on planning for water quality, and our recommendations look at addressing both point sources of pollution like combined sewer overflows (CSOs), as well as non-point sources of pollution such as agricultural and stormwater runoff. For Land, we focus on five key types of land cover types: forests, wetlands, agriculture, coastal areas, and urban land, and our recommendations center on strategies to preserve and enhance these different land cover types and better coordinate how they work together. For Hazards, we focus on coastal hazards of special concern to a Great Lakes coastal community, including high-energy waves, shoreline recession, and flooding. For Energy, we focus on planning for advancing both clean energies and energy efficiency and their benefits for people, the planet, and the economic well-being of a community. After touching on each of these topics, we then look at how they can be applied to both Chikaming Township and Manistee to help illustrate best practices for other coastal communities in Michigan and the Great Lakes.

Paying for climate resilience in coastal communities

Municipalities can leverage a number of conventional finance and funding mechanisms to pay for coastal resilience, such as municipal general obligation or revenue bonds, property taxes, user and licensing fees, special districts, tax increment financing, and private sector investment. Newer approaches are also emerging, such as use of insurance premiums and parametric insurance for natural capital. Federal and state grants may require cost sharing, so even if municipalities are able to bring in external funds they will likely still need to cover a portion of the costs. More information and case study examples of conventional municipal finance and funding mechanisms for resilience can be found in the following report: Playbook 1.0: How Cities Are Paying for Climate Resilience.

Endnotes, Intro and Overview

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2: Water

Introduction

While water supply is a pressing issue many communities face throughout the nation, Michigan is uniquely positioned in the Great Lakes water basin, where it has bountiful access to freshwater. The greater issue at hand is the quality of water and how various sources of water contamination affect coastal communities and the natural environment. Environmental planning for water quantity and quality can help a community anticipate and address both point and nonpoint sources of pollution, and subsequently the amount of future development it can support.

This section focuses on the water quantity and quality issues that Michigan's coastal communities should address through their local master planning. It then describes examples of the planning tools, policies, and strategies that communities can use to conserve and protect their freshwater resources. Finally, the section examines the water quantity and quality issues present in the cases of Chikaming Township and the City of Manistee, assessing their current water management planning efforts and identifying additional steps these communities might take to enhance those efforts.

Water supply

Overall, Michigan is abundant with both surface water and groundwater. Even so, there are limits placed on water withdrawal and distribution to ensure the health and sustainability of the state's freshwater supplies.

Groundwater withdrawal

When installing a new well for withdrawal, or increasing the withdrawal of an existing groundwater source, the responsible party must make sure that they will not be depleting that source beyond the water table rate of recharge. This is done through registration with the Michigan Department of Environment, Great Lakes, and Energy (EGLE), which tracks groundwater withdrawals throughout the state.[17] In Michigan, a reasonable withdrawal rate is one that does not interfere with nearby water resources or cause a detrimental ecological effect in the region.[18]

Water affordability

Water affordability can be an issue in some parts of Michigan. Communities that rely on public water systems and have a low population density will naturally

need to pay more for their water because the baseline costs of building and maintaining the system are shared among fewer households. For similar reasons, communities that have experienced a decline in population might struggle with climbing water prices, as they are forced to manage outsized water systems built in their more populous pasts.[15] Michigan coastal communities such as Chikaming Township have prominent seasonal populations, which can have a distorting effect on water prices between the winter and summer months. Seasonal residents in these communities might be surprised by their water bills from vacant homes, which have to be maintained even in the wintertime.[16]

Sustainability of water supply

Communities in regions that have sparse populations, like the majority of Michigan's coastal communities, typically have a greater reliance on well withdrawals and septic systems than urbanized regions.[19] Maintaining these systems properly is important, as cleaning up a failed septic system or contaminated wellhead can be prohibitively expensive.[20]

Failed septic systems or wells can lead to the need for the extension of centralized water and wastewater systems in order to remedy water contamination.[21] At the same time, this kind of evolving relationship between infrastructure needs and land development patterns is one of the key dynamics behind the proliferation of urban and suburban sprawl.[22] Lower-density and less compact urban land uses can themselves generate new and additional harmful impacts to the natural environment, and increase maintenance costs for overall infrastructure systems.[23] The Land section of this guidebook goes into more detail about the harmful effects that unmanaged sprawling land patterns can have on the environment.

Water quality

Our very survival requires having adequate access to clean drinking water, food, and energy. Each need is highly connected to each other, however, and actions taken to secure one can negatively affect one or both of the others. In the Great Lakes, for example, nitrogen and phosphorus from farming, as well as mercury linked to coal burning, are common sources of surface water contamination. Agricultural practices and energy production have also caused sediment contamination that impairs the water quality of the Great Lakes. Whether it be a chemical, physical, or biological alteration, these alterations pollute the water when soils and vegetation cannot assimilate or break them down.[24] Communities can use environmental planning to help sustain themselves, as well as the different kinds and varying scales of development they can support, by addressing these potential harms.[25]

Specifically, communities can use environmental planning to anticipate and address both point and nonpoint source pollution that can arise from various land uses. Point sources are pollutants that enter the environment from a fixed, direct source of contamination, whereas nonpoint sources are dispersed pollutants on the landscape not coming from a fixed, single point of discharge, making them harder to monitor and control.

The Great Lakes Basin Compact

Figure 2.1: A map of the Great Lakes-St. Lawrence River basin. Retrieved from USACE.

In 2008, the governing bodies of the region created the Great Lakes-St. Lawrence River Basin Water Resources Compact.[26] The Compact, reaching across state and international boundaries to protect the Great Lakes Basin as a whole, sets the framework for much of the region's water policy. It also dictates the guidelines for managing the basin's water supply, most prominently by incorporating state and provincial pledges to manage the basin's water resources sustainably and responsibly, and by banning new diversions that carry water outside of the basin.[27]

As part of the compact, each state is required to administer a water management program - in Michigan's case through the Department of Environment, Great Lakes, and Energy - that "ensures that uses overall are reasonable, that withdrawals overall will not result in significant impacts to the waters and water dependent natural resources of the basin...."[28, 29]

The federal government and state governments have a more active role in regulating point source pollution, such as discharges from industrial facilities. The most common source of point source contamination that local governments commonly manage are those coming from combined stormwater and sanitary sewer system overflows (referred to commonly as 'combined sewer overflows' or CSOs). Nonpoint sources of contamination, in contrast, are typically the greater concern to communities in general, including Great Lakes coastal communities. These sources of greatest concern are related typically to stormwater runoff from impervious surfaces, agricultural runoff, and septic system failures.

Point source water pollution

In times of heavy rainfall and flooding, combined sewer overflows (CSOs) can spill into and contaminate adjacent waterways. The amount of sewage that can be dumped is regulated by the National Pollutant Discharge Elimination Systems (NPDES); however, these limits still disturb the surrounding natural and built environment. From January 2018 to May 2019, 6.7 billion gallons of CSO entered Michigan waters.[30] These combined sewer and stormwater treatment systems have led to dangerous e-coli levels and odor, which impede recreational and economic activity and create public health concerns in Great Lake communities. Moreover, with heavier rainfalls becoming more frequent,[31] it will be increasingly difficult for communities to comply with discharge limits, bringing in turn greater economic hardship to those municipalities.

Nonpoint source water pollution

Stormwater runoff threatens water quality when it is unmanaged. Rainfall and snowmelt naturally pick up debris, motor oil, transmission fluid, road salt, fertilizers, insecticides, and other contaminants. This is a common issue in areas with extensive impervious surfaces. Once 10 percent of the watershed area is covered in impervious surface, water quality degradation is likely to occur. Runoff can also occur on open, pervious (i.e., unpaved) land; even there, about half of the rainwater is absorbed and infiltrates into the ground, 40 percent evaporates, and the remaining 10 percent runs off the land.[32] In especially heavy rainfall, flooding can cause even greater water quality degradation as well, on top of road closures, property damage, and other public health concerns. All of those impacts from flooding can be further exacerbated by the lack of both adequate stormwater infrastructure and proactive maintenance,[33] which can lead to economic losses for individual property owners as well as public health impacts.

Additionally, on-site wastewater systems, commonly known as septic tanks and systems, are a source of groundwater pollution when they leak nitrogen, phosphorus, and fecal coliform bacteria into groundwater.[34] In Michigan, there are between 1.3 and 1.4 million onsite septic systems, an estimated 10 percent of which are polluting the environment.[35] Michigan does not have a state-wide septic system regulatory program; the only statewide oversight occurs when systems are installed or discharged into surface bodies of water. The state also oversees

local health department septic regulation through the Michigan Local Public Health Accreditation Program and the permitting process. However, inspection requirements vary by municipalities.

Drinking water contamination

Communities should plan to address the distribution of clean water for drinking and other consumptive uses. Contamination of drinking water with lead from transmission pipes is especially relevant in Michigan due to the Flint water crisis, which has prompted more stringent regulations on drinking water standards within the state. In 2018, the state introduced a Lead and Copper Rule (LCR) which aims to minimize exposure to lead and copper in household water use by establishing requirements for communities that exceed a certain threshold of either contaminant in samples. Requirements can include increased monitoring of water quality, corrosion control treatment, public education, and water line replacement.[36]

Lead or copper contamination tends to be of greater concern in urban and suburban areas with old centralized water systems that were constructed using lead and copper pipes. Central water systems also come with the need for central water treatment.[37] When a water treatment facility fails, it can lead to the entire municipality's water supply becoming contaminated.[38] Water from a central water supply can also end up contaminated if it sits stagnant in pipes as a result of water utility shut offs, or when the pipes go for long stretches of time without use.[39] For these reasons it is important that water continues to flow through pipes regularly, and that there is a contingency plan in place for when water supply is potentially contaminated.

Wellhead zone protection

Keeping well water from becoming contaminated is a primary concern for drinking water and other consumptive uses.[40] EGLE encourages wellhead protection for local communities and provides assistance in building such systems.[41, 42] It is critical to closely monitor these zones for potential contaminants and to have a contingency plan for water provision to the area served by the well in the event of contamination.

Environmental planning tools for water management

Communities can take a number of steps to address the challenges of managing water quantity and quality problems through their planning efforts. In this section we will provide an overview of some of the water management planning tools and strategies that are most applicable to Michigan's coastal communities.

To best preserve water quality and drinking water sources in a cost effective manner, local governments should allow water to percolate through the ground as much as possible. By allowing this natural process, soil filters contaminants from runoff, as illustrated in Figure 2.2, and appropriate

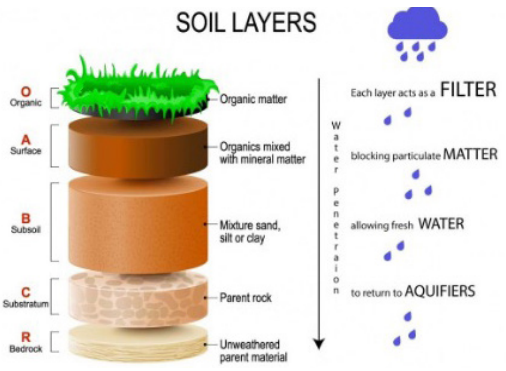

Figure 2.2: Soil filtration visualization Created by Dean Richards with Denbow. Retrieved from: https://www.denbow.com/Soil-Stormwater-Management-Tool/

groundwater levels are maintained. Vegetation and trees, and especially wetlands, play an important role in either absorbing or filtering runoff. Since impervious surfaces block water from percolating through the ground, it is important to complement impervious areas with roadside vegetation, swales, or other systems that slow the flow of runoff and allow the ground to absorb the stormwater. Those landscape treatments can also prevent erosion. Lastly, allowing the ground to absorb stormwater diverts water from the sewer system, which alleviates stress on the built system and better serves the water needs of the natural environment. Tools to help planners accommodate natural filtration processes are listed in Table 2.1.

A good first step to folding water quality and quantity planning into a master planning effort is to conduct a natural resource inventory. That inventory should note the location and quality of the surface and groundwaters within the juris-

Sources of water contamination:	**Mechanism to mitigate or repair harm:**
Stormwater runoff and flooding	• Natural Resource Inventory and Planning - Identify wetlands, stream buffer areas, impaired waterways - Delineate priority cleanup areas to improve water quality • Master Plans - Set goals and adopt policies for improving water quality, such as reducing per capita impervious surfaces • Zoning Ordinance and Maps - Require greater setbacks from rivers and shorelines - Add riparian zone buffers - Encourage compact development • Other Ordinances - Soil erosion - Stormwater management
Agricultural runoff	• Conservation Easements - Acquire easements to ensure conservation of swales and buffers along surface water bodies, wellhead protection areas
Combined sewer overflow (CSO)	Divert stormwater from the system by: • Removing stormwater connections to sewer systems (downspout disconnection) • Adopting low-impact development, or 'green infrastructure,' to reduce the volume and rate of stormwater. Examples of green infrastructure include: - Rain gardens - Bioswales - Planting of trees and shrubs - Pervious Pavement • Enacting tailored stormwater management ordinances
Septic tank leakage	• Review municipal septic codes for greater frequency in septic tank checks • Work with neighboring communities, regional planning agencies, and watershed protection councils to establish a regional watershed planning approach • Advocate for state-wide standard for septic systems
Drinking water contamination	• Adhere to state drinking water regulations and requirements • Make use of state-provided wellhead protection assistance • Replace lead drinking water pipes • Distribute public service announcements as appropriate, such as boil water notices • Adopt a community contingency plan in case drinking water becomes contaminated

Table 2.1: Sources and solutions to water contamination

diction, as well as wellhead protection areas and any natural land types important to water quality, such as wetlands. The inventory should also note hazardous waste sites and potential point or nonpoint water pollution sources, such as septic tanks. With the inventory, local planners can better identify focus areas for further analysis.

Building from that inventory and the common threats to water supplies described above, a community can then work to develop appropriate water management goals, objectives, and policies through its master planning efforts. General goals can be as simple as "maintain or improve surface water and groundwater quality," or "protect present and future sources of drinking water."[43] These goals are then complemented by more specific objectives and policies in a water section of the master plan, or other sections of the plan as appropriate, such as the land use, economic development, and parks and recreation elements. Objectives and policies might call for actions such as restoring wetlands, reserving open land as buffer zones to waterways, setting growth boundaries, limiting development in sensitive environmental areas, or modifying building plans to better manage stormwater. Another objective might be to initiate programs to incentivize homeowner participation in stormwater management practices. In developing these goals, objectives, and policies for the master plan, communities should look to both restore areas with poor water quality and prevent future contamination.

While the state of Michigan plays the lead role in regulating agricultural practices for various purposes, including water quality, local communities can address water quality concerns directly as well by acquiring conservation easements to preserve lands vital to water quality, such as designated wellhead protection areas surrounding public water supply wells. Local governments can also administer the federal Conservation Reserve Program to prevent use of land in erodible areas or riparian zones for 10 years.[44] This is effective in preventing the degradation of land or fertilizers from running into surface water. Buying easements allows the private landowner to retain ownership rights while preserving land vital to preventing water contamination.

In addition, communities can promote or require the installation of green stormwater infrastructure to enable the natural soil filtration of stormwater directly and to divert it from entering the sanitary sewer system. More cities throughout the U.S. are opting for green stormwater infrastructure as a less expensive alternative to expanding wastewater treatment facilities and other gray infrastructure components of the water system.[45] Chicago, for example, has been active in planting trees, installing green alleys, and replacing impervious surfaces with previous pavement and green spaces.[46] Similarly, the more recent Capital Improvement Program (CIP) from the Detroit Water and Sewerage Department (DWSD) heavily stresses expanding green stormwater infrastructure throughout the city.[47]

Because Michigan currently lacks a state-level regulatory system for septic tanks, cities should partner with neighboring municipalities and counties in the same watershed to decide on a regional watershed planning approach. The

regional partnership should decide how frequently tanks should be checked and how to handle historic systems that predate ordinances. Regardless of political boundaries, a malfunctioning septic tank greatly harms groundwater sources in the same watershed, and this issue is best addressed collaboratively.

Case study: Chikaming Township

Chikaming Township and its residents value its rural character, which contributes greatly to its tourism economy and general charm.[48] The Chikaming Township Master Plan, last updated in 2014, lays out goals for increasing the year-round population and maintaining summer tourism into the future.The plan outlines a path to these goals through a combination of smart growth and low-impact development. Mixed-use development and green infrastructure are encouraged throughout the plan as ways to mitigate harmful environmental impacts. Importantly, the plan echoes the desire of Chikaming Township residents to avoid the transformation of the township into a sprawling suburban hub.[49] These development goals come with noteworthy water quality challenges and opportunities that will be summarized here.

Pesticides, fertilizers and lawn chemicals can be a substantial source of nonpoint source water pollution. This is of particular concern to Chikaming Township, for which zoning is in large part designated to single-family residential and agricultural uses.[50] The township is also home to one golf course; these typically make heavy use of pesticides and other chemicals for course maintenance.[51]

The more sparsely populated areas of the township east of I-94 rely largely on wells and septic systems for water utilities.[52, 53] These installations come with their own risks to environmental and groundwater quality, as previously described.

In 2020, the Chikaming Parks Board adopted a 5-year plan that aims to address in part the challenges of being a coastal Lake Michigan watershed community. The plan identifies measures that can be taken to improve water quality in Chikaming township to the benefit of the environment and its residents. The parks plan identifies wetland restoration and conservation as one of its near-term goals.[54]

These are all promising measures to protect and improve the water quality of Chikaming Township. Chikaming Parks currently only controls a small portion of the township's natural areas, though its plan is expansive in scope.[55] It will be important to take the measures identified by the Parks Board and integrate them with other goals of local planning and development. Chikaming Township might consider the following tools and measures as it updates its Master Plan.

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Environmental planning strategies to minimize threats to water quality

Green stormwater infrastructure

The Chikaming Township Master Plan identifies the utility of various forms of low-impact development strategies that help preserve and improve water quality. Strategies mentioned include green stormwater infrastructure like rain gardens and porous pavement, as well as land that would go hand in hand with runoff filtration objectives, like green corridors adjacent to roadways.[57] As it grows and develops, Chikaming Township could redouble its efforts to promote these strategies, as well as introducing new ones.

The Master Plan notes a desire among residents and leadership to maintain the Red Arrow Highway corridor as an open and green "gateway" to the community.[58] In its current state, the roadway is a natural corridor for future development. By investing in runoff-filtering swales alongside the highway, along with other green infrastructure measures, the township would be able to tailor development in a way that does less harm to water quality.

Wellhead protection and septic tank maintenance

As described above, failing to properly maintain septic systems and wellhead zones can lead to demand for the construction of water and sewage lines linking remote parcels to the municipal network. Chikaming Township's master plan identifies this kind of development pattern as a potential threat to the Township's rural character and natural environment.[59]

To avoid expanding the central water system to remote land parcels, Chikaming Township should continue to be vigilant in ensuring that its rural residents adhere to statewide wellhead protection guidelines and carefully maintain septic tanks. Through its Wellhead Protection Program, EGLE offers support to municipalities in identifying wellhead zones so that property owners can then take measures to avoid and mitigate contamination of the water source.[60] These measures may include relocating potentially polluting facilities or placing signage notifying the public of the wellhead, in order to help prevent toxic dumping. If septic maintenance becomes a concern, on-site septic ordinances can set regulations for proper siting and cleaning.[61]

Conservation easements, parks, and wetland restoration

Wetland restoration can be a helpful tool to maximize natural filtration of runoff within a watershed.[62] Chikaming Township is home to many wetlands, most notably along the Galien River. The township might consider taking steps to protect and restore more of these natural areas. The Chikaming Township Parks Board has already outlined plans to promote wetland restoration in its recent 5-year plan, but as seen in Figure 2.3, Chikaming Township parks and conservation areas only cover a small area of wetlands in the area.[63]

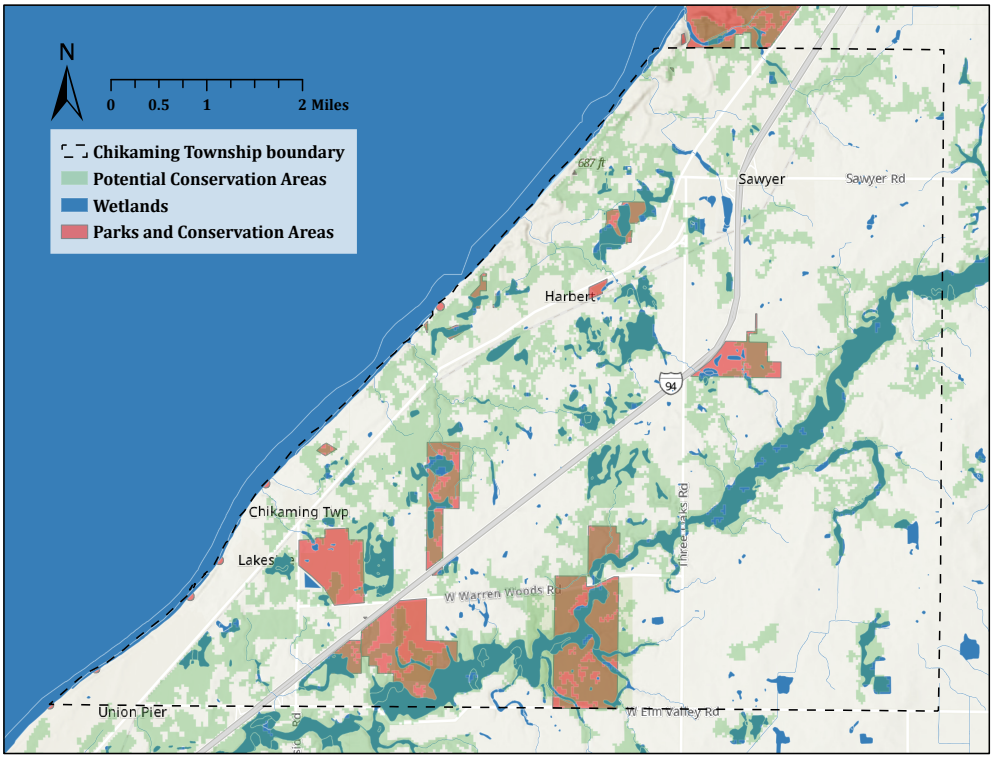


Figure 2.3: Wetland conservation potential in Chikaming Township. Data retrieved from Southwest Michigan Planning Commission.

A significant portion of the township is highlighted in green, indicating high levels of potential for environmental benefits from natural conservation. Almost all of Chikaming Townsship's wetlands fall within these highlighted areas. In the next master plan update, the Township might consider buying up more conservation easements along the Galien River and around other wetlands. These easements could be integrated into the Galien River greenway proposed in the Parks Board 5-Year Plan.[64] Wetlands are important coastal ecosystems that cannot be replaced with green infrastructure; protecting them will help maintain the region's water quality in the long term.[65]

The Southwest Michigan Water Partnership

The Southwest Michigan Planning Commission (SWMPC) manages a water resource partnership among several municipalities in Berrien and Cass Counties. This coalition, known as the Southwest Michigan Water Partnership, helps to coordinate stewardship of the major Southwest Michigan watersheds through promoting best practices and planning initiatives.[66]

The values and goals described in the Chikaming Township Master Plan align with those of the SWMPC, and the Township already has an established relationship with the organization. Since watersheds often cross jurisdictional boundaries, continued coordination with neighboring communities is critical to successful maintenance of water quality, and the Township should remain engaged with the SWMPC to avail itself of the planning support and resources this partnership can offer.

Case study: City of Manistee

The most recent Manistee Master Plan from 2016 commits to improving quality of life for residents and visitors while preserving unique features, small town charm, and historic characteristics. The city's plan recognizes that maintaining water quality is an important part of this to support consumption, recreational, and industrial uses of water. The plan also mentions green infrastructure and low impact development, but discussion regarding implementation of these systems is limited. The plan does include, however, a thorough natural resource inventory.

The 2016 plan also initiated a Wellhead Protection Program (WHPP), identifying protection areas to prevent contamination of groundwater that supplies local drinking water. The WHPP includes a contaminant source inventory, management strategies, and contingency plans for water supply in emergencies. It also includes a public education and outreach component. In 2017, the city added a Wellhead Protection Overlay District,[67] which delineates permitted and special uses in the areas identified.

In 2017, the county also passed a Guidelines For StormWater Management in Manistee County. The county encourages regional use of 'Low Impact Design' (LID), such as pervious pavement, rain gardens, green roofs, to manage stormwater on-site. The City of Manistee has encouraged certain development projects to include these stormwater management on site, but does not yet require new developments to manage stormwater on site.

In addition, Manistee plans collaboratively with surrounding political entities through the state of Michigan's Regional Prosperity Initiative. Together the partners addressed growth, food and farming, natural resources, and healthy communities in the Northwest Michigan Regional Prosperity Plan A "Framework For Our Future."[68]

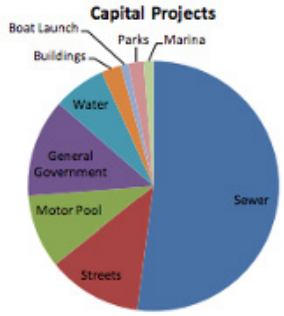
A main priority for city management in Manistee is addressing the amounts of combined sewer overflow it releases annually into waterways. Recently, the City of Manistee and the Water and Sewer Utility had to eliminate point-source overflow sites to meet the NPDES requirements. As of 2016, the City worked to construct facilities at three of the four points that released untreated sewage into the waterways. This project cost $3,810,704, which was about 27 percent of the overall Capital Improvement Project for 2001-2015.[69] In the most recent Capital Improvement Project for 2022-2027, 52 percent of the nearly $35 million dollar expenditure is dedicated to sewer system maintenance and repairs, which is the largest portion of the funds (Figure 2.4).[70] The second largest expenditure is for street resurfacing and improvement projects. Maintaining and improving the sewer system is an ongoing issue for the City of Manistee. This is clearly stated in the City's Strategic Action Plan from 2017.[71]

As discussed above, repairing and adding gray infrastructure to prevent CSOs from entering waterways is costly, and it can represent a substantial portion of the local municipal budget. For smaller cities and towns, these recurring costs

greatly burden a municipality and can prevent it from investing public dollars elsewhere. There are less costly alternatives the city can implement to help alleviate this stress on the sewerage system as well. Smaller coastal cities, such as Manistee, could greatly benefit from shifting as much as possible from the use of gray infrastructure to the use of green infrastructure that prevents stormwater from entering the sewage system in the first place, and that replenishes groundwater sources.

Capital Projects by Year

FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	Total
23,592,655	4,049,427	2,135,433	1,203,481	968,675	3,040,001	34,989,672



Capital Projects by Type

Sewer	18,225,000	52%
Streets	4,253,315	12%
Motor Pool	3,329,857	10%
General Government	4,439,000	13%
Water	2,373,000	7%
Buildings	897,000	3%
Boat Launch	340,000	1%
Parks	692,500	2%
Marina	440,000	1%
Total	**34,989,672**	**100%**

Figure 2.4: Manistee Capital Improvement Projects 2022-2027. Retrieved from the City of Manistee website.

Environmental planning strategies to minimize threats to water quality

The City of Manistee has taken numerous steps to protect water quality, such as conducting dye and smoke testing to root out illicit connections to municipal water infrastructure and requiring that new developments incorporate detention basins to the extent possible. However, there are a number of additional steps the City of Manistee might consider for preventing or at least minimizing the amount of stormwater entering the existing sewage system and to improve the quality of stormwater flow in general, such as the following:

- *Encourage residents to divert water from their downspouts into the sewer system*
  - Disconnect downspouts
  - Add rockbeds below downspouts
  - Install dry wells below downspout
  - Allow collection of stormwater in rain barrels
- *Incorporate green stormwater infrastructure into other project plans, such as parks and recreation, transportation, building asset management, etc.*
  - Install swales along roads
  - Add pervious pavement in road or sidewalk pavement projects
- *Include priority green infrastructure development areas in the next master plan update*
- *Consider establishing a growth boundary or moratorium to temporarily suspend the expansion of the sewer system until the CSO events have been reduced*

Green stormwater infrastructure represents an evolving practice that has made a significant difference for many municipalities in managing stormwater and minimizing the impacts from flooding. Green stormwater infrastructure techniques include things as simple as adding rocks below downspouts and in swales to help slow the flow of water, prevent erosion, and provide a permeable surface that allows rainwater to enter the ground to bioretention basins. Most of these technologies can be implemented by landowners with relatively little effort and cost.

That said, the greater challenge with these techniques is incentivizing landowners to actually implement these practices. Municipalities can take a number of steps to do so, such as launching awareness campaigns, subsidizing the cost of rain barrels, or providing credits to the drainage fee to encourage citizens and businesses to take action. To ensure residents are able to participate, municipalities should focus on removing economic barriers in their rollout. Understanding barriers homeowners may face should be included in the community engagement portion of creating the next master plan update.

Manistee might also explore the feasibility of integrating additional green stormwater infrastructure into ongoing road repavement or park restoration projects, as well as other projects in the city's Capital Improvement Projects schedule. For example, a project from the 2022-2027 CIP plan that could incorporate green stormwater infrastructure is the Veterans Park and North Riverwalk Upgrades project. The aim of that project is to refresh landscaping and rebuild the retaining walls along the shoreline of the Manistee river that connects Lake Manistee to Lake Michigan. Incorporating additional green stormwater infrastructure techniques, such as rain water gardens, into the project could further help achieve the original goals of the project while also preventing contaminated stormwater from running off into the waterway.

Figure 2.5, top left: The photo collage displays an example of adding rock and vegetation (top) or a dry well (bottom right) below the downspout to prevent runoff.[73] Retrieved from Pintrest.

Figure 2.6, top right: Graphic of a roadside bioswale.[74] Retrieved from "Great Lakes Green Streets Guidebook," SEMCOG.

Figure 2.7, bottom: Computer rendering of a stormwater detention basin and garden for the median of Oakman Boulevard in Detroit.[75] Retrieved from DBusiness Magazine.

Finally, moving forward, the City of Manistee could select and prioritize specific locations for low-impact development through its next master plan update. These areas can be determined using the completed Natural Resources Inventory and the Wellhead Protection Program noted above. A starting point would be to address low-lying lands or downhill areas with higher concentrations of impervious surfaces. The City of Manistee Natural Features map, shown in Figure 2.8, notes downhill areas with the brown lines marking the 10 foot contours. A map marking the impervious surfaces should be overlaid to determine priority areas. Areas along the shoreline should be included in the priority areas to prevent stormwater runoff from directly entering the waterways. Manistee might also consider the installation of end-of-pipe detention basins and underdrains, an approach taken by the City of Grayling, Michigan.[72] Finally, direct input from community members through public engagement programs can help to identify and guide planning efforts in terms of prioritizing the development of additional green stormwater infrastructure.

Figure 2.8: Natural features of Manistee. Retrieved from the City of Manistee 2016 Master Plan.

Resources and potential funding for water quality and supply management

Additional water management resources for Michigan:

- Great Lakes Green Streets Guidebook
- Low Impact Development Manual for Michigan
- Michigan Sea Grant - Green Infrastructure Implementation
- Financing Green Infrastructure in Michigan

Potential funding sources for local water management initiatives:

- *EPA Great Lakes Restoration Initiative*
- *EGLE Strategic Water Quality Initiatives Fund*
- *EGLE Drinking Water State Revolving Fund (DWSRF)*
- *EGLE Clean Water State Revolving Fund (CWSRF)*

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3: Land

Introduction

Local land resources such as forests, wetlands, agriculture, and coastal areas provide important benefits for Michigan communities. When combined with responsibly planned urban land uses, these resources help sustain the economic, social, and environmental conditions that make Michigan coastal communities so unique. Michigan's economy is supported by these land resources through opportunities for recreation, tourism, timber harvesting, agricultural production, and new urban development that, in turn, help sustain the economy of the state and nation as a whole. Ecosystem services of these lands also provide economic benefits through carbon capture and storage, stormwater management, climate regulation, and nutrient cycling, to name a few.

Forests, wetlands, agriculture, and freshwater coasts provide social benefits for Michigan's coastal communities as well. Both residents and tourists rely on these resources for activities like hiking, birding, swimming, fishing, and camping, while often finding innate value in their existence and protection. Similarly, urban land use can provide a wide range of social benefits by concentrating human development and activity, facilitating access to daily needs and services, and creating rich connections across cultural and social institutions. Though urban land uses are often framed as being at odds with the goal of conserving nature, communities that pursue more concentrated urban development can enable the preservation and sustained value of natural land uses at larger scales more so than is possible with less concentrated development patterns. Environmental benefits can be protected in particular by conserving areas that would otherwise experience significant land transformation. These benefits include but are not limited to regulating water quality and quantity, providing habitat for wildlife, maintaining biodiversity, and supporting the viability of local ecosystems. Through the environmental planning process, communities can safeguard these benefits.

Environmental planning principles and strategies for protecting land resources can be implemented through a number of mechanisms, including zoning ordinances, urban and village growth boundaries, building codes, subdivision regulations, and other local ordinances. Additional protection can be achieved through capital improvement programming that implements plan policies, as well as the acquisition of conservation easements, or land in fee, to provide open space, flood mitigation, and strategically located public parkland.

This section focuses on the specific and interconnected benefits that different land use types provide for Michigan's coastal communities. It then describes examples of planning tools, policies, and strategies that communities can use to preserve and enhance these benefits for current and future residents. Finally, the section examines the unique dynamics and integration of natural and urban land use types in Chikaming Township and the City of Manistee, assessing their current planning efforts and identifying additional steps these communities might take for illustration.

Overview

Forests

Forests cover approximately 54% of Michigan's landscape (19.7 million acres) and provide clean air, absorb atmospheric carbon, filter water, and serve as recreational sites.[76] Forests provide key economic assets for the Michigan economy and communities by supporting a forest product sector with an annual value of over $17 billion while providing more than 96,000 jobs.[77,78] Throughout the Great Lakes region, there are six national forests, three of which are located in the state of Michigan.[79] Research has shown that protecting forests is the most cost-effective way to address climate change, save endangered species, and protect watersheds for inland fishing.[80] More than 1,300 species of plants and animals in the U.S. are threatened or endangered, and most of these species live within forests.[81] Nearly half of Michigan forests are under private ownership, however, indicating that the forest management practices of 400,000 land owners in the state have huge implications for preserving forest resources.[82]

Wetlands

Wetland areas serve as the foundation for vital ecosystems around the world. In the Great Lakes region, freshwater inland and coastal wetlands support a rich and unique diversity of fish, insects, birds, mammals, amphibians, and plant and microbial life that are deeply interconnected with the region's other physical landscapes and ecosystems. In addition to their central role in the region's many land and aquatic ecosystems, wetlands provide valuable services to human communities. Wetlands collect and convey stormwater, serving as sites for detention, retention, and infiltration that helps reduce flooding and filter harmful pollutants. They are often sought after as recreational areas, or for the support they provide to ecosystems that serve as recreation and tourism sites for activities like hiking, camping, bird watching, hunting, and fishing. And they even serve as carbon sinks by hosting living vegetation and trapped dead biological matter, which sequester atmospheric carbon that otherwise would contribute to climate change.[83, 84] Despite these benefits, over half of Michigan's wetlands have been drained or filled for development, signifying the urgency with which remaining wetlands should be protected both in Michigan and the wider region.[85]

Agriculture

The state of Michigan has a thriving agricultural sector that produces over 300 commodities, making it the second-most agriculturally diverse state in the country.[86] The Great Lakes region as a whole is ideal for corn, soybean and hay crops, which are widespread throughout the region. Agriculture in Great Lakes states generates about $15 billion in revenue each year and accounts for 7% of the annual agricultural production in the U.S.[87] The agricultural sector has important implications for lakes and other waterways. Fertilizers and pesticides applied to boost crop productivity often enter lakes and groundwater as water drains off the surface of agricultural land, known as runoff. Runoff containing high levels of fertilizers and pesticides can lead to diminished water quality, which has been linked with loss of aquatic life and toxic algae blooms. By contributing to declines in water quality, increased sediment and nutrient runoff from agriculture changes the coastal landscape over time.[88] Agricultural lands, therefore, must be managed carefully to ensure health and sustainability of the agricultural sector and the region's waterways.

Coasts

For many communities in Michigan, coasts provide a wide range of opportunities for recreation, tourism, business, and industry. The Great Lakes are surrounded by 4,530 miles of coastline, with regional economies that generate $3.1 trillion in gross domestic product each year.[89] Recreation and tourism account for an estimated $6.5-11.8 billion of this GDP, with $955 million generated through coastal tourism in the state of Michigan alone.[90, 91] In addition to the social and economic benefits the coastlines bring, they are also home to wetland, dune, and beach ecosystems that play an important role in creating habitat, maintaining biodiversity, and regulating both water quality and quantity. Dune ecosystems provide a buffer between the lakes and uplands, and the Great Lakes region hosts the largest freshwater dune system in the world.[92] Beach ecosystems, which encompass dunes, also attract residential and commercial development because of all the social and environmental benefits they provide.

Urban land use

Urban land refers in general to any areas that have been altered by development or human management in significant ways. It actually includes a wide variety of different use types, intensities, and physical forms. From the perspective of urban ecology, urban land can be divided into two parts, including those especially important for maintaining the ecological resilience and stability of environments, like urban green spaces, and those that constrain the ecological functions of natural environments, such as residential, commercial, and industrial spaces. The former is characterized by higher pervious surfaces that allow larger amounts of water to penetrate the ground and hence play a significant role in replenishing groundwater and maintaining optimum surface water quantity and quality. The latter, due to its higher impervious surface, accumulate larger

amounts of water that become urban stormwater runoff and yield increased flooding. Ecologically designed cities have a good balance between the two parts so that the problems created by the latter part will be offset by the mitigating role of the former.

Urban built environment

The urban built environment translates roughly to the buildings, homes, roads, parking lots, and infrastructure typically associated with cities and neighborhoods. These areas hold most of Michigan's housing, commercial spaces and activities, government offices, cultural venues, and other public institutions like schools and hospitals. Accordingly, the urban environment is also where much of the population and valuable properties are located, and where hazards related to extreme weather, erosion, flooding, or man-made disasters are most likely to affect human health and economic vitality. Local governments can regulate and guide human activity in urban areas in ways that limit potential negative consequences for other land uses and enhance the benefits of green spaces.

Urban green space

Urban green space refers to the community areas of an urbanized area, like a city, village, or hamlet, that are free from intense development and that provide access to natural features like trees, grass, shrubs, and other vegetation. The parks, playing fields, public gardens, and community forests found throughout Michigan fall within this category. Urban green spaces can help reduce environmental problems such as flooding and climate extremities, such as increased temperatures within dense urban settings (often referred to as the "heat island effect"), while protecting biodiversity and providing recreational services to the community. Environmental planning plays a critical role in creating green spaces that are not only good for recreational purposes but also serve a number of ecological functions central to urban sustainability.

Planning methods

Forests

Forests are widespread in Michigan, but they still face a variety of challenges. Timber harvesting, fires, pests, and disease all threaten the long term sustainability of forested areas. Development pressure from urban, suburban, and rural expansion also poses challenges for protecting forest resources, with the parcelization of forests for these land uses driving increased fragmentation of forest cover.[93] As a part of these development pressures, demand for second homes along the shorelines of Lakes Michigan and Huron are a particular concern.[94] Small coastal communities are often reluctant to forgo the increased tax support that comes with such development, despite losses in forested lands.

Local governments interested in protecting forest resources can use zoning ordinances, capital improvement plans, and land trusts to mitigate development pressure. Zoning ordinances specific to timber conservation or production are useful for forested areas that communities want to protect for different uses.

Timber conservation zones often permit recreation, livestock grazing, and a small number of residences, while timber production zones designate forest lands exclusively for timber production.[95] Other zoning ordinances can ban clearcutting, either outright or within a certain distance from roads, streams, and wildlife habitat.[96]

Capital improvement programs can also be leveraged to direct growth and development away from commercial or community forestlands. For instance, the creation of community forests can be included as a part of this process. Likewise, subdivision regulations and the acquisition of conservation easements, either by local governments or land trusts, can be used to provide additional protection for forested lands. Subdivision regulations can be used to require buffers between residential property and commercial forests, for example, or to require that subdivision developers replace trees damaged during construction.[97] At a larger scale, the acquisition of conservation easements can be used to safeguard forest resources by restricting urban development possibilities for entire forests.

Putting environmental improvements in perspective

Many environmental planning strategies come with trade-offs, and the costs and benefits of planning decisions should always be weighed according to context. For instance, subdivision regulations requiring developers to set up centralized water and sewer infrastructure may not be the best solution for protecting wetlands from septic system failures in all communities. In some cases, water infrastructure expansion will open up new and more intensive development opportunities, which can yield more environmental degradation than what came before. Improving septic system maintenance in these instances can be a more valuable strategy for protecting wetlands.

Wetlands

While wetlands have the potential to moderate flooding, absorb pollutants, and stabilize landscapes and surrounding ecosystems, they are also uniquely vulnerable to human development pressures and pollutants. Nearby development of buildings and infrastructure can greatly alter water flow and recharge for wetlands, while leading to excess storm flows and nonpoint source pollutant loading from increased impervious surfaces.[98] Wetland areas are often altered, drained, or flooded to accommodate human development on or near these spaces as well.

To protect wetland areas from threats posed by development, there are a number of options available to local governments, including developing and implementing wetland ordinances, regulating subdivisions, integrating wetland protection into capital improvement programs, and purchasing wetlands or wetland conservation easements.[99] It is important to note that the state of Michigan sets its own wetland regulations through the Natural Resources and Environmental Protection Act (NREPA), which applies to all wetlands greater than 5 acres and to coastal wetlands.[100] NREPA also authorizes local units of

government to set regulations for isolated wetlands under 5 acres and to adopt and administer their own wetland protections as long as they are consistent with state regulations.[101] These protections can be incorporated into local zoning ordinances along with other measures for wetland protection authorized by Michigan's planning and zoning enabling acts.

Zoning ordinances dictate whether development is concentrated near wetlands and can limit its impact on wetland areas through setback requirements and overlay zones. An overlay zone might be specific to particular wetlands or part of larger conservation areas such as a floodplain to provide a wide range of natural features.[102] Limits on development can also be established to protect wetlands through minimum lot sizes or subdivision regulations with requirements for hooking up to central sewer and water systems. On-site infiltration requirements for stormwater and impervious surface limits are also useful wetland protection mechanisms, along with buffers between development and wetland sites or environmental impact assessments requirements for new development.[103]

Through the capital improvements program, local governments can direct development patterns altogether by encouraging growth away from large wetland areas or including requirements for restoration where wetlands have been altered. Additionally, purchasing wetlands or conservation easements from private landowners can help local governments better manage wetland areas that otherwise might be developed for urban land uses. It is important to keep in mind that many of these regulations and programs can and should be pursued in tandem to ensure wetlands are adequately protected as communities continue to grow. (The importance of protecting wetlands for the role they play in conserving freshwater supplies, and planning methods for doing so, is also addressed in the Water section of this guidebook.)

Agricultural lands

One of the most important roles of agriculture, besides providing food for communities, is its capacity to sequester atmospheric carbon dioxide and mitigate climate change. However, farmland loss is common in the U.S., and one of the greatest threats to agricultural lands is their conversion for residential, commercial, and industrial purposes. High quality farmland is a valuable resource, but close to 50% of leading agricultural counties in the United States are located within or adjacent to metropolitan areas.[104] As these areas expand, agricultural lands will continue to be diminished.

Without plan implementation tools like subdivision regulations, growth boundaries, purchase of development rights, and agricultural zoning, the protection of farmlands from urban sprawl is almost impossible. In many communities, the gradual fragmentation of contiguous farmlands is leading to greater loss of farmlands. One approach to counteract this problem is to implement zoning and subdivision regulations that restrict the further parceling of farmlands into smaller lots for the purpose of further infrastructure, home, and business development.

Urban growth boundaries are also used by local governments as a mechanism to protect farmland from urban sprawl. According to a 2015 study, sprawl costs the country $1 trillion and can increase land consumption by 80%.[105] Limits on urban growth not only protect farmland, but can protect water supplies by keeping groundwater aquifers, watersheds, and infiltration zones that small agricultural communities rely on for drinking water and irrigation free from intrusive development. (The potential use of urban growth boundaries to help protect water supplies, as well as to conserve agricultural lands, is also discussed in the Water section of this guidebook.)

While some zoning efforts are used to protect water sources for agriculture, others can be used to protect these resources from potential contamination by land use activities associated with agriculture as well. Nutrient runoff from farms is an important source of pollution in creeks and rivers, which diminishes water quality. One strategy to keep chemicals from flowing directly into waterways is to encourage the use of land at the boundaries of farms as bufferstrips. Grassy areas with deep rooted trees at the edge of farms can ensure that polluted water does not flow into a waterbody, but rather is absorbed into the land and is filtered by the plants. Agricultural zoning is also essential for water protection. These zones help concentrate farming impacts away from urban and suburban development, buffering these communities from the incompatible uses of one another.

As with other land uses, local capital improvement programs can also be leveraged to encourage growth away from agricultural lands, while Purchase of Development Rights (PDR) programs can prevent agricultural conversion entirely. A PDR program refers to the voluntary process through which landowners sign a deed of easement restricting the use of their lands in exchange for a cash payment.[106] PDR programs can serve both to conserve rural lands and to better define the boundaries of developed urban areas, as discussed more below.

Coastal areas

Water and wind currents, waves, ice, vegetation changes, and human activities constantly reshape coastal land boundaries. In the Great Lakes, rapid changes in standing lake water levels also play a role in shifting the coastline, moving it landward and lakeward overtime as lake levels rise and fall. (These dynamics are addressed as well in the Hazards section of this guidebook.)

Changing precipitation patterns in the Great Lakes watershed, expanding lake volume from rising average temperatures, changes to ice cover and evaporation rates, and other climatic shifts all affect net lake levels.[107] In turn, the interaction of higher or lower water levels with the coastal land area through erosion and beach replacement shape the boundaries and contours of the shoreline and coastal land area. The regional effects of climate change in particular have led to greater volatility in lake water levels, and they appear to have recently contributed to a rapid net rise in lake levels over the last 10 years.

Despite these changes, coastal areas hold tremendous aesthetic appeal for residences, and they are valued for their tourism potential. Hence, they tend to attract substantial development activities. As coastlines are developed, human structures such as residential and commercial properties are built ever closer to the shoreline. This along with the natural erosion of the beach through wind, water action, and lake level fluctuations can cause the natural beach to shrink, diminishing the unobstructed, walkable area that makes the shoreline aesthetically valuable in the first place. Development also encourages the parcelization of the coast, disrupting key wildlife habitat and recreational lands.

Many coastal shoreline management strategies are the same as those used for addressing coastal hazards more broadly. A detailed account of these strategies can be found in the Hazards section of this guidebook.

Urban land use

Though the year-round population of Michigan's coastal communities may be relatively small, seasonal second homeowners, tourists from within and outside the state, and outdoor sports enthusiasts flock to these coastal cities and townships throughout the year to experience their beauty and support their economies. It is important for coastal communities to employ regulations and strategies for supporting everyone who lives within or visits them, while sustainably protecting the natural areas and resources that serve as their foundation.

Urban built environment

Often, urban land uses include a considerable amount of impervious surface, which is land covered by concrete, asphalt, buildings, plastic, or other materials that prevent water from infiltrating directly into the soil. As a result, water from precipitation flows over these surfaces to areas of lower elevation like ponds and creeks while picking up debris and chemical pollutants like herbicides, fertilizers, sediment, industrial byproducts, and oils that can become concentrated in toxic amounts.[108] (See the Water section of this guidebook for a discussion of this topic.)

This accumulation of diffuse contaminants is called nonpoint source pollution and it is not well-regulated by federal or state environmental laws.[109] A high proportion of impervious surface in a community can also create challenges for stormwater volumes, as rain water is channeled into man-made stormwater infrastructure which can cause flooding if the total flow exceeds a system's capacity. (Planning for water quality and stormwater runoff are covered more thoroughly in the Water section of this guidebook.)

In addition to generated water quality impacts, the impervious surfaces of urban land areas coupled with a relative lack of shade and heat dispersal from biological ground cover can lead to an urban heat island (UHI) effect.[110] Urban areas both radiate and absorb more heat than do tree canopy, brush lands, or agricultural land cover, leading to higher average temperatures than surrounding

areas. This effect can cause serious problems for human health, especially for the elderly, heat-sensitive populations, those with pre-existing conditions, or those who do not - or cannot afford to - cool their homes or workplaces properly. UHI effects can lead to higher utility bills and maintenance costs, and they can generally make urban areas less comfortable and habitable if left unaddressed.

Local governments should consider the aggregate contributions of urban land use and development toward flooding and nonpoint source pollution, and design wastewater treatment, master plans, zoning codes, and other land-related regulations accordingly. Planning and zoning in coastal communities should also seek to guide urban development and land use in more environmentally sustainable ways by limiting the impact of urban land uses on both nearby and distant natural resources like forests, wetlands, and coastal areas. Zoning and building codes can include setback requirements and flood zone overlay districts that restrict the nature and location of development that can be undertaken in areas likely to be inundated by water. Wetland setbacks can protect vulnerable aquatic ecosystems from encroachment, erosion, and concentrated pollution. Similar setback requirements and zoning codes can help limit the exposure of private and public property to coastal flooding and erosion while regulating the kinds and locations of shoreline armoring that property owners can employ (see Water and Hazards sections of this guidebook for more detail).

Master plans and zoning codes can proactively account for community expansion by assessing optimal areas for additional construction and growth while avoiding development in areas that are at high risk of natural hazards or may negatively impact other areas. Communities can allow for a greater range of land uses and building types in developed areas to encourage infill, allowing for more housing and retail density in places that are already supported by existing public infrastructure like roads, pedestrian paths, water, electricity, internet, and sewerage lines. Master plans can explicitly set goals of limiting excessive 'green field' development and preserving existing forest and open land cover. At the same time, the use of strategically acquired conservation easements, such as through the Green Belt initiative in Washtenaw County and the purchase of development rights by Peninsular Township in the Traverse City region, offer another method communities can employ to preserve strategically located natural and open spaces.[111, 112]

Separating wastewater conveyance and treatment systems from drains used to handle stormwater runoff can prevent events known as combined sewer overflows (CSOs) that occur when waste treatment infrastructure is overwhelmed during storm events and untreated water is discharged directly into rivers and lakes. Communities can also expand urban tree canopy by planting street trees, employing education and planting programs that promote tree planting on private property, and maintaining existing forest and park areas. Urban vegetation like trees, bioswales, and preserved green spaces can help mitigate urban heat islands, improve the aesthetic and recreational quality of communities, and serve as green stormwater infrastructure that filters pollutants and reduces the risk of flooding.

Urban green space

The main challenge for urban green space emanates from the assumption that it should be used only for recreational purposes. Supporting the same perception, studies have shown that urban green spaces in the U.S. have mostly been used for recreational purposes.[113] The conservation of urban green spaces can help reduce a variety of current environmental problems including flooding, climate extremities, and the loss of native biodiversity, while still providing recreational services to the community. Green spaces should thus be planned and designed with due consideration of both their ecological and recreational benefits. This will result in urban planning strategies aimed at creating multi-functional urban green spaces which maximize benefits to the community.

Case study: Chikaming Township

The first step for creating multi-functional green spaces is to conduct an inventory of the ecological and recreational services provided by existing urban green spaces, then identify and prioritize the key functions provided by them and recognizing the fact that different sites might have different priorities. For instance, one of the priority functions provided by a given urban green space could be flood regulation services. In making this inventory, the important role that green spaces can play for preserving native plant and animal biodiversity should also be emphasized, as well as the proximity of any given space to other features that might be leveraged for benefits such as improved habitat connectivity or stormwater mitigation. In making this inventory, planners should also assess areas that are currently degraded and might provide enhanced services through restoration, along with areas that are currently developed and could similarly be converted back to some type of green space. Having identified existing and potential green spaces, the community can then develop goals and objectives for conserving green spaces already providing high functional values and for identifying and restoring additional green spaces as appropriate.

In setting out those goals and strategies, additional consideration should be given to the spatial distribution of urban green spaces, which has implications especially for equity and accessibility. There is growing evidence that many cities in the U.S. are experiencing disproportionate green space access and availability, where the neighborhoods where lower income residents and people of color live are those that offer the least access to green spaces.[114]

Forests

Land cover data from the U.S. Geological Survey (USGS) reveals that a significant portion of Chikaming Township (around 53%) is covered by forest and woodlands (See Figure 3.1 and Table 3.1).[115] The total forested area is over 300,000 acres, with per capita forest cover of the township at 100 acres/person. When taken together, forest and agricultural areas comprise around 79% of Chikaming Township.

Even though per capita forest cover in Chikaming Township is high, it is important to note that the number of acres per person does not reflect the actual amount of forest lands accessible to the public, or the amount of forestland subject to conservation. A large proportion of forests in the community are privately owned and hence, not publicly accessible. Public forest accessibility is important for community health and recreation, but also has important implications for land management. Forests that are publicly owned or maintained as conservation lands are more likely to be protected from development pressures, whereas private forest lands are susceptible to conversion for other uses without adequate regulation.

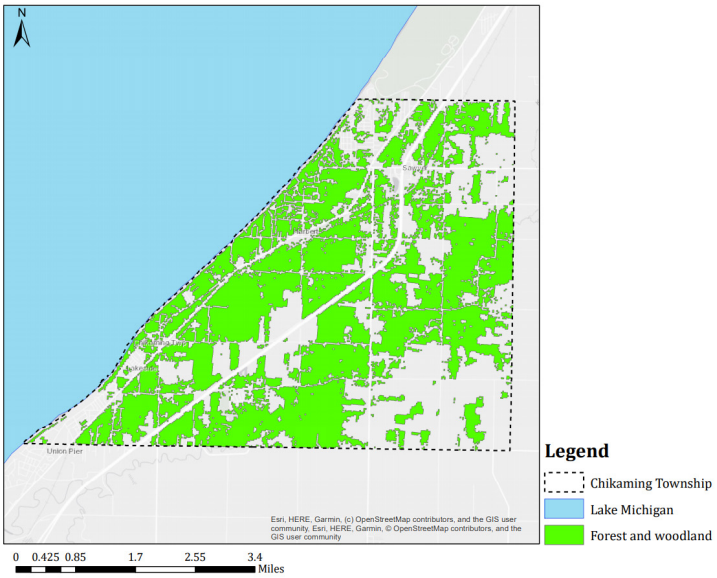


Figure 3.1:Forest and woodland cover in Chikaming Township. Data retrieved from USGS.

	Chikaming Township
Population	3,100
Total area	572,975 acres
Total forest (%)	303,192 (53%)
Total green space (%)	452,727 (79%)
Per capita forest	100 acres/person
Per capita green space	146 acres/person

Table 3.1:Forest and woodland cover in Chikaming Township. Data retrieved from USGS.

In order to promote forestland conservation and public accessibility, Chikaming Township might consider a more focused analysis on this topic through its next master planning efforts. The township should also consider adopting more focused forest conservation policies through its zoning code. The current Chikaming Township Zoning Code makes clear the need for forest protection in two zoning districts, namely the Residential Rural Estate District (R-2) and Agricultural District (AG).[116] The ordinance does not, however, address the extent to which forestlands within these districts, including those on residential lots, should be conserved. In addition, the township might explore additional efforts to provide increased public forests, or public access to private forests. An exemplary recent effort organized by Chikaming Open Lands provided the township with 40 acres of woodland through the purchase of private land in perpetuity.[117]

Wetlands

The National Wetlands Inventory identifies a number of wetlands throughout Chikaming Township, comprising around 81,934 acres or 14.3% of the total land area.[118] Most of these wetlands are located in close proximity to already developed areas, mainly those zoned for agricultural and residential purposes. A 100-foot buffer was used to identify wetlands that are located close to developed lands (see Figure 3.2). The 100-foot criteria is a common standard for delineating setbacks for wetlands in other states and is identified by the Environmental Protection Agency (EPA) as being of adequate size for removing pollutants from nearby development.[119] Unfortunately, in Chikaming Township, around 81,510 acres (99%) of wetlands are located within the specified setback, signifying that all wetlands in Chikaming Township are under some form of human development pressure. Moreover, as shown in Figure 3.3, smaller wetlands are most affected by human development in the township. This indicates that transforming even a few portions of a smaller wetland, as opposed to larger ones, will more likely eradicate the remaining wetlands in the township.

Already, Chikaming Township has extensive wetland protections provided through its zoning ordinance. The township's Recreation District (RE) conserves open space, woodlands, and wetlands for public and private recreational purposes. Section 7.15 outlines wetland and waterway setbacks for hazardous substances and petroleum storage, raised septic systems, solid waste, and all other structures (p.98). These setbacks range from 25-300 feet and require vegetated buffer strips to capture associated runoff. In addition to these

Resources and funding opportunities for land conservation and management

A variety of federal and state grant funding and technical assistance programs are available to Michigan communities pursuing land conservation and management strategies.

Federal opportunities and programs

- The National Park Service's (NPS) State and Local Grants program through the Land and Water Conservation Fund (LWCF) provides matching grants for communities to acquire and develop public outdoor park areas or receive transfers of federal lands.
- The NPS's Urban Park and Recreation Recovery Program (UPARR) provides matching grants and technical assistance to local governments to establish or reclaim park and green space in urban boundaries - target toward economically struggling communities.
- Federal land grants for private owners
- The North American Wetlands Conservation Act provides grants for wetland and habitat conservation.
- The Forest Legacy Act provides protection for forest land by purchasing conservation easements which are held by federal, state, or local governments.

Michigan opportunities and programs

- Statewide Comprehensive Outdoor Recreation Plan (SCORP) provides matching grants for acquisition of land for public outdoor recreation.
- Natural Resources Conservation Service (NCRS) funds.
- Voluntary conservation easements through the Department of Agriculture and Rural Development (MDARD)

Nonprofit land conservancies

- Southwest Michigan Land Conservancy (SWMLC)
- Manistee Conservation District

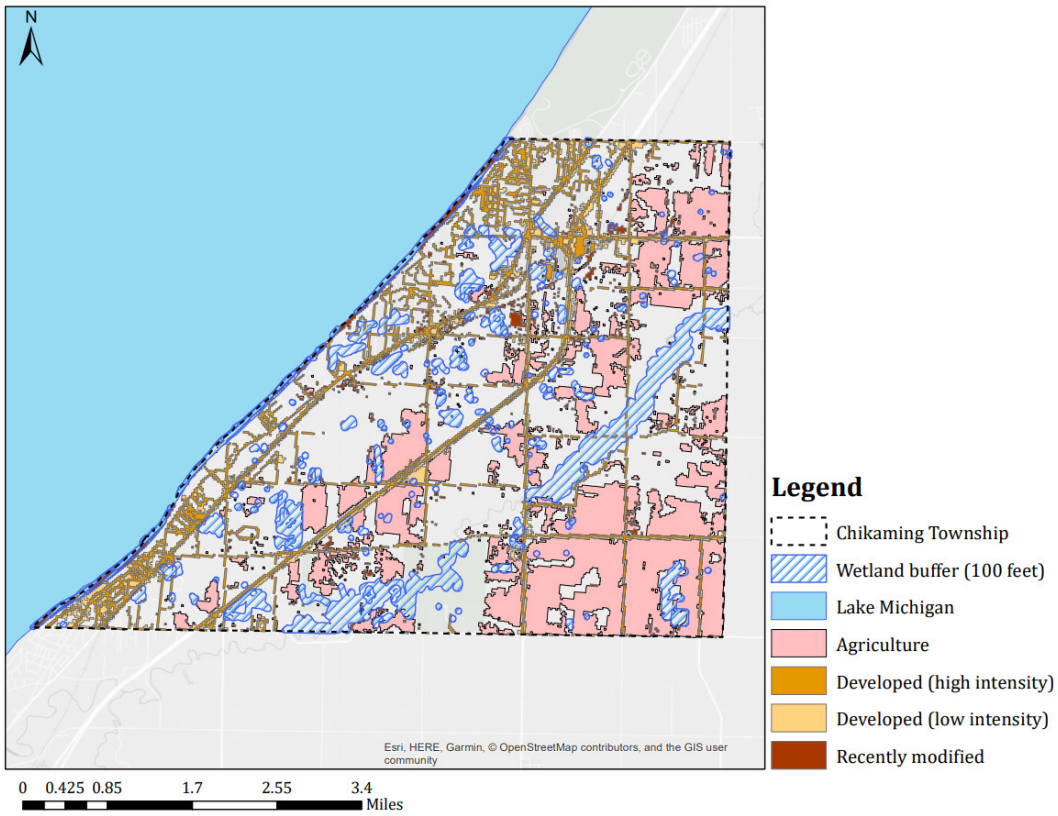


Figure 3.2: Distribution of wetlands and land use types in Chikaming Township.[151] Data retrieved from USGS.

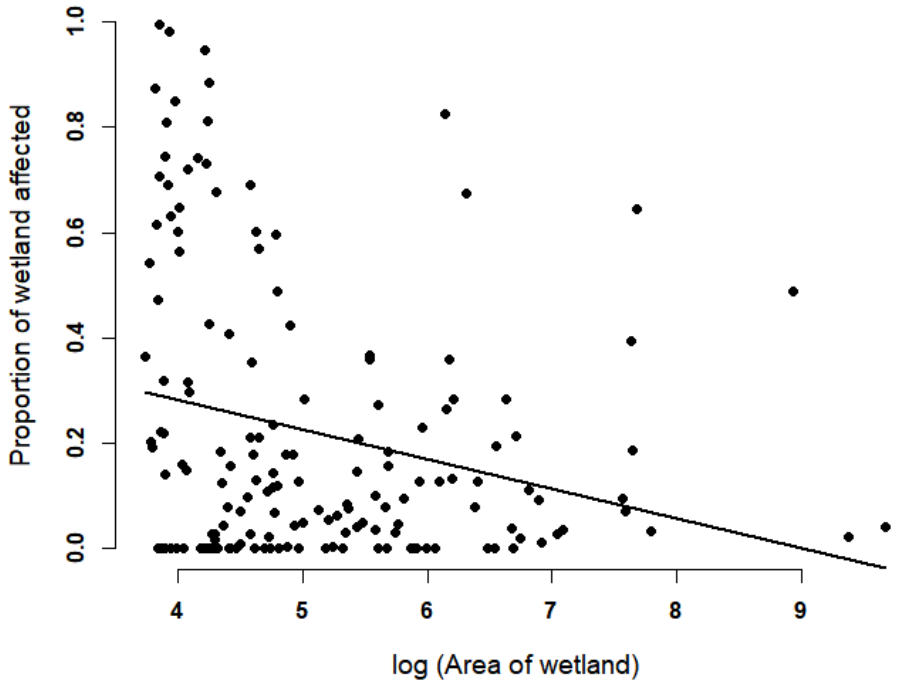


Figure 3.3: The relationship between the area of a wetland and its proportion affected by human development for Chikaming Township.[152] Data retrieved from EGLE.

requirements, Section 7.15 outlines regulations to minimize wetland disturbance during the construction process. Other considerations for wetland protection are provided through the ordinance's Planned Unit Development Open Space Requirements (Article 15), Open Space Preservation Option for R-1 and R-2 districts (Section 16.01), Cemeteries (Section 6.09), and Wind Energy Facilities (Section 6.49). Many of these sections and articles require consultation with wetland experts for development to be carried out or prohibit development on wetlands entirely.

While these zoning ordinance provisions represent a substantial step in the right direction for wetland protection, Chikaming Township could still more comprehensively analyze explore options for better conserving its wetlands through the next master plan update. The planning methods for wetland protection outlined earlier in this section can be a starting point for undertaking this work. The Filling the Gaps guide published by the state of Michigan in 2010 also offers important considerations for wetland protection, particularly for those under 5 acres.[120] The township should consider undertaking a more detailed investigation of its wetlands than what is provided here, and amending its zoning ordinance applicable to specific development pressures accordingly.

Agriculture

Agriculture accounts for a large portion of local land use in Chikaming Township (see Figure 3.2). Most of these agricultural lands are concentrated away from areas of high intensity development and instead surrounded by forests and woodlands. These land use patterns are ideal for agricultural land protection, as few farms are threatened by forest or woodland expansion. Nonetheless, some agricultural lands within the township either encompass or are in close proximity to wetlands. This proximity can be problematic if agricultural runoff (with the pesticides and nutrients it often carries) is not properly contained.

In Chikaming Township, the preservation of agricultural lands has been an important part of the local zoning ordinance, which establishes an Agricultural District (AG) "to maintain the rural character of the district area in an open, partly natural state." [121] Rural Estates also have a separate zoning district, R-2, to:

> *"(a) satisfy demand for a semi-rural lifestyle by providing large lots in non-prime agricultural land, (b) encourage the survival of small-scale specialty agriculture which is compatible with low-density residential areas, (c) preserve significant forest, ravine and wetland areas, (d) discourage dense development where municipal water and sewer services do not exist, and (e) provide a transition between the more densely settled and rural portions of the Township."* [122]

For other Michigan coastal communities with agricultural lands that contribute to tourism, agribusiness, and local character, establishing similar districts can help in protecting agricultural land from development. If Chikaming Township is interested in further protecting its large, contiguous zones of

agricultural land, a Purchase of Development Rights (PDR) program could also be a useful method for doing so on a long term basis. In the case of farmland preservation, this would mean restricting the land's use to agricultural purposes.

To further explore possibilities for protecting agricultural land, investigations into the size of individual landholdings could benefit Chikaming Township. Currently, parcels within the Agriculture District can be as small as 10 acres, which may be too small to ensure viable and productive agricultural activities into the future. Such an analysis would determine whether large, contiguous areas of farmland are owned by a few residents or many, and could help determine to what extent currently active farms might be broken up and lost to farming in the future. The results of the analysis would provide context for determining how effective planning strategies like PDR programs or other farmland conservation strategies might be. Other investigations could include an inventory of agricultural commodities produced in the township, along with any threats to their production, and an analysis of the change in agricultural land over time to determine the effectiveness of existing ordinances in curbing agricultural land conversion.

Coasts

A detailed assessment of coastal issues affecting Chikaming Township can be found in the Hazards section of this guidebook, but it is important to note that rising average water levels over the past decade have combined with an increased frequency and severity of extreme storm events, causing rapid changes in Chikaming Township's coastal areas. To protect the coastline, Chikaming Township has taken significant steps for managing erosion and the loss of its public beaches. The township requires a setback from Lake Michigan for structures located within the R-1-W Waterfront district, and it recently adopted a general police power ordinance banning the installation of permanent hard shoreline armoring. While many other coastal communities have setback requirements, the township's efforts to prohibit hard armoring structures is a novel approach to coastline protection in the state of Michigan. Other local governments might consider a similar approach when looking to ensure that their beaches are around for generations to come. For Chikaming Township, it would be prudent to continue addressing the effectiveness of both of these measures during the next master plan update.

Urban land use

Urban built environment

While Chikaming Township is primarily agricultural in character, many areas along the coastline and highways have undergone high intensity development (See Figure 3.2). Much of the coastal development is in the form of secondary residences and vacation homes, along with the infrastructure that accompanies these structures, like roads, driveways, swimming pools, and tennis courts. This level of coastal development has important implications for stormwater management and the stability of the coast, as explained in more detail in the Water and Hazards sections of this report.

The township's master plan and zoning code include a number of laudable sustainability and conservation goals as well as several provisions that are effectively designed to make those goals a reality. The township's wetland and coastal setback requirements should continue to protect waterways from the effects of urban land use as well as the siting of hazardous waste like septic tanks and petroleum businesses. Chikaming Township's Open Space Preservation Development ordinance for R-1 and R-2 zones represents a creative solution that allows much of a plot to remain 'undeveloped,' which can provide protections for natural land uses and resources.[123] The township has already established and continues to expand its preserved parks and natural areas, such as Warren Woods, the Chikaming Park and Nature Reserve, and Pepperidge Dunes. The township should continue its efforts to acquire land for small urban parks and continue encouraging developers to preserve natural areas and open space, as well as working with the Chikaming Open Lands nonprofit to expand these protected areas.

The township's 2014 master plan highlights the need for more affordable housing options as property prices and rents in the area continue to increase. The plan also notes that unmanaged suburban development could lead to unwanted and unsustainable sprawl.[124] Chikaming Township could follow through on encouraging more affordable and compact residential development by expanding by-right accessory dwelling unit (ADU) additions in R-1 and R-2 zones; allowing for a greater variety of housing types through by-right attached single family townhomes and modest multifamily structures in all residential zones; and expanding the areas of the township zoned for larger multifamily developments (R-3) beyond the small region in the southwest, all while keeping more compact urban development contiguous with and concentrated within the township's existing urbanized areas.[125]

Finally, Chikaming Township's 2014 master plan includes a future land use section that provides a hopeful vision for their community going forward. This includes a potential 'Green Corridor' and several proposals for preserving natural lands as well as community character through preservation efforts, overlay districts, and plans for potential new parks. The township should continue exploring and committing planning resources to these efforts, along with promoting the goal of encouraging more infill of the already developed residential areas.[126]

Urban green space

In Chikaming Township, only 6,631 acres (1.46%) of the total green space in the community is accessible for public use (see Figure 3.4). Following a World Health Organization (WHO) standard, the percent of Chikaming Township's population that has access to public green spaces within a walking distance of less than 300 meters (0.2 miles) is only 40%.[127, 128]

*Green space index = Number of population within 300 meters of green space/ total population * 100*

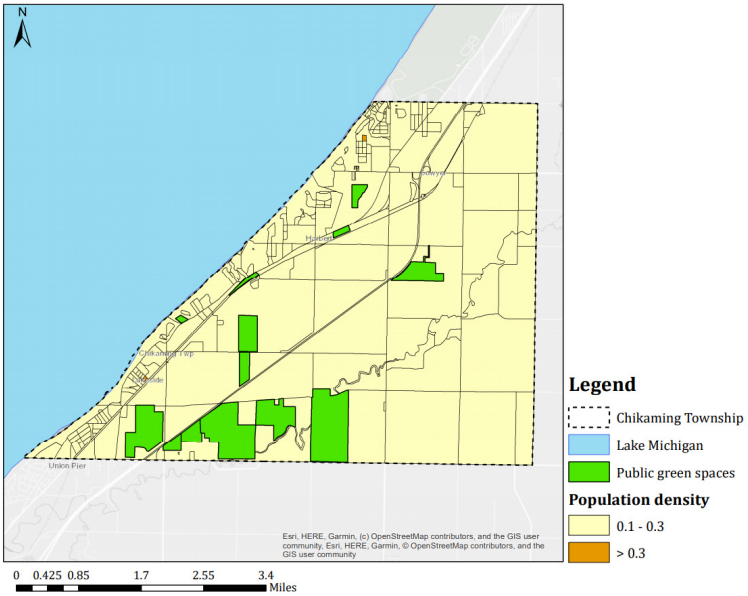


Figure 3.4. Distribution of public green spaces in relation to gradients of urban density in Chikaming Township by block group.[153] Data retrieved from USGS.

This analysis does not include coastal areas due to incomplete information about public access points, and it is important to note that there are some limitations when using these green space standards. For one, the aerial distance between green space and residents' homes may not be an indicator of actual accessibility if pedestrian paths do not safely connect these areas. Additionally, if entry and exit points are situated farther away than a site boundary, the 300 meter buffer is not applicable to the entire site. So while the WHO standard can be useful for an initial investigation of green space access, local governments might consider setting their own green space standards based on their communities' specific recreational, ecological, and development needs.

More importantly, neither the township's current master plan nor the zoning code provide detailed analyses or requirements regarding accessibility to public green spaces (aside from beach access points). The zoning code references the need for connecting open (green) spaces with adjacent developed lands through the provision of paths, trails, or greenways; yet, it lacks specific standards on the needed accessibility and equitable distribution of these spaces. The ordinance could address more directly and thoroughly a goal of designing these green spaces with due consideration to the spatial variability of population density and socio-economic composition of neighborhoods.

Our analysis does not consider disproportionate access to green space among different racial groups because of the limited diversity in the township presently (the population is over 98% white), but this is a worthwhile line of inquiry for many Michigan communities.[129] To that end, Chikaming Township might consider both the physical accessibility and social equity of existing and future urban green spaces in other ways through its future planning efforts. Furthermore, more urban green space accessibility could be achieved for Chikaming Township if green space planning is integrated with transportation planning, as the physical accessibility of green spaces is contingent on the existence of roads and paths linking green spaces with built-up areas.

Case study: City of Manistee

Forests

The City of Manistee has a small proportion of forest cover at 6,093 acres, or only 5.5% of the total land area.[130] This makes the per capita forest and woodland in the city 1 acre/person. Much of this forested land is concentrated in the northwest corner of the city and is not well distributed across space. In addition, much of the length of the Manistee river is highly developed and largely devoid of vegetative buffers like forests, making it possible for pollutants from urban areas to enter the river and ultimately Lake Michigan.

Manistee's Zoning Ordinance makes few references to forests or woodlands, which aligns with their general absence throughout the city. Yet, the city maintains connections with the forests that once dominated the Manistee landscape through their annual Forest Festival. The 2016 Master Plan identifies the festival as a celebration of Manistee's history of forestry and a reminder of the role timber harvesting played in the development of the city.[131] The city's master plan also identifies a large proportion of vacant areas in Manistee.[132] While some of these areas should be used for redevelopment purposes, the city might consider using others as part of a network of strategically located woodland lots or parks across the city. In combination with these efforts, the city might also consider possibilities for the development of small woodlot or tree preservation requirements for existing smaller lots. These efforts could help the city regain some of its historical character as a forested community.

Additional efforts for protecting individual trees in private yards of urban communities could be emphasized as well, as the city lacks sufficient contiguous forest cover relative to its total area. This could be achieved by putting more restrictions on individual landowners to protect their trees, or through the provision of incentives for individual tree protection. For instance, they can use the resources provided by the Department of Natural Resource and Environment (DNRE) to protect private trees through the Urban and Community Forestry (UCF) program. The UCF provides technical, financial, and educational assistance to nearly 7.5 million urban residents in over 1,300 communities throughout Michigan.[133]

Wetlands

The City of Manistee has only a few contiguous wetlands along its western shoreline and northeastern edge. These wetlands comprise around 3.8% (4,189 acres) of city land use, and 18% are under human development pressure currently.[134] Wetland areas in the northeastern portion of the community overlap with a large segment of the forested lands, as depicted in Figures 3.5 and 3.6.

Manistee's wetland-related zoning ordinance provisions include hazardous substance groundwater protection requirements for stormwater and drainage facilities to capture runoff, development restrictions for manufactured housing communities, and site plan requirements for residential development and its

access points.[135] As a part of its Open Space Preservation Development element, the ordinance also includes new parcel siting requirements for creating and maintaining native vegetative buffers adjacent to wetlands and surface waters.[136]

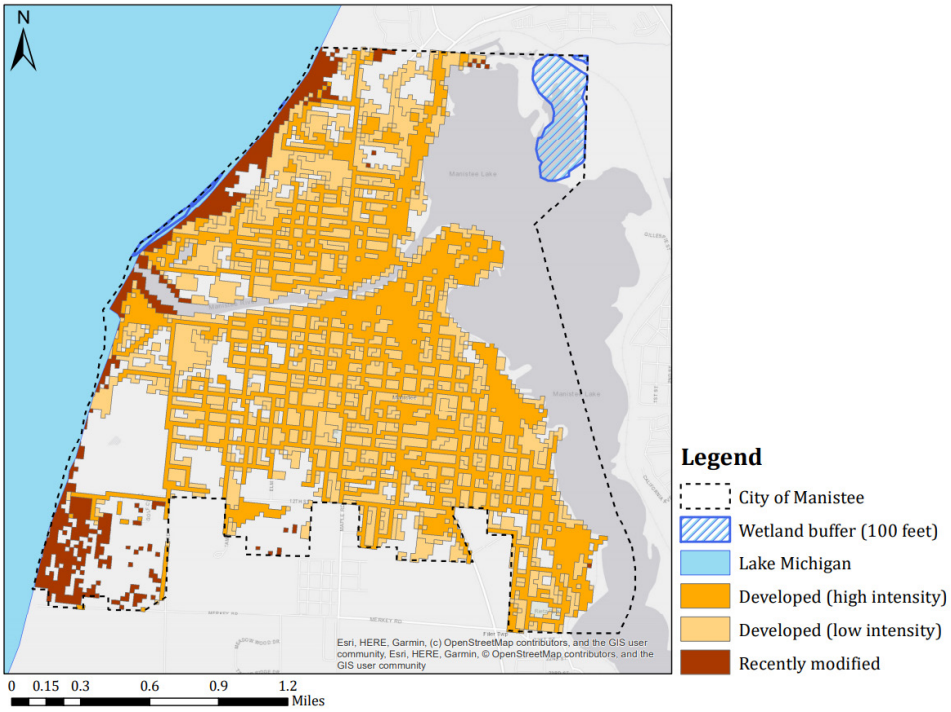


Figure 3.5: Forest and woodland cover in the City of Manistee.[137] Data retrieved from USGS.

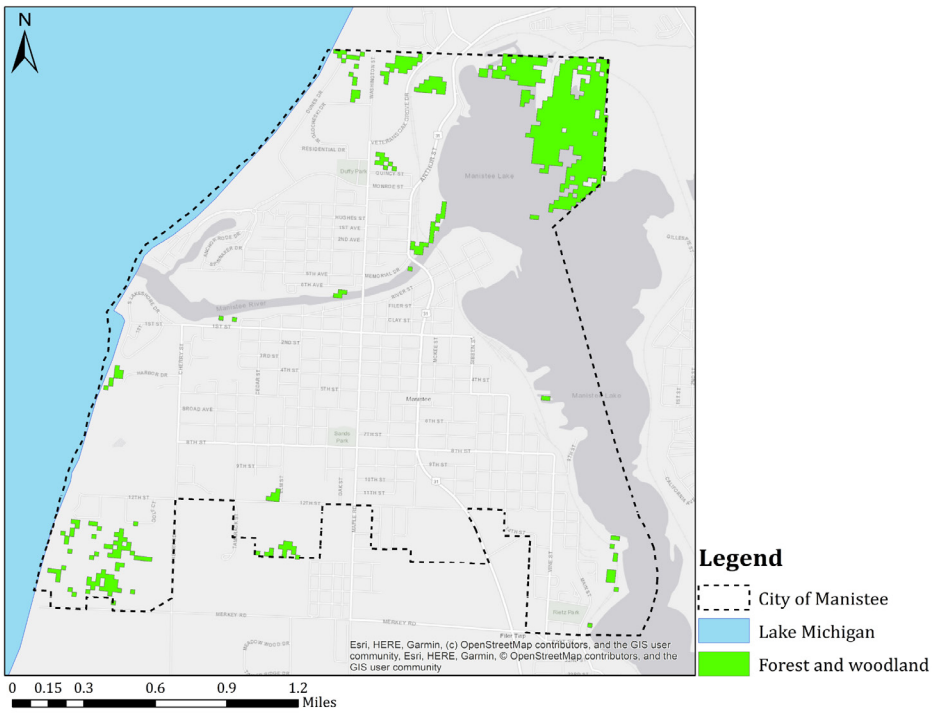


Figure 3.6: Distribution of wetlands and land use types in the City of Manistee.[138] Data retrieved from USGS.

There are a number of planning options the city does not appear to be employing currently that it might consider adopting. Under the Michigan Natural Resources and Environmental Protection Act (NREPA), for example, the city has the authority

to regulate its wetlands that are under 5 acres and can establish protections separate from those provided to larger wetlands.[139] If in close proximity to other natural features, sensitive area protections can also be used to require setbacks from wetlands; however, the way local governments define natural features when doing so is important for regulating wetlands and should be done with great care. Key considerations for these efforts can be found in the Appendix of the state of Michigan's Filling the Gaps report.[140]

Since many of Manistee's zoning ordinances target new development for wetland protection, the city should consider regular assessments of existing infrastructure and its impacts on wetland areas. There are regulatory options for addressing undesirable impacts even after development has occurred - like those mentioned under NREPA - but a more detailed analysis of where wetland threats (e.g. runoff) are coming from could be undertaken to make the best management decisions.

Agriculture

In Manistee, significant losses in agricultural land have already occurred. This is to be expected of an urban community, though there are always opportunities to restore areas for agricultural purposes in the form of urban agriculture and small-scale agricultural production. These operations are becoming increasingly popular as some urban residents look to reconnect with the food they eat, while others enjoy these spaces primarily for recreational purposes.

Given the density of urban development in the City of Manistee, the absence of agricultural land is fitting. The scale of development evident in the area typically allows communities surrounding the city to dedicate more land for agricultural purposes. As development remains concentrated within the city center, growth pressures are limited at the outskirts of the community. Agriculture can also conflict with more urban land uses when in close proximity, and to the detriment of both farmers and their urban neighbors. Farmers often apply fertilizers and pesticides to crops that neighboring residents might find concerning. Many farmers also operate large machinery that can be a nuisance to those within earshot. These are just some of the reasons that agriculture and urban development come into conflict, but they are illustrative of why urban agriculture and small-scale operations should be the preferred level of agricultural development for the city.

If the City of Manistee is interested in the environmental benefits that agricultural lands tend to bring (e.g. carbon sequestration, stormwater infiltration, etc.), it might consider other more natural land use types that are better suited to an urban context. Urban forests and green spaces are more appropriate alternatives that also offer many recreational benefits that agricultural lands lack. Opportunities for expanding the urban forest have already been described in some detail, and options for urban green spaces can be found later in this section.

Coasts

As with Chikaming Township, a detailed analysis of the City of Manistee's coastline is provided in the Hazards section of the guidebook, highlighting the shifting coastline and threats posed by coastal development. The City of Manistee has addressed some issues of coastal management through designated Coastal Zone Management Areas in its 2016 Master Plan, as well as provisions of its zoning code. Since the city is bound by water on two sides - Manistee Lake to the east and Lake Michigan to the west - the Coastal Zone Management Areas extend across much of the community.[141] The mixed-use Waterfront District, described in Article 12 of the Manistee Zoning Ordinance, also protects coastal areas and "is intended to encourage and promote sustainable, environmentally and aesthetically compatible developments that use or compliment the shoreline while promoting expanded use of the shoreline by the public." [142]

Urban land use

Urban built environment

Much of the City of Manistee's land use consists of low- to high-intensity urban development with much of the recent development and modification happening along coastal areas and the coastal inlet of the Manistee River. We recommend that the city be mindful of impervious surface area, which can lead to flooding, contaminant loading, and urban heat island effects. Manistee should consider street tree planting programs and green stormwater infrastructure implementation for new and existing developments rather than relying on existing stormwater sewer capacity. The city should also limit development in the riparian and coastal zones, especially in the downtown area along the river. Areas that are undeveloped now but set aside for future development in the city could also be considered for preservation as urban parks and green space.

The master plan notes that, according to 2010 U.S. Census data, Manistee is currently experiencing a 22 percent vacancy rate for housing which surpasses the Michigan State Housing Authority's threshold of 10 percent that is associated with 'blight.' However, it is not clear whether this is a vacancy rate associated with year-round residents or if some of the vacancies are rental properties available to short and medium-term visitors. The master plan notes that U.S. Census data poorly tracks seasonal populations but then says that the 22 percent vacancy rate likely does include seasonal residents.[143] Perhaps more regular community surveys could better determine the extent to which residential properties are truly vacant and unused over different time-scales.

It does appear that the City of Manistee has seen population decline when compared with the township and county levels. While this may seem to be a loss for the city, the master plan notes that a key foundation of successful 21st century economies is functional regionalism.[144] Even if fewer people choose to call the City of Manistee itself home, the city can still benefit economically from coordinated policies and economic development initiatives in cooperation with its neighboring communities and counties.

For future housing development, Manistee might consider allowing more by-right housing density in R-1, R-2, and R-3, including duplexes, triplexes, and four-plexes in R-2 and R-3 along with single family attached townhomes and multi-family housing developments of appropriate size in R-2 and R-3. While R-4 residential zones appear in the zoning code, nowhere in the city appears to be zoned for this residential use type.[145] This could instead be discarded in favor of allowing C-2 and C-3 commercial districts to include more flexible mixed use commercial and residential combinations. These changes would help encourage moderate density and overall walkability/bikeability for Manistee while limiting outward expansive pressure to construct additional car-dependent and infrastructure-stressing large-lot suburban neighborhoods.

Manistee's master plan addresses the problem of nonpoint source pollution and identifies zoning as the correct tool for mitigating this kind of pollution; especially storm runoff. Future growth and construction along the lines outlined above would also help limit the overall expansion of impervious surface in Manistee, helping to mitigate potential problems with flooding and water contamination from storm runoff. This is consistent with the zoning ordinance's provisions related to groundwater and wetland protection.[146] The other strategies and techniques outlined in the plan such as bio-retention (swales), buffers, and onsite infiltration should also be given serious policy consideration.[147] This is especially the case along the Manistee river where a high level of existing impervious surface may lead to flooding and contamination issues. Adequate green space, green stormwater infrastructure, additional street trees, and setbacks are highly recommended in this area.

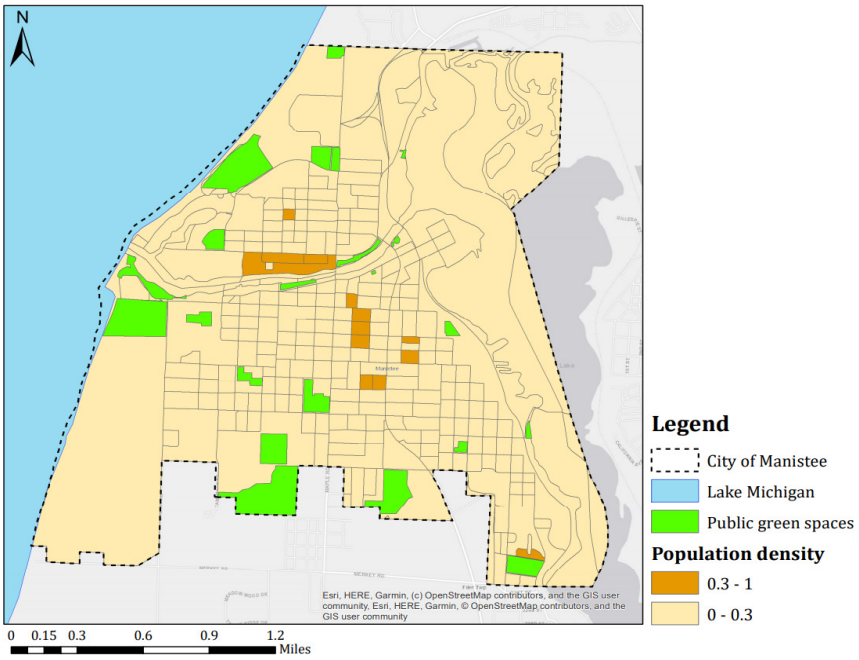
Given that climate change projections show Michigan is likely to experience a greater frequency of more severe precipitation events, the buildable area regulations and setbacks referencing the 100-year floodplain may need to be revised.[148] FEMA flood risk maps are often lagging descriptions of actual risk, and an increasing frequency of intense storms might mean that '100-year' precipitation events may occur much more frequently in the future putting properties and infrastructure at risk, as discussed again in the Hazards section of this guidebook.

Urban green space

In Manistee, areas with higher population densities tend to have a small number of proximal green spaces (see Figure 3.7).[149] Altogether, only 607 acres (2.63%) of the total green space is accessible for public use. According to WHO standards, the green space index for Manistee is 72%, meaning that about three-fourths of Manistee's residents have access to green spaces within a distance of less than 300 meters (.2 miles).[150] However, this analysis does not include coastal areas due to incomplete information about public access points.

As with Chikaming Township, Manistee's most recent master plan provides information on the current recreational amenities provided by the city's existing public green spaces, but it does not address in detail the ecological functions of

those green spaces or issues of accessibility. The city's zoning code similarly does not provide specific guidelines on accessibility and equity of urban green spaces and their use, particularly in terms of residents from different socio-economic groups. All of these topics would be appropriate for further investigation and policy development through the city's next master plan update and follow-up planning efforts.



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4: Hazards

Overview

For Michigan's Great Lakes coastal communities, the shoreline is a source of inspiration, recreation, and economic opportunity, and an indelible part of the community's history, culture, and identity. In light of climate change's disruptions to natural cycles, however, the Great Lakes are experiencing increasingly volatile and pronounced swings in lake levels, and coastal communities are likely to experience more high-intensity storms.[155] If, in upcoming years, lake levels rise to new highs and storms become more intense, households, businesses, and municipal facilities could experience 'perfect storms' that yield heightened losses of property and quality of life. This damage will arrive in the form of increasingly high-energy waves in the coastal zone, leading to direct damage and nuisance flooding; increased incidences of inundation within both coastal and riverine zones; and an increased rate of long-term shoreline recession (i.e., movement landward over time). Even if the 'perfect storm' never arrives, coastal communities can expect their Great Lakes shorelines to continue to be highly dynamic, given the ocean-scale size of the lakes, and they would do well to be as prepared as possible. Incorporating hazards analysis and mitigation into the community's ongoing environmental and master planning efforts offers an effective way to do so, and to better ensure a desirable and sustainable future.

This section outlines a variety of questions to consider as communities grapple with their resilience to coastal hazards, provides resources to build knowledge on how best to respond, and presents several case studies to illustrate how coastal communities can leverage innovative planning methods to enhance their resilience. Because this topic in particular has received extensive attention recently from a variety of research groups and federal and state agencies, this section presents an overview of these topics and methods, with references to resources that provide more detailed explanations and direction elsewhere.

Michigan's dynamic Great Lakes and coastal shorelands

The Great Lakes are large water bodies that behave like oceans in many ways, but they are not large enough to experience twice-a-day tidal fluctuations like the oceans do. Even so, they do fluctuate dramatically, over the course of seasons, years, and decades. Figure 4.1 reproduces a hydrograph developed by the Great Lakes Environmental Research Lab (GLERL) illustrating standing lake level fluctuations for Michigan's Great Lakes, including Lake St. Clair, from 1918

through 2021. This hydrograph shows how dramatically lake levels vary over time and suggests that there is some degree of regularity to that pattern, but it also demonstrates that the timing, frequency, and amplitude of those fluctuations are not so regular that they can be predicted (i.e., as are tidal fluctuations on the oceans). Figure 4.2, a similar hydrograph recently produced by the U.S. Army Corps of Engineers, shows estimated lake levels into the near future for Lakes Michigan and Huron, highlighting the increasing levels of uncertainty present in the near future, as well as the differing levels of uncertainty associated with the particular estimation approach used.[156]

These estimates and figures help to demonstrate that Great Lakes shorelines have always been highly dynamic. The impacts of continually fluctuating water levels, along with an increasing incidence of high-energy waves, will likely only increase as storm events increase from climate change. In fact, current research further suggests that climate change could also result in fluctuations in standing water levels that rise above record highs, drop below record lows, and come with increasing frequency. All of those changing conditions could lead to increasingly aggressive erosion of beaches and shoreline bluffs especially during high-water periods, accelerating the long-term recession of shorelines over time. That increased shoreline recession, in turn, could threaten structures built too close to the shore during periods of low lake levels - at least, threatening those structures more quickly than they otherwise would have been in the past.

Three key coastal areas for local planning

Three areas should be given special attention by coastal communities for their master planning, both to mitigate possible impacts from coastal hazards and to conserve coastal resources. All of these areas are designated and regulated to some extent by the Michigan Department of Environment, Great Lakes, and Energy (EGLE) and development affecting them may require permitting from EGLE, but all are important resources for communities to plan for as well.

High Risk Erosion Areas (HREAs) are shorelands of the Great Lakes and connecting waters where erosion has been documented as occurring at a long-term average rate of one foot or more per year[157]

- Caused by high water levels, storms, wind, groundwater seepage, surface water runoff, development along shoreline such as armoring and groins
- Vegetation on bluffs can slow rate of erosion[158]

Critical Dune Areas (CDAs) are dunes that were formed over time as sand and other sediments accumulated, with help from the waves crashing along the shoreline[159]

- May also be HREA depending on rate of erosion
- Support biodiverse habitat for vegetation and wildlife
- The state has designated some dunes as 'critical,' requiring state-level permitting, but communities often encompass dunes that provide equally important functions deserving local attention, even though not designated as critical by the state

Coastal wetlands are lands or water features inundated or saturated by water at a frequency and duration sufficient to support hydric soils and a predominance of wetland vegetation or aquatic life.[160] Refer to Water and Land sections for more details on wetlands.

- Provide buffers between water and land
- Enhance flood mitigation
- Reduce soil erosion
- Improve water quality
- Support biodiverse habitat for vegetation and wildlife

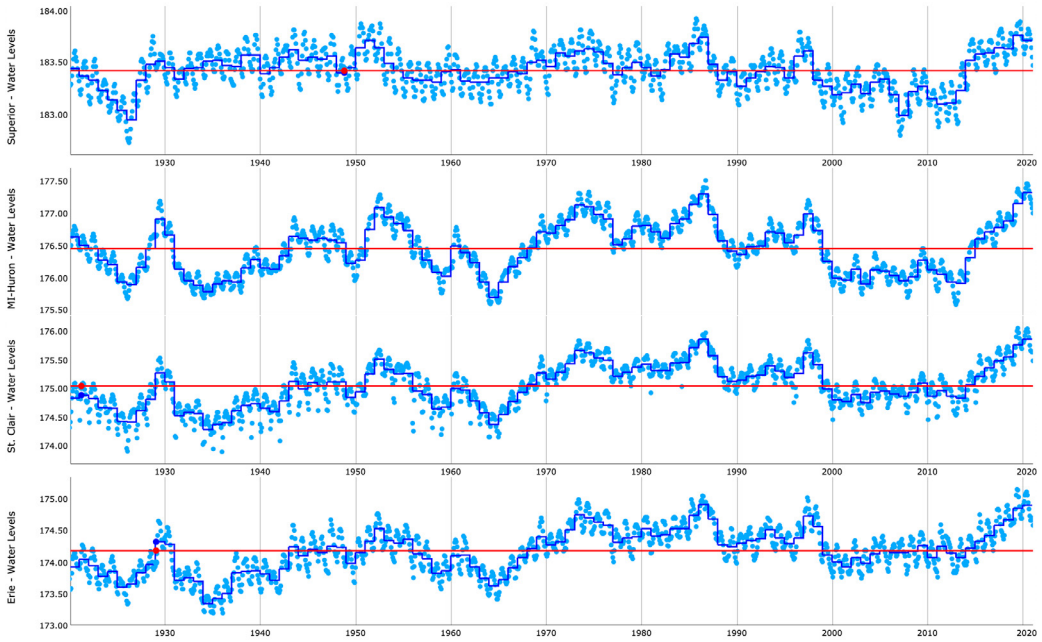

Figure 4.1: Great Lakes Average Water Levels from 1920 to 2020 - NOAA
Retrieved from https://www.glerl.noaa.gov/data/dashboard/GLD_HTML5.html

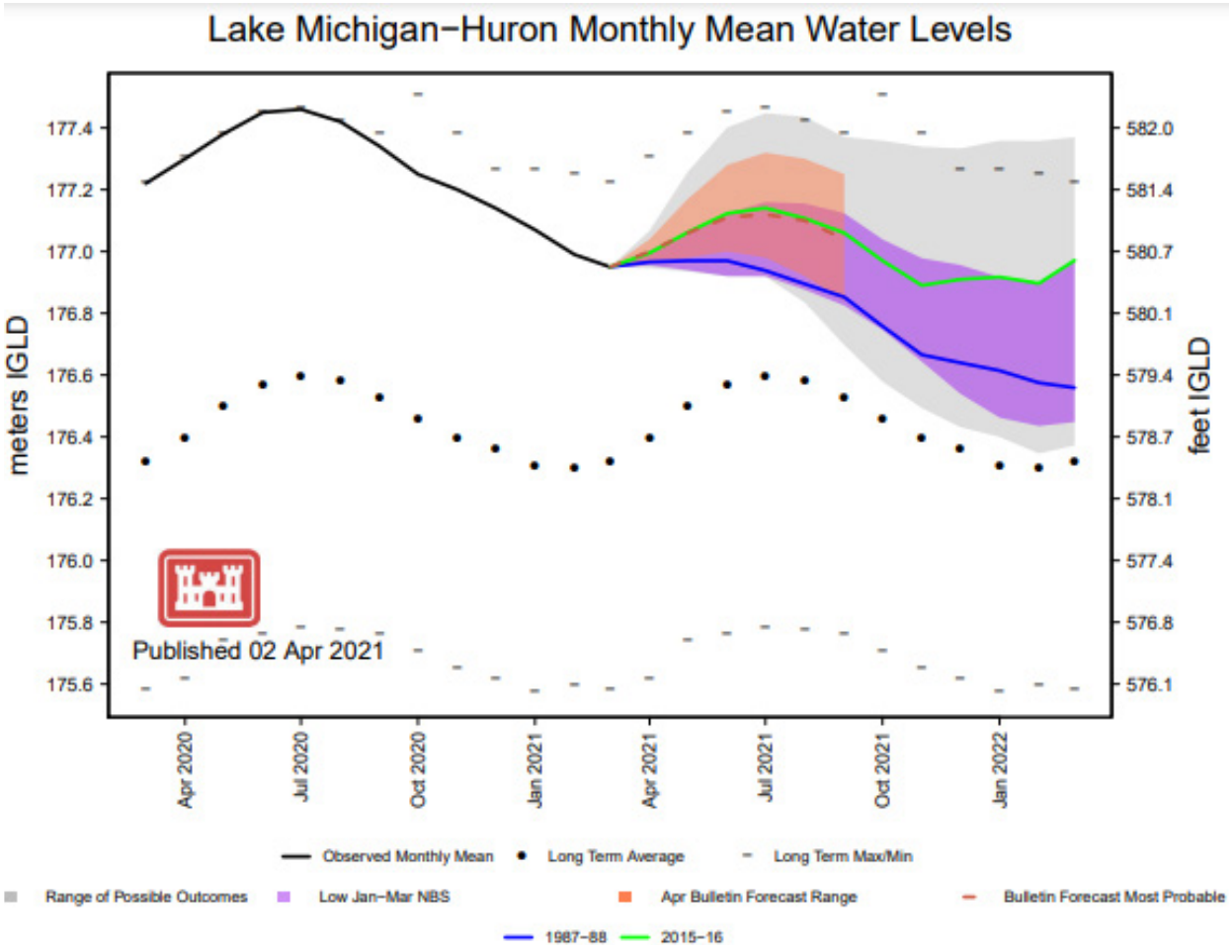

Figure 4.2: Lake Michigan-Huron Monthly Mean Water Levels - USACE
Retrieved from https://www.lre.usace.army.mil/Missions/Great-Lakes-Information/
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Finally, higher lake levels and increased storminess will also likely increase riverine flooding, especially in near-coastal settings affected directly by Great Lakes water levels. That possibility should prompt coastal communities to revisit their development regulations within coastal and riverine floodplains and to take other steps such as preserving and restoring coastal wetlands, which help to absorb flood water and to prevent the placement of - and future damage to - built structures from inundation.

The full array of benefits of conserving wetlands, and methods for conserving them, are both discussed more thoroughly in the Water and Land sections of this report, and they are not addressed further here. The focus of the remainder of this section is on the challenge of identifying and analyzing coastal areas subject to hazards from high-energy waves and inundation during storm events, and on planning for the long-term recession of Great Lakes shorelines. Those topics raise the additional challenges of estimating accurately the likely locations of shorelines over time as they recede, and ensuring that actions taken by coastal localities are legally viable. Both of those topics are addressed briefly at the end of this section as well. Before describing efforts that coastal localities can use to address hazard mitigation through their planning efforts, however, it would be helpful first to consider the roles played by federal, state, and local governments along Great Lakes shorelines.

Federal, state, & local regulatory authorities & programs at the shore

Each level of government has different jurisdictional responsibilities and roles to play in responding to Great Lakes coastal hazards. The U.S. Army Corps of Engineers (Corp) regulates shoreline development along the Great Lakes because the lakes are navigable waters of the U.S.[161] In partnership with the Michigan Department of Environment, Great Lakes, and Energy (EGLE), they approve permits for many shoreline activities and development. Both the Corp and EGLE have regulatory jurisdiction lakeward from an elevation-based ordinary high water mark (OHWM) along the shore, although each uses slightly different elevations for those standards. Shoreland property owners must obtain approval from the Corp and from EGLE for any work done lakeward of the OHWM.[162]

At the state level, EGLE provides the primary regulatory oversight of activities taking place on submerged bottomlands of the lakes and at the shoreline. It manages a variety of programs toward that end, such as the High Risk Erosion Area (HREA) and Critical Dune Area (CDA) programs. General permits, for example, are required for activities of general maintenance along the shoreline, such as grooming sand, leveling sand, constructing a pathway, or mowing bottomlands. If the activity requires mechanized tools or the construction of a structure, an individual permit may be required from both EGLE and the Corp.[163] EGLE's various program websites offer a plethora of information regarding permits and best practices for addressing shoreline erosion and related issues,[164] and they should be consulted early in a local community master planning effort.

At the local level, coastal communities have broad authority to plan for and manage development within their coastal areas under the Michigan Planning Enabling Act (MPEA) and the Michigan Zoning Enabling Act (MZEA). Local governments are authorized to implement the state's high risk erosion and critical dune protection programs through their local zoning codes as well, with oversight from EGLE. Coastal communities can address the risk of hazards through local planning, infrastructure policy making, and regulations.[165]

Explicit inclusion of coastal resources, the formation of actionable objectives for their stewardship, and indicators denoting progress (or lack thereof) should ideally be incorporated into the master plans of all Michigan coastal municipalities. Those analyses and background information can then be used to inform and justify appropriate shoreland management policies and regulations, such as setbacks from the shore, limitations on structure height and size, regulations addressing parcel size and shape, and so on, as discussed more below.[166] Local governments could also use their zoning authorities to regulate the installation of various kinds of shoreline armoring, and they may be able to use general police power ordinances to do the same as well, again as discussed more below, along with brief attention to several legal questions concerning the use of those authorities and related issues.

Coordination during local planning

An important beginning step for a coastal community is to reach out to its neighboring communities to share ideas; coordinate management activities, especially for adjacent shoreline areas; and provide mutual support. Another early step is to coordinate with state officials administering the various coastal management programs described above that might influence local regulatory decisions, or that might provide support for local planning and zoning efforts. Finally, communities that lack local in-house staff knowledgeable about Great Lakes shoreline dynamics or shoreland management strategies might look to engage professional consultants who could provide that expertise, being sure to engage both planners familiar with the full array of policy options a locality might consider and engineering consultants attentive specifically to engineering solutions.

Planning for & managing Great Lakes coastal shoreland hazards

Because of the highly dynamic nature of Michigans' Great Lakes and their coastal shorelands, given the amount of new development that has occurred over the past several decades in near-shore coastal settings, and especially given the very rapid rise in lake levels during the past decade - along with the number of structures now at heightened risk - substantial efforts have gone into conducting research and providing resources to assist coastal localities better understand and plan for the coastal hazards they confront (see sidebar on next page for a sampling of those resources). Without replicating all of those resources here, this discussion presents an overview of some of the key planning concepts and methods they provide.

Given the challenges of planning for hazard mitigation along Great Lakes shores because of the uncertainties inherent in Great Lakes water levels and storm events, especially in light of climate change, a promising way to approach that planning effort is to use scenario-based planning.[167] In brief, using that approach, the first step is to identify coastal areas potentially at risk from high-energy wave action on the lake shorefront, along with storm-induced flooding, under varying conditions of standing lake levels and storminess. On a Michigan Great Lakes coast, that might entail identifying areas that could be at risk during a 'lucky' climate future (i.e., when lake levels are low and storms are minimal), compared to areas at risk during an 'expected' climate future (lake levels are near the long-term average and storminess is moderate), compared to areas at risk during a 'perfect storm' climate future (lake levels are high and storminess is extreme). The second step is to generate local shoreland management options. That might entail identifying current development patterns, estimating future development at buildout given the community's current zoning regulations, and then estimating buildout if additional best management practices (BMPs), such as setbacks from water features, were incorporated into the community's zoning.

Resources for coastal hazard mitigation and resilience

A large array of resources are now available to Michigan's Great Lakes coastal communities to assist them with their coastal shoreland area and community resilience planning. See the following examples:

General Resources

- NOAA Digital Coast
- Great Lakes Coastal Flood Study
- Resilient Great Lakes
- Resilient Michigan
- MTU Great Lakes Coastal Shoreland Viewer

EGLE resources

- Coastal Management Program
- Michigan's Resilient Coast
- Shorelands Management Program
- Submerged Lands Program
- Wetlands Program
- Floodplain Management Program

Informational videos

- Michigan Coastal Management Program on 'Building Coastal Resilience' (youtube.com)
- Nature Change on 'Why Shoreline Armoring Fails' (naturechange.org)
- Nature Change on 'Who Protects the Public Trust?' (naturechange.org)

Combining climate futures with management options then yields scenarios, which can be analyzed to determine how each combination of a given possible future with a given management approach fares in terms of the numbers of properties at risk, the number of structures at risk, the potential fiscal impacts to the community, and so on. For example, Figure 4.3 shows a high-hazard area map generated by researchers for the City of Grand Haven, MI, illustrating the land areas at risk during lucky, expected, and perfect storm climate futures, projected on top of existing structures. When combined with potential buildout analyses, the city was able to conduct the kinds of buildout assessments and impact analyses described, which demonstrated that the risk to future development could be substantially mitigated - although not eliminated altogether - by the inclusion of BMPs like setbacks in the city's zoning code.

Having identified the array of potential hazard-related impacts a coastal community might experience in the foreseeable future, recognizing uncertainties about coastal dynamics and the array of potential management options the community might employ to address those risks, the next step is to then decide what to do. Here again, an extensive and growing array of resources are available to assist coastal localities in their efforts. The Adaptation Strategies Matrix produced by the NOAA-funded Resilient Cape Cod project, for example, compiles 43 different fact sheets on different types of strategies and infrastructure projects aimed at promoting coastal resilience.[168]

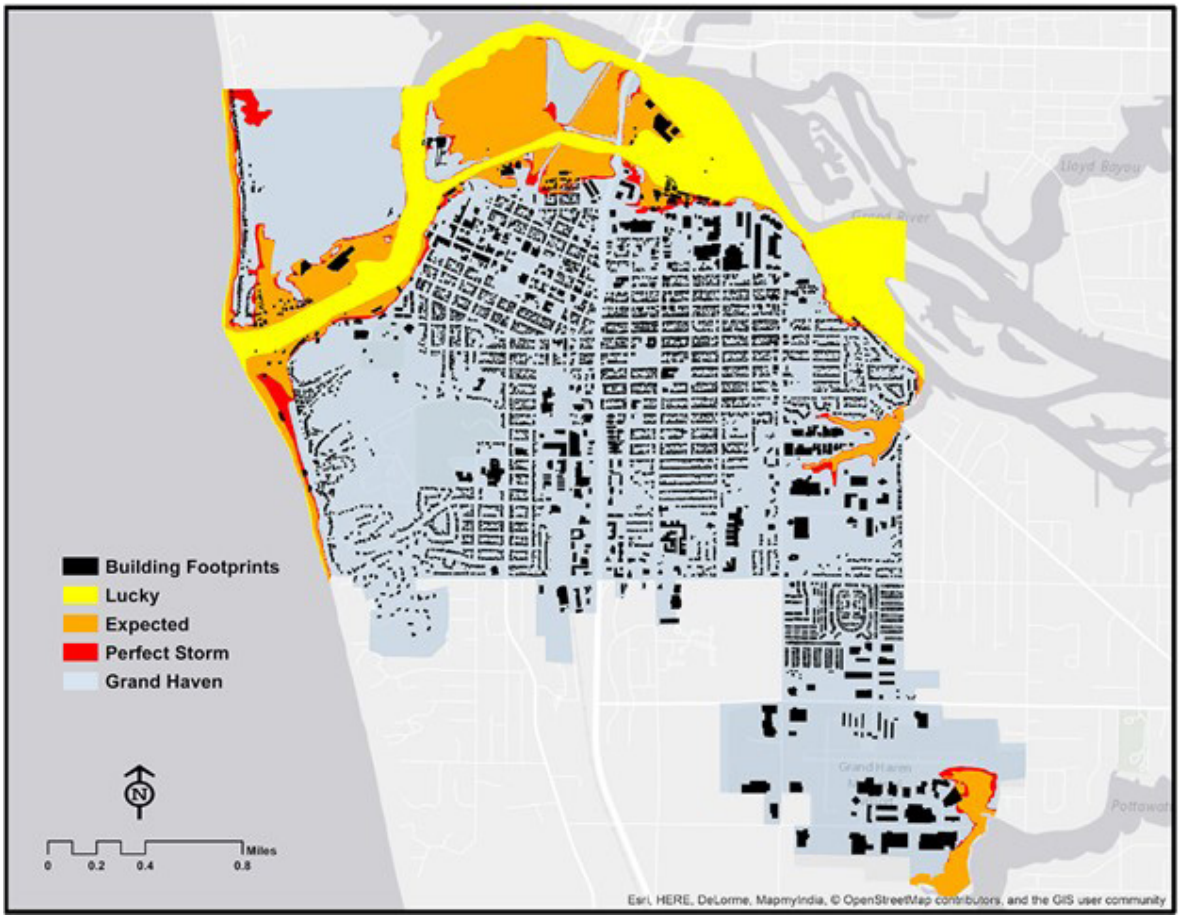


Figure 4.3: Image of high-hazard areas for the City of Grand Haven, MI, during potential lucky, expected, and perfect storm climate futures. Retrieved from http://www.resilientmichigan.org/chikaming.asp.[170]

While promoted specifically for coastal communities on the Cape Cod shore, many of the management options listed in this resource are applicable along Great Lakes shores as well. Multiple types of strategies - including nature-based (i.e. living shorelines), structural or hard armoring, non-structural/soft armoring, and planning/regulation-based mechanisms - are included on this site. Each strategy's pros, cons, costs, expected lifetime, and level of expected maintenance are detailed in these fact sheets. This resource also categorizes each strategy as protective infrastructure (directly shields vulnerable assets), accommodating infrastructure (reflects a pattern of "living *with* nature" rather than fighting against it), or strategies for retreat (i.e. acknowledges that building in a location was ill-advised, and transitions towards localized "de-growth"). Similar resources on the types of projects a community can undertake in service of building coastal resilience are also available from the National Park Service's broad index of coastal engineering interventions.[169] The NPS fact sheets on different types of adaptation strategies address many of the same concepts as does the resilient Cape Cod project, but the write-ups delve deeper into the science behind each type of intervention (i.e., rather than just the more practical points of cost, maintenance, and benefits to a community).

Anticipating and planning for long-term shoreline recession

All of the analyses and various planning approaches just described address in particular the challenges of mitigating coastal hazards given the location of lake shorelines as they exist today. A real complication that the state of Michigan and its coastal localities confront, however, is that those shorelines will not remain stable and stationary where they exist today, but rather will continue to recede landward over time - at least along most of the state's Great Lakes shore. As described above, the state regulates coastal development where that rate of recession has been determined to be one foot per year or greater, through the High Risk Erosion Area (HREA) program. In many areas subject to HREA regulation, that rate of recession is actually much greater than one foot per year, and even where the state does not administer that program the shoreline is likely receding at about one foot or less per year.

This long-term dynamic of receding shorelines puts into tension valid, but competing interests. Shoreland property owners' interest in stopping erosion by installing shoreline armoring, for example, exists in tension with the broader community's interest in maintaining accessible beaches and ecologically healthy wetlands, dunes, and other coastal resources. The problem is that any hardened shoreline armoring installed to arrest erosional processes will ultimately degrade, if not eliminate entirely, those natural coastal resources, doing so at great and ongoing expense because of the work required to maintain those structures over time. There are good reasons, therefore, for coastal communities to consider carefully and to possibly adapt their own regulations in order to manage coastal development for the purpose of better balancing potential damage to structures with potential damage to coastal resources. They might do so, for example, by

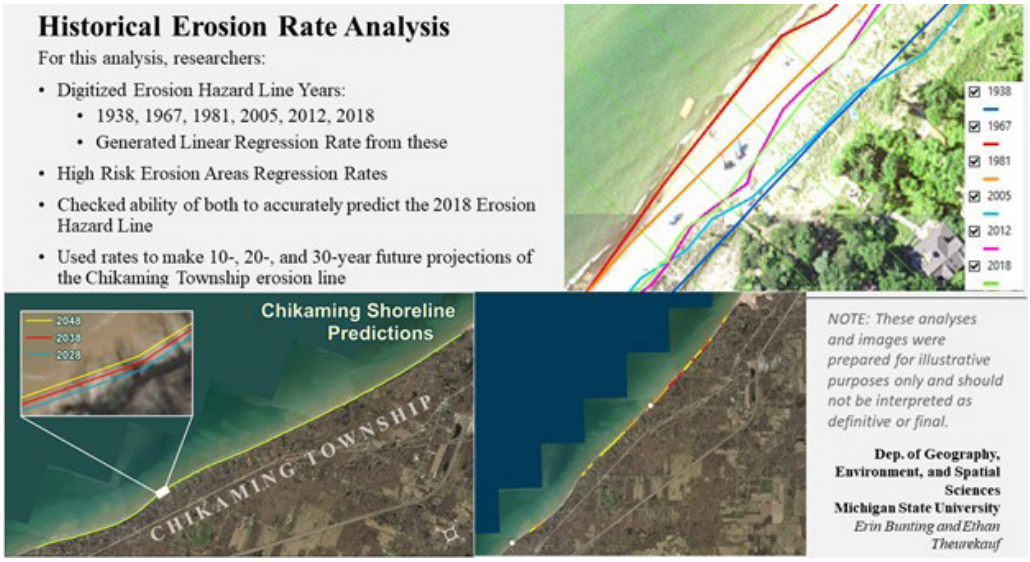


Figure 4.4. Schematic image presenting initial analysis methods and findings from a preliminary assessment of long-term shoreline recession along Chikaming Township. Provided by Michigan State University.[173]

adopting setbacks that shift landward over time as the lake shoreline naturally recedes over time,[171] limiting otherwise the kinds of structures that can be placed in near-shore areas, and possibly limiting or prohibiting the installation of shoreline armoring.

The real challenge in doing any of those things is accurately estimating where exactly the shoreline is likely to be in the foreseeable future. As part of the HREA program, EGLE estimates and maps the ongoing rate of recession experienced in the recent past for those stretches of shore receding at a rate of one foot or more per year, but those maps only show the rate of recession - not the estimated location of the shore in the future. Researchers at the Great Lakes Research Center at Michigan Technological University have recently developed a coastal shoreland viewer.[172] That resource can provide a first-cut, visualized estimate of shoreline and coastal bluffline recession rates over time and, along with the EGLE HREA maps, is a good place to start. Even more recent research, currently in progress at the time of this writing, is being conducted by researchers with the Department of Geography, Environment, and Spatial Sciences at Michigan State University. Figure 4.4 presents an image of some of the initial findings from that work, prepared for this guidebook and focusing on the shoreline along Chikaming Township for illustration. Community planners looking to better account for long-term recession rates and possibly map potential future shoreline locations should look for updates that may be available from these several research groups on these methods and findings at the time they undertake their analyses.

Legal issues to consider

Many of the development management options coastal communities might employ to mitigate hazards within their coastal shoreland areas would require the regulation of private shoreland properties in one way or another. Michigan's local units of government, including its coastal communities, have in general been

delegated by the state the authority to adopt 'police-power' regulations for the purpose of protecting the public health, safety, and general welfare. It may be possible to adopt local police power ordinances accordingly to regulate activities taking place within high hazard areas that could be harmful to the community. Similarly, Michigan's localities, again including its coastal communities, also have broad authority to regulate land uses in a number of ways through zoning ordinances. The use of setbacks to conserve nearshore coastal areas, for example, would take form through a zoning code. Finally, in addition to these local government regulations, there may be the potential for litigation between local governments and the state, or between neighboring shoreland property owners, related to nuisance, to the extent that activities taking place on one shoreland property - such as the installation of shoreline armoring - could adversely affect the shoreline of a neighboring shoreland property.

Taken altogether, therefore, it is important to stress that there may be legal consequences from the planning and regulatory decisions that a local government makes regarding hazard mitigation along its Great Lakes shores (including the decision not to act, relying on private litigation instead), and local officials should consult with their municipal attorneys about the legal implications and possible outcomes of their decisions accordingly. A team of law students at the University of Michigan have made an initial assessment of several possible legal questions that communities should be thinking about as they undertake their planning efforts. The appendix to this guidebook presents those questions, along with initial analyses addressing those questions, in more detail. In brief, the questions researched to date include the following:

1. *Under Michigan common law and constitutional law, is there a credible cause of action for interested parties to sue the state of Michigan to compel the state to require that shoreline armoring causing the loss of natural beach be removed?*
2. *Under Michigan nuisance or trespass law, would a shoreland property owner who can demonstrate that the installation of a shoreline armoring structure by a neighboring property owner has resulted in the accelerated erosion and/or premature recession of her shoreline have a credible cause of action in nuisance for that impact?*
3. *Would the Michigan courts likely recognize a general police power regulation prohibiting armoring structures as valid, or would they construe that regulation as a zoning ordinance—or require that it be enacted as such? (Would the courts accept the proposition that the installation and maintenance of armoring is more akin to an 'activity' than a 'use' of the property by location or district?)*
4. *Under general police power authorities and/or the MZEA, can a local unit of government prohibit the installation and/or maintenance of hard shoreline armoring structures? Do those authorities differ by jurisdiction type (i.e., county, township, city, village)? If so, what would the legal and appropriate sanctions be for violations?*
5. *How far lakeward does a locality's regulatory jurisdiction extend under the MZEA (or a police power regulation) both in general and, specifically, given state authorities that apply lakeward of the elevation-based ordinary high-water mark?*
6. *Would the courts be likely to uphold an anti-armoring police power or zoning regulation as against an alleged violation of U.S. and Michigan constitutional due process protections?*
7. *Would the courts be likely to uphold an anti-armoring police power or zoning regulation as against an alleged violation of U.S. and Michigan constitutional equal protection protections?*

Case study: Chikaming Township

A largely rural community, Chikaming Township prides itself on its wide-open spaces, natural areas, and access to the beaches of Lake Michigan. As part of its current master plan, Chikaming Township emphasizes maintaining these natural features as the backbone of the township's economy, and for the other benefits they provide. An important aspect of conserving those natural features, as well as safeguarding public health and safety into the future, will be to integrate good hazard mitigation for its coastal shoreland areas into its future planning efforts. This case analysis first presents the findings from an initial assessment of the potential high-hazard areas within the township under various potential climate futures, drawing from the scenario-based planning methods described above, and then assesses the township's current efforts to manage development along its Great Lakes shoreline and within in its riverine floodplains. The case analysis concludes with a brief discussion regarding long-term shoreline recession on Lake Michigan. Current efforts to address wetland conservation, and steps the township might take to enhance those efforts for a variety of purposes including hazard mitigation, are presented in the Water and Land sections of this guidebook.

High hazard area assessment

Figure 4.5 presents an image that reports the findings of an initial assessment of Chikaming Township's potential high-hazard areas under lucky, expected, and perfect storm climate futures. As detailed above, these climate futures reflect variations in future lake levels and storminess, where the coastal shoreland area at risk from high-energy waves and storm-induced flooding expand with worsening conditions (i.e., moving from lucky to expected to perfect storm conditions). That assessment suggests that the township faces some degree of risk to several riverine areas during extreme storm events, as well as some risk of wave action and inundation along its Lake Michigan shore, but that the areas at risk throughout the entire township are fairly limited. The township has not conducted this kind of assessment for its current planning or zoning efforts but should consider doing so for its next plan update, combining it with potential buildout analyses in order to generate and analyze scenarios as described above.

The township is currently managing development in its coastal areas through the use of setbacks in its zoning code, by requiring that certain structures be set back from the ordinary high water mark (OHWM) within its zoned waterfront residential areas by 150 feet, by regulating development within its floodplains through its floodplain ordinance (ordinance 35), and by including a future land use plan in the master plan to set aside the Galien River as an overlay zone to further protect its floodplain. The township also recently adopted an ordinance limiting the installation of hardened shoreline armoring throughout its jurisdiction, discussed in more detail with regard to long-term shoreline recession below.

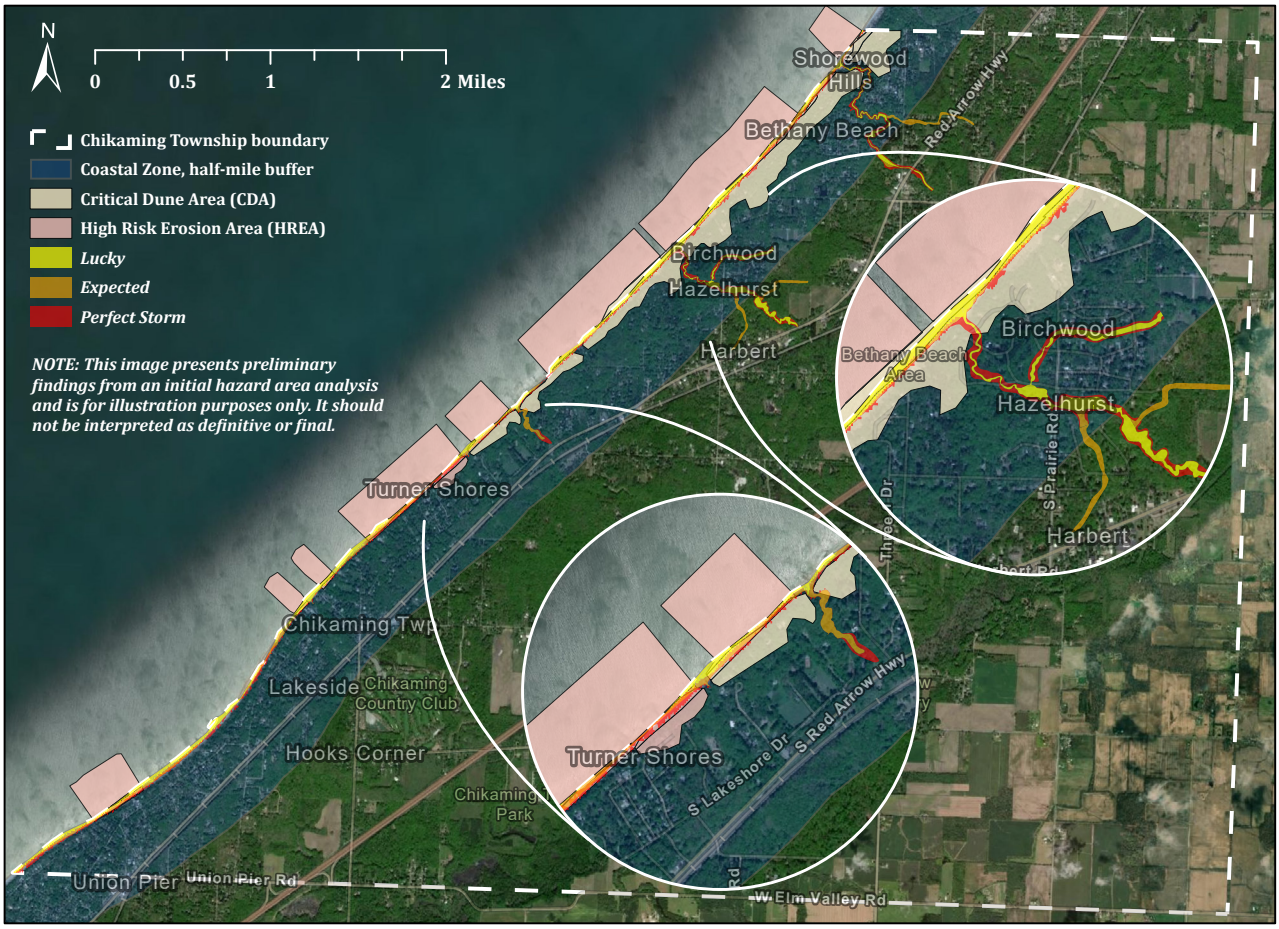


Figure 4.5: High Hazard Area Analysis of Chikaming Township. Data: FEMA, USGS, EGLE, and Southwest Michigan Planning Commission

With regard to floodplains, Chikaming Township currently mentions the need to protect floodplains in its master plan under Chapter IV under different objectives, along with action strategies to achieve these objectives.[174] One objective focuses on preserving the Galien River floodplain for the sustainability of the community and includes an action strategy of undertaking a professional survey to identify flood zones.[175] Another objective in the master plan is to protect high-priority open lands (including floodplains) with action strategies that include continuing to coordinate reviews of new development proposals with other governmental agencies to ensure the new development is in compliance with regulations concerning floodplains (and other natural features).[176] The FEMA Flood Map Service Center last updated a map of Chikaming Township in 2006.[177] The ordinance on floodplains (35) was enacted in 1978 to identify the floodplain boundaries and set regulations for this area based on the 100-year flood plain.[178] While this is a starting effort to protect floodplain areas, this ordinance is based on data presented over 40 years ago. Climate change has produced circumstances that may have not been taken into account in the 1970's. Chikaming Township should consider updating its floodplain ordinance to be consistent with the current data available surrounding the changing water levels and based on an updated assessment of high-hazard areas and potential hazard mitigation options, as described above.

Long-term shoreline recession

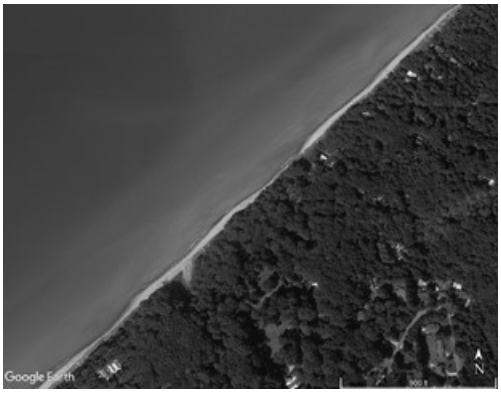
According to Chikaming Township's current master plan, most of the residential zoning for the township lies within one or two miles from Lake Michigan. While some of these homes belong to permanent residents, many belong to seasonal residents. Both year-round and seasonal residents expect to come back year after year and enjoy access to natural, walkable beaches along Lake Michigan, highlighting the need to account for long-term shoreline recession through the township's planning and development management efforts.

A comparison of aerial photos from Cherry Beach in Chikaming Township taken over a recent 20-year period suggests that substantial shifts in the position of the coastline have occurred over time, although the depth of beaches can vary substantially over seasons and years and these images by themselves do not document long-term recession of the shore.

Even so, much of the shoreline is classified as a high risk erosion area (see those areas noted on Figure 4.5), suggesting that long-term shoreline recession is occuring, at least in those areas. A good first step for addressing this phenomenon for its next master plan update, and for informing any revisions it might make to its zoning code accordingly, would be to conduct a more thorough assessment of its shoreline conditions drawing from the ongoing research on shoreline recession described above.

Responding to concerns about aggressive erosion that has come with recent high lake levels, long-term shoreline recession processes, and the potential for degradation to the shoreline from the installation of shoreline armoring (see Figure 4.6a and 4.6b, illustrating the loss of beach commonly associated with the installation of hard shoreline armoring), Chikaming Township recently adopted one shoreland area management strategy that has not yet been adopted by any other Michigan Coastal locality. Specifically, in February of 2021, the township enacted Police Power Ordinance 147. That ordinance prevents the installation and maintenance of hardened shoreline armoring, including seawalls, bulkheads, riprap, revetments, groins and breakwaters. It does not prohibit the temporary placement of sandbags, geo-textile tubes, and sand fences, which are permitted under certain conditions as described in detail in the ordinance.[179] The township drew upon recent science and planning analyses to support the validity of this regulation, and it stressed the importance of protecting the natural shoreline

Cherry Beach, Chikaming (1998)



Cherry Beach, Chikaming (2017)

Figure 4.6a/4.6b. Coastal conditions at Chikaming Township's Cherry Beach in 1998 & 2017. S Google Earth.

Chikaming Township (2017)

Chikaming Township (2019)

Figures 4.7a/4.7b: Chikaming Township coastline before and after shoreline armoring. Retrieved from Google Earth.

from degradation and preventing public safety and navigation hazards to justify its enactment. Because of the novelty of this approach, the ordinance does raise a number of legal questions, several of which are addressed in the legal analysis materials included in the appendix to this report. Communities looking into the possibility of adopting similar regulatory controls for their shorelines will want to engage similar analytical and planning efforts as employed by Chikaming Township, as well as staying apprised of any legal issues that might arise through its implementation.

Case study: City of Manistee

Located between three bodies of water - Lake Michigan, Manistee Lake, and Manistee River - the City of Manistee may be particularly vulnerable to increased storm events that cause flooding, as well as accelerated shoreline recession over the long term. As with the Chikaming Township case, this case analysis first presents the findings from an initial assessment of the potential high-hazard areas within the city under various potential climate futures, drawing from the scenario-based planning methods described above, and then assesses the city's current efforts to manage development along its Great Lakes shoreline and within in its riverine floodplains. The case analysis concludes with a brief discussion regarding long-term shoreline recession on Lake Michigan. Current efforts to address wetland conservation, and steps the city might take to enhance those efforts for a variety of purposes including hazard mitigation, are presented in the Water and Land sections of this guidebook.

High hazard area assessment

Figure 4.8 presents an image that reports the findings of an initial assessment of the City of Manistee's potential high-hazard areas under lucky, expected, and perfect storm climate futures. As detailed above, these climate futures reflect variations in future lake levels and storminess, where the coastal shoreland areas at risk from high-energy waves and storm-induced flooding expand with worsening conditions (i.e., moving from lucky to expected to perfect storm conditions). That assessment suggests that the city faces some degree of risk to several riverine areas during extreme storm events, particularly on the

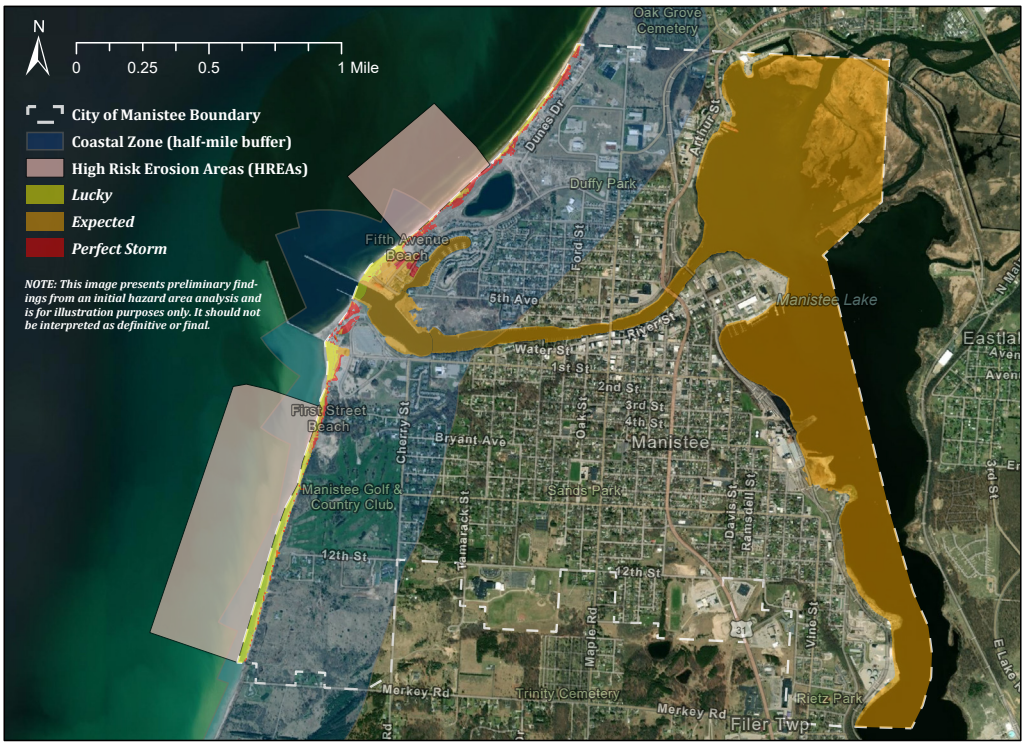


Figure 4.8: High Hazard Area Analysis of City of Manistee. Data: FEMA, USGS, and EGLE

shores of Lake Manistee and along the Manistee River, as well as some risk of wave action and inundation along its Lake Michigan shore. Nonetheless, as with Chikaming Township, the areas at risk throughout the entire city are fairly limited. The city has not conducted this kind of assessment for its current planning or zoning efforts but should consider doing so for its next plan update, combining it with potential buildout analyses in order to generate and analyze scenarios as described above.

The city does currently address coastal shoreland area hazards to some extent through the use of setbacks and floodplain management. Its zoning ordinance, for example, currently requires waterfront setbacks ranging from 20 feet to 100 feet landward of the the Ordinary High Water Mark (OHWM),[180] using the state of Michigan's elevation-based standard for determining that mark.[181] In addition, the general provisions of the code provide guidance for setbacks from the shoreline and state-designated high risk erosion areas.[182] Similarly, the city's Environmental Practices and Standards guidance document and its updated zoning code, both current through 2018, identify floodplains as areas of concern, but both do so only minimally without substantial analysis or attention, and its most recent master plan does not address floodplains at all. The U.S. Federal Emergency Management Agency (FEMA) has developed new floodplain insurance rate maps for the city, but those maps have not yet been formally adopted (the tentative effective date is 6/1/2021).[183] Given the increasingly dynamic conditions the city will experience because of climate change, and given the availability of recently update flood maps, the city might undertake a more detailed assessment of the flood risks it faces through its next master plan update, and consider amendments to its zoning code, standards and other related development management programs, based on that assessment accordingly.

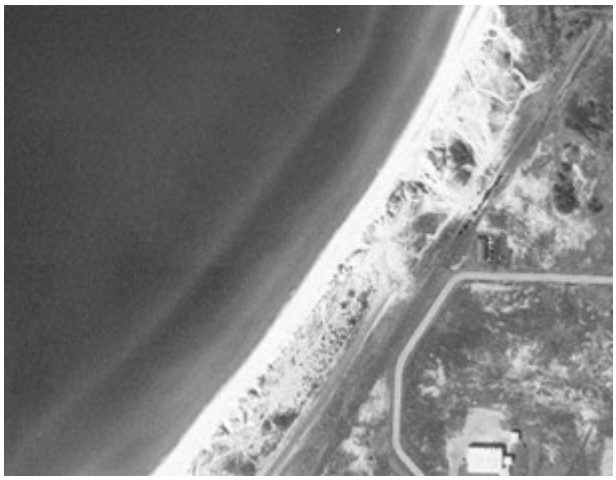
Long-term shoreline recession

As with the Chikaming Township case, a comparison of aerial photos shown below from 1st Street Beach in Manistee, along with a parallel comparison of the North Beach area, show the effects of rising water levels in Lake Michigan, especially during the past decade (Figures 4.9a, 4.9b, 4.10a, and 4.10b). These comparisons similarly suggest that substantial shifts in the position of the coastline have occured over time, although the depth of beaches can vary substantially over seasons and years and these images by themselves do not document long-term recession of the shore. Given the dynamics of its Lake Michigan shoreline, a good first step for the city to take in addressing this phenomenon for its next master plan update, and for informing any revisions it might make to its zoning code accordingly, would be to conduct a more thorough assessment of its shoreline conditions drawing from the ongoing research on shoreline recession described above.

1st Street Beach, Manistee (1993)

1st Street Beach, Manistee (2018)

Figures 4.9a/4.9b: Coastal conditions at Manistee's 1st Street Beach in 1993 & 2018. Retrieved from Google Earth.



North Beach, Manistee (1993)

North Beach, Manistee (2018)

Figures 4.10a and 4.10b: Effects of coastal development in Manistee. Retrieved from Google Earth.

Endnotes, Hazards

155. Annual Climate Trends and Impacts Summary for Great Lakes Basin https://glisa.umich.edu/summary-climate-information/annual-climate-trends/

156. Ardizone and Wyckoff. ``FILLING THE GAPS..." pg 36

157. EGLE's High Risk Erosion Area Program https://www.michigan.gov/egle/0,9429,7-135-3311_4114-344443--,00.html

158. Ardizone and Wyckoff 2010, Filling The Gaps II pg 41

159. EGLE's Critical Dunes Area Program https://www.michigan.gov/egle/0,9429,7-135-3311_4114-9832--,00.html

160. More information on wetlands can be found here on EGLE's site here https://www.michigan.gov/egle/0,9429,7-135-3313_3687-141296--,00.html along with Wyckoff, Ardizone 2010 Filling the Gaps

161. U.S. Army Corps of Engineers Detroit District Website https://www.lre.usace.army.mil/

162. U.S. Army Corps of Engineers Detroit District OHWM Information https://www.lre.usace.army.mil/Missions/Great-Lakes-Information/Links/Ordinary-High-Water-Mark-and-Low-Water-Datum/

163. Michigan Sea Grant Along the Coast booklet https://www.uwsp.edu/cnr-ap/UWEXLakes/Documents/ecology/shoreland/maintenance/along_the_shoreline_booklet_mi_sea_grant.pdf

164. EGLE Coastal Management Program https://www.michigan.gov/egle/0,9429,7-135-3313_3677_3696---,00.html

165. EGLE High Risk Erosion Area Program https://www.michigan.gov/egle/0,9429,7-135-3311_4114-344443--,00.html

166. Ardizone and Wyckoff 2010. Filling in the Gaps Part III pg 2

167. A more detailed discussion of scenario-based planning, and detailed methods for using that approach, can be found at http://resilientgreatlakescoast.org/, also described by Norton, R.K. et al., 2019, Using simple, decision-centered, scenario-based planning to improve local coastal management, Journal of the American Planning Association, 85:4, 405-423.

168. Adaptation Strategies Matrix by NOAA https://ww2.capecodcommission.org/coastal/#fact-sheets and thee Resilient Cape Cod projet https://spark.adobe.com/page/H3TgtzULGkbjH/ are resources for local communities

169. National Park Service's board index of coastal engineering interventions https://www.nps.gov/subjects/geology/engineering-the-coastal-environment.htm

170. This figure was generated by the research team led by Professor Richard Norton at the University of Michigan. A webinar held in November of 2020, presenting this analysis and describing it in more detail, can be found here: http://www.resilientmichigan.org/chikaming.asp.

171. See, for example, Norton, R.K. (2020), Dynamic coastal shoreland zoning: Adapting fastland zoning for naturally shifting coastal shores. Zoning Practice 2020(3)

172. This work was conducted under the direction of Professor Guy Meadows and is available here: https://portal1-geo.sabu.mtu.edu/mtuarcgis/apps/webappviewer/index.html?id=d758800bb18e460ab39aa666631051T

173. This work is being conducted under direction of Professors Erin Bunting and Ethan Theuerkauf. Ongoing updates regarding this work are available at: https://www.coastalgeomorphology.com/

174. Chikaming Master Plan Chapter IV: Focus: Agriculture, Open Space and Natural Features

175. Chikaming Master Plan Chapter IV: Focus: Agriculture, Open Space and Natural Features Chikaming Master plan pg 47. https://static1.squarespace.com/static/5a6b510b9f8dce26797a0b8e/t/5a7f07ecec212d8118bed26e/1518274546239/zoningMasterPlan.pdf

176. Chikaming Master Plan pg 28-31 https://static1.squarespace.com/static/5a6b510b9f8dce26797a0b8e/t/5a7f07ecec212d8118bed26e/1518274546239/zoningMasterPlan.pdf

177. FEMA Flood Map Service Center https://msc.fema.gov/portal/search?AddressQuery=chikaming%20township%2C%20mi#searchresultsanchor

178. Chikaming Township Floodplain Ordinance 35 https://static1.squarespace.com/static/5a6b510b9f8dce26797a0b8e/t/5a8739d7085229721a0c2b2f/1518811608037/Ordinance35.pdf

179. Chikaming Ordinance on Hardened Shoreline Armoring https://static1.squarespace.com/static/5a6b510b9f8dce26797a0b8e/t/603d0bfbcfad7f5152a47f1c/1614613500386/Ordianance+147.pdf

180. City of Manistee Zoning Code (2018), zoning map and Art III, pg. 5.

181. Id., Art. II, pg. 17.

182. Id., Art. V, pg. 5.

183. For analytical purposes, these proposed floodplain maps were incorporated into the analysis conducted to identify high-hazard areas for the sake of long-term planning (see Figure 8), although they have not yet been adopted by FEMA and thus have no direct regulatory effect.

5: Energy

Overview

In many ways, energy is the lifeblood of modern society. Good energy planning provides not only vital support for a community's ability to thrive, it can also support new economic development, reduce financial expenditures, create jobs, advance community resilience, and support healthier environments.[184] Energy planning should be an integral component of any community master plan.

For coastal communities in particular, plans that advance energy efficiency and clean energy help to mitigate climate change by reducing greenhouse gas emissions, helping in turn to temper future climate impacts like extreme storms and coastal flooding. In addition to climate mitigation, energy plans for coastal communities should also incorporate climate adaptation efforts, or 'energy adaptation'. Planning for energy adaptation may include identifying potential natural, technological, and human threats to power systems, conducting an energy vulnerability assessment, and developing strategies early on for ways in which to increase energy resilience and conservation.[185] Energy adaptation for coastal communities also requires other unique considerations for climate adaptation, such as securing energy infrastructure and transmission lines away from areas subject to flooding and high-energy wave action.[186]

Communities are increasingly setting clean energy and energy reduction goals because they recognize the associated co-benefits energy efficiency and clean energy has for people, the planet, and a community's prosperity. Michigan's Great Lakes coastal communities can and should make energy part of their comprehensive planning efforts. An effective and feasible way of doing so is by conducting energy inventories and analyses – or 'municipal energy audits' – and by developing energy action plans and goals.

Conducting energy planning

There are three primary types of energy utilities in the U.S., including investor-owned utilities, electric cooperatives, and publicly owned municipal utilities. Communities should be aware of their energy providers, and the sources of energy produced by them, in order to better understand their local energy landscape, to establish energy goals, and to identify key stakeholders for bringing their energy goals to fruition.

No matter what utility provides power to a community or where that power comes from, energy planning plays an important role in facilitating safe, reliable,

and efficient power to an area. To begin planning for energy, communities should conduct a data inventory on energy consumption patterns across their residential, commercial, and public buildings.[187] From the findings of the energy inventory, a careful analysis of energy consumption patterns should then be conducted and used to estimate the community's overall energy footprint, identify energy intensive areas, develop ways to reduce energy use, and promote energy efficiency and clean energy production.[188] While evaluating the inventory, a community should also take note of its energy portfolio and identify how much of its power comes from differing types of sources such as oil, natural gas, nuclear, and renewables.

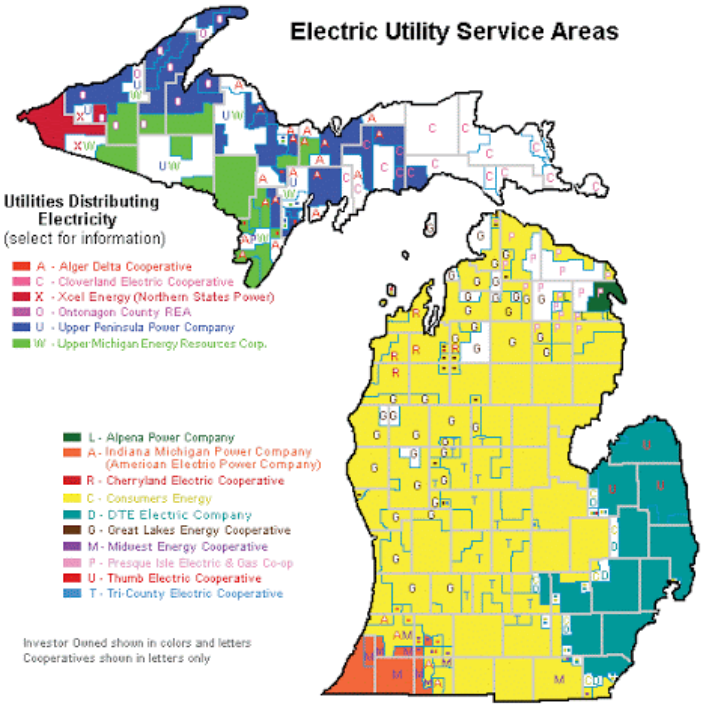


Figure 5.1: Service area map for electric utilities distributing electricity in Michigan. Areas are color-coded based on which utility provides service. Created by Michigan Public Service Commission staff from data in utility Rate Books. Retrieved from https://www.michigan.gov/mpsc/0,9535,7-395--451519--,00.html

With a baseline understanding of energy trends, the community should also consider long term energy trends. As the community develops and its populations grow (or shrink), events such as these will create implications for future energy consumption. Therefore, it is important to take into account demographic, environmental, and other developmental trends when making future energy plans to meet the energy needs of a changing community. Questions to consider would include, for example: will a new development require the extension of energy infrastructure? Will a development create substantial disruptions to energy consumption needs or present challenges to existing infrastructure? How can community planning be done in a way that helps reduce energy use and promote clean energy?

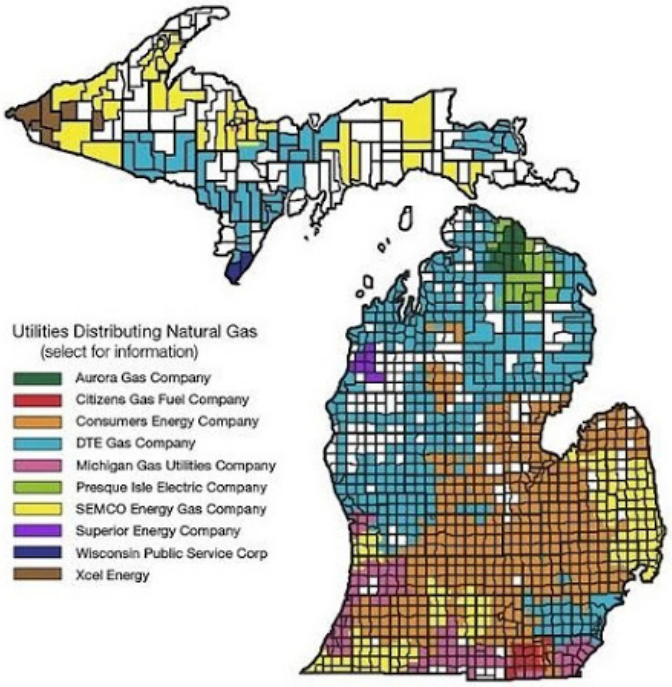


Figure 5.2:Service area map for utilities distributing natural gas in Michigan. Areas are color-coded based on which utility provides service. Created by Michigan Public Service Commission staff from data in utility Rate Books. Retrieved from https://www.michigan.gov/mpsc/0,9535,7-395-93308_93325_93422_93762_94260-504480--,00.html

Additionally, communities should take into account future climate impacts and consider the effects that a changing climate will have on both energy production and consumption. Questions

to consider in the context of climate change might include, for example: is the community's infrastructure resilient to extreme weather events? Is current or newly planned energy infrastructure sited away from hazardous areas, such as shorelines or flood plains? Will members of the community have spaces to seek refuge in the event of extreme weather, such as extreme heat?

Energy planning goals and strategies

Establishing energy planning goals and strategies to achieve those goals is another important component of energy planning. Primary goals should focus on energy conservation and efficiency, energy affordability and accessibility, energy resilience, and increasing production of clean energy sources.[189] Additionally, communities should plan for land-use patterns that assist in supporting and implementing these goals. When conducting energy planning, it is especially important to fully and meaningful engage the full array of community members who will be affected by decisions made. Not only will community engagement facilitate inclusivity and allow opportunities for community helpful feedback on potential energy initiatives, it can also help deter potential future obstacles for energy planning later on, such as resident or neighborhood opposition to energy related projects.

After initial community engagement, community leaders should develop an action plan that presents strategies for achieving energy goals, as well as a corresponding timetable. Those action plans should also set benchmarks and processes for evaluating progress toward those benchmarks. Annual or semi-annual progress reports should also be developed. Components of an energy action plan might include the following:

1. *Revise local building codes and incorporate planning to promote to energy-saving materials and designs for buildings.*[190]
2. *Revise zoning ordinances to encourage compact, mixed-use development.*[191]
3. *Conduct a local environmental impact assessment to help identify energy-related environmental impacts, such as assessing a new development's energy footprint and how planning can be done to minimize energy use, or at least to identify trade-offs between clean energy projects and environmental damage.*
4. *Conduct a study on local solar and wind energy potential and siting.*
5. *Conduct community engagement and education programs.*
6. *Explore outside policies, programs, and funding mechanisms to help develop or expand energy planning goals.*[192]

Case studies: Chikaming Township and City of Manistee

Based on their master plans and zoning ordinances, both Chikaming Township and Manistee have begun notable energy planning efforts and it is clear that both communities recognize the benefits that good energy planning has for communities. Within their Zoning Master Plan's priority to-do list, Chikaming

Township has outlined the action item "launch a sustainability initiative to involve the whole community in identifying improvements for future generations."[193] Within this action item, the plan calls for the township to conduct a "solar and wind readiness" assessment.[194] To aid in the potential for solar and wind energy, the township has developed policies and zoning ordinances for such solar and wind energy siting.[195] The current language for such bylaws and zoning ordinances do not appear to be so unduly burdensome that they would hinder the development of these clean energy installments. Considering its relatively abundant amount of open land, Chikaming Township has good planning potential for clean energy installments in their community.

Like Chikaming Township, Manistee's community plans have also developed policies and zoning ordinances for solar and wind energy siting. These bylaws also do not appear to be so burdensome that they would hinder solar and wind energy development. When it comes to clean energy siting, Manistee has taken the initiative to identify additional advanced energy technologies in their planning efforts. For example, according to its 2006 Zoning Ordinance, Manistee has developed policies for electric vehicle charging stations and battery outlets. Through their participation in a 2010-2011 grant program funded by the Michigan Public Service Commission, the City of Manistee developed a local 'green team' which served an important role in developing their 2011 Energy Efficiency and Renewable Energy Action Plan.[196] The green team and its respective deliverable helped the City of Manistee identify and develop their current energy planning initiatives and goals. As outlined in its updated 2020 Master Plan, Manistee has incorporated energy efficiency within its planning Goals and Tasks. Specifically, Manistee has identified a goal to "support building practices which utilize Low Impact Design (LID) measures and meet Leadership in Energy and Environmental Design (LEED) practices," within its city.[197]

While Chikaming Township and Manistee are making good progress on energy planning, there are ways in which they can improve and enhance their initiatives to support even better energy standards in their communities.

Energy planning recommendations

Conduct an energy inventory and analysis

As described in the above sections, a typical starting point for energy planning is to conduct an energy inventory and analysis – or a 'municipal energy audit.' However, neither Chikaming Township nor Manistee has identified doing so in its respective community planning documents. While Manistee was able to conduct an energy inventory and analysis through its participation in the grant program funded by the Michigan Public Service Commission, and assuming the city is using this inventory as a basis for its energy planning efforts, Manistee should update that energy inventory with more recent data. Conducting thorough and current municipal energy audits would provide baselines for both Chikaming Township and Manistee and help both communities develop new energy planning initiatives.

Incorporate energy goals

While both communities have begun energy planning efforts, such as solar and wind energy siting ordinances, neither community's plans have introduced a comprehensive set of short- or long-term energy initiatives and goals, such as in the form of an energy plan. While energy planning initiatives and goals should be worked into comprehensive community planning documents, both Chikaming Township and Manistee should consider developing a stand-alone energy plan. This energy plan, best developed after conducting and analyzing the municipal energy audit, would then outline energy initiatives and goals. These initiatives and goals might include increasing energy efficiency across the community or for publicly owned buildings, increasing the community's clean energy portfolio, or developing energy education and community engagement programs.

Consider development, demographic, and climate trends as they relate to energy

Chikaming Township and Manistee can expect to see increased real estate development and population growth along their Lake Michigan shorelines. Therefore, planning efforts should consider whether or not a development will require the building of new energy infrastructure, and if so, how planning can be done to encourage conservation and efficiency. New real estate development should be done along existing energy infrastructure routes and transmission lines. Additionally, because both Chikaming Township and Manistee see population increases during the summer months, planners should account for this annual demographic trend and determine how best to prioritize energy efficiency during the summer months. Both communities should consider for example, what specific areas, buildings, or other spaces become more energy intensive during peak summer and tourist months, and how they can plan to increase energy efficiency in these priority areas. Lastly, energy planning should consider future climate impacts. Energy planning in Great Lakes coastal communities should include climate adaptation efforts such as bolstering energy infrastructure and locating infrasture away from high-energy wave action and flood prone areas.

Promote home and building weatherization and other advanced building designs

Great Lakes coastal communities like Chikaming Township and Manistee are frequently exposed to extreme weather such as snow, storms, and gale-force winds. According to their current master plans and zoning ordinances, however, neither community addresses the goal of or ways to incorporate or encourage weatherization practices for homes and buildings within the community. Weatherization of homes and buildings is important not only for protecting homes and buildings from disastrous extreme weather events, but also increases energy efficiency and helps property owners save money on energy bills. In addition to weatherization, Chikaming Township and Manistee could also promote other more advanced building designs that promote energy efficiency and mitigate other negative externalities that may affect buildings and their other adverse impacts

upon their communities. For example, green roofing – the use of vegetated rooftops – is an excellent way to make buildings that are not only aesthetically pleasing, but help property owners save energy and capture stormwater.

Incorporate community engagement, inclusion, and education into energy planning efforts

As mentioned, the City of Manistee formerly participated in a Michigan Public Service Commission grant program that helped them to develop a 'green team.' Based on the city's proactive energy planning goals and initiatives as outlined in their planning documents, the City of Manistee likely benefited by participating in this program. Both Chikaming Township and Manistee should consider developing local green teams made up of government officials, residents, and other stakeholders from the community, either as its own jurisdiction or in collaboration with the county. Currently, Manistee County has a green team, but Berrien County does not--offering the opportunity to continue ongoing work or forge a new initiative, respectively.

Utilize external energy planning incentives and programs

Often, when it comes to energy planning, municipalities are ready to do more to increase energy efficiency and clean energy production, but they need financial or technical support. Fortunately, external programs and incentives to enhance energy planning efforts within communities are available. For example, the State of Michigan currently offers programs that both Chikaming Township and Manistee should consider utilizing to support energy planning efforts. Specifically, as part of its MI Healthy Climate Plan, the State of Michigan recently implemented its Catalyst Communities program, which provides local governments training, education, and other resources to support local planning efforts to improve energy efficiency and promote clean energy.[198] Additionally, both communities could promote energy efficiency within their local commercial building sectors by opting into the State's Property Assessed Clean Energy (PACE) financing market. PACE is a unique public-private form of real estate financing available to commercial property owners across Michigan, which allows them to receive upfront financing to pay for energy efficiency improvements to their buildings. Property owners then pay back their PACE loans over time through long-term fixed rate financing, via their property taxes. Currently, 48 local governments across the State of Michigan participate in the Michigan PACE program, though neither Chikaming Township, Manistee, nor their respective counties are current participants. Both of these State programs would serve as useful resources to advance energy planning in Chikaming Township and Manistee. More specifically for Manistee, programs such as these could help reach their goal for more LEED (Leadership in Energy and Environmental Design) buildings. For Chikaming Township, programs such as these could help provide more technical and financial resources to enhance energy planning initiatives.

Plan for holistic clean energy readiness

Chikaming Township and Manistee are already working toward clean energy planning efforts, such as through permissible zoning for solar and wind energy. Both communities, however, should also consider planning efforts that can proactively accommodate other clean energy and advanced energy technologies, such as electric vehicle charging stations and battery storage. While Manistee has included zoning ordinances for electric vehicle charging stations, Chikaming Township has not. Zoning ordinances and bylaws to support electric vehicles may include siting areas for electric vehicle charging stations, mandating electric vehicle installations be included within certain developments such as parking garages, or identifying how electric vehicle charging stations will be identified for the community with uniform signage. Including planning efforts to accommodate and install electric vehicle charging stations should especially take precedent because electric vehicles are becoming more abundant across the country and across Michigan. A community that has sufficient electric vehicle charging stations will reap the co-benefits of facilitating green economic development and tourism, placing it ahead of the curve for a coming rapid increase in electric vehicles. Because clean energy technology is a rapidly changing industry, both communities should also be proactive in conducting permissible siting for other clean energy installments as they arise. These technologies could include, for example, battery storage stations, community solar, and microgrids.

Collaborate with other planners and nearby communities to develop regional energy initiatives

Because energy issues extend beyond jurisdictional boundaries, communities are increasingly looking to work on collaborative initiatives with other nearby communities. In the context of clean energy siting, this is especially important because land appropriate for clean energy siting is often located outside of the jurisdictional boundaries of a community that might use the power produced. Both Chikaming Township and Manistee might consider developing clean energy initiatives with partners and communities in neighboring areas. For example, to help achieve its clean energy goals, Traverse City (with its energy utility) worked with communities outside of Traverse City's jurisdictional boundaries to help bring its initiatives to fruition.[199] Because of its small and mostly urban environment, Traverse City was not able to develop a large enough wind turbine and solar farm to provide an adequate supply of clean energy to meet its needs. Through regional collaboration, however, Traverse City was able to site a wind turbine and solar farm located in neighboring Elmwood Township, to host the city's clean energy supply.[200]

Consider energy in all planning efforts

Finally, access to energy plays a vital role for thriving communities. Energy touches virtually every sector of our society and is a holistic area that can and should always be considered within comprehensive planning. By considering

energy in all planning efforts, communities can double down on their energy initiatives and help facilitate the associated co-benefits of responsible energy planning. By approaching energy planning in a holistic context, communities can promote economic development, reduce utility operating expenses, support climate action and resilience, reduce adverse human health and environmental impacts, and support vibrant communities.

Clean energy readiness

According to the American Planning Association, there seven general steps planners should take to incorporate clean energy readiness.[201]

1. Lay the groundwork for clean energy planning by identifying the potential for clean energy within existing comprehensive plans

2. Identify land use for large scale clean energy potential

3. Identify pathways to initiate clean energy installations, such as by establishing permitting requirements for ground mount and rooftop solar arrays

4. Focus on the impacts that clean energy deployment will have on communities, promoting positive community impacts and mitigating potentially negative impacts, should they arise

5. Maximize potential land for clean energy

6. Address community concerns of clean energy planning early on and throughout planning processes

7. Avoid developing zoning ordinances and other policies that may be overly burdensome to the point that clean energy potential is reduced within a community[202]

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Appendix: Preliminary analysis of selected legal questions

1. The Public Trust Doctrine

Question: Under Michigan common law and constitutional law, is there a credible cause of action for interested parties to sue the state of Michigan to compel the state to require that shoreline armoring causing the loss of natural beach be removed?

Summary: The Michigan case law is unclear whether a cause of action exists for any plaintiff to require the removal of hard armoring. Generally, the common law rule in Michigan allows a littoral landowner to benefit from additions to their shoreland. This is justified under the assumption that landowners must also suffer the loss of erosion. In theory, landowners should not be permitted to "fix" the ambulatory water line, such that they capture lands that would transition to bottomlands of Lake Michigan. A court could issue an injunction to remove hard armoring that fixes the line, under the theory that the public trust doctrine is a limitation of state discretion, and the state cannot permit installation of armoring that effectively seizes public lands. Any actions taken to remove hard armoring would be highly fact-specific, so the outcome of any such claim is difficult to predict.

The outcome of any litigation will necessarily be a fact bound inquiry. Several issues are important to note. First, owners of land that was patented by the United States before the entrance of Michigan as a state are not subject to losing their lands by erosion, under certain conditions. Such patents appear to be located primarily along the shores of Lakes Erie and St. Clair. Second, the location of hard armoring — above or below the OHWM — is important. Structures built in an area controlled by the public trust may be amendable to removal. Lands wholly on private property are less likely to be removable. Finally, there are not truly on-point cases, and so any analysis currently available is circumstantial, rather than based on precedential holdings.

Key Cases: St Clair County v. Lovingston, 90 U.S. 46 (1874); People v. Silberwood, 67 N.W. 1087 (Mich. 1896); Glass v. Goeckel, 703 N.W.2d 58 (Mich. 2005); Peterman v. State Dept. of Natural Resources, 521 N.W.2d 499 (Mich. 1994); Klais v. Danowski, 129 N.W.2d 414 (Mich. 1964); People v. Broedell, 112 N.W.2d 517 (Mich. 1961); Obrecht v. National Gypsum Co., 105 N.W.2d 143 (Mich. 1960); Burt v. Munger, 23 N.W.2d 117 (Mich. 1946); Killmaster v. Zeidler, 257 N.W. 721 (Mich. 1934); Hilt v. Weber, 233 N.W. 159 (Mich. 1930); Nedtwed v. Wallace, 208 N.W. 51, 53 (Mich. 1926); Burleson v. Dep't of Evironmetnal Quality, 808 N.W.2d 792 (Mich. Ct. App. 2011); Kurrle v. Walker, 224 N.W.2d 99 (Mich. Ct. App. 1974); People ex rel. MacMullan v. Babcock, 196 N.W.2d 489 (Mich. Ct. App. 1972); Henson v. Gerlofs, 164 N.W.2d 533 (Mich. Ct. App. 1968); Rice v. Naimish, 155 N.W.2d 370 (Mich. Ct. App. 1967); U.S. v. Milner, 583 F.3d 1174 (9th Cir. 2009).

2. Nuisance and Trespass

Question: Under Michigan nuisance or trespass law, would a shoreland property owner who can demonstrate that the installation of a shoreline armoring structure by a neighboring property owner has resulted in the accelerated erosion and/or premature recession of her shoreline have a credible cause of action in nuisance for that impact?

Summary: A property owner next to a shoreline armoring structure could bring a claim against the owner of the structure for public nuisance, private nuisance, or trespass. It is not clear from the Michigan cases that any theory will succeed. Causation will be a problem under private nuisance; showing the extent of damage attributed to the armoring structure and not the natural erosion of the Great Lakes has been a stopping point in other nuisance cases. Under a public nuisance theory, a private citizen would need to show distinct harm from that suffered by the general public. Under a trespass theory, the Peterman case seems to stand as an obstacle. Finally, an injunction or abatement might be available, unless a court determines that the harm to the defendant from removal would be great, and that damages would be a sufficient remedy.

Causation will be one of the largest obstacles to any claim. Showing the extent to which hard armoring alters the shoreline above and beyond natural erosion will be crucial at a motion to dismiss or summary judgment stage and will require compelling evidence. Recent compelling scientific evidence regarding dynamic Great Lakes shoreline processes, however, might be sufficient to meet that burden. Further, Michigan case law on nuisance is complicated, and the Michigan courts adjudicating nuisance cases have not clearly delineated what must be shown under the different elements. For example, "significant harm" and "unreasonable interference" are always recited but infrequently addressed by the courts. Mere recitation of the elements is not enough at the pleading stage. Finally, injunctive relief or abatement is not guaranteed, especially if a court believes that damages will suffice to remedy the harm. There is further the issue of the statute of limitations. Depending on the relief requested and the claim brought, either a 3-year or a 15-year limitations period could exist. Even if all the other elements are met, some claims could be barred because the act of armoring the shore was completed years or decades ago. It is difficult to predict with any degree of certainty what a court would do when faced with a private or public nuisance or trespass claim.

Key Cases: Sholberg v. Truman, 852 N.W.2d 89 (Mich. 2014); Adkins v. Thomas Solvent Co., 487 N.W.2d 715 (Mich. 1992); Peterman v. Dep't of Natural Resources, 521 N.W.2d 499 (Mich. 1994); Hadfield v. Oakland County Drain Com'r, 422 N.W.2d 205 (Mich. 1988); Garfield Twp. v. Young, 82 N.W.2d 876 (Mich. 1957); Board of Water Com'rs of Detroit v. City of Detroit, 76 N.W. 70 (Mich. 1898); Beach v. People, 11 Mich. 106 (1862); Capital Properties Group, LLC v. 1247 Ctr. Street, LLC, 770 N.W.2d 105 (Mich. Ct. App. 2009); Ypsilanti Charter Tp. v. Kircher, 761 N.W.2d 761 (Mich. Ct. App. 2008); Terlecki v. Stewart, 754 N.W.2d 889 (Mich. Ct. App. 2008); Adams v. Cleveland-Cliffs Iron Co., 602 N.W.2d 215 (Mich. Ct. App. 1999); Jackson County Hog Producers v. Consumers Power Co., 592 N.W.2d 112 (Mich. Ct. App. 1999); Traver Lakes Community Maintenance Ass'n v. Douglas Co., 568 N.W.2d 847 (Mich. Ct. Ap. 1997); Cloverleaf Car Co. v. Phillips Petroleum Co., 540 N.W.2d 297 (Mich. Ct. App. 1995); Wagner v. Regency Inn Corp., 463 N.W.2d 450 (Mich. Ct. App. 1990); Town v. Harr, 460 N.W.2d 596 (Mich. Ct. App. 1990); Ken Cowden Chevrolet, Inc v. Corts, 316 N.W.2d 259 (Mich. Ct. App. 1982); Kurrle v. Walker, 224 N.W.2d 99 (Mich. Ct. App. 1974); Howard v. Glenn Haven Shores Ass'n, No. 340174, 2018 WL 3594782 (Mich. Ct. App. July 26, 2018); Divito v. Post, No. 333855, 2017 WL 3044232 (Mich. Ct. App. July 18, 2017); Gunter v. Apap, No. 333169, 2017 WL 4654975 (Mich. Ct. App. Oct. 17, 2017); John H. Bauckham Trust v. Petter, No. 332643, 2017 WL 4158025 (Mich. Ct. App. Sept. 19, 2017); Gutwein v. Kahle, No. 329919, 2017 WL 382411 (Mich. Ct. App. Jan. 26, 2017); Howard v. Glenn Haven Shores Ass'n, No. 325812, 2016 WL 3639899 (Mich. Ct. App. July 7, 2016); Postma v. County of Ottawa, No. 243602, 2004 WL 1949317 (Mich. Ct. App. Sept. 2, 2004); Banks v. United States, 721 Fed. Appx. 928 (Fed. Cir. 2017); Van Buskirk v. ConocoPhillips, Inc., No. C06-1220-JCC, 2009 WL 3784334 (W.D. Wash., Nov. 10, 2009); Rutz v. City of St. Louis, 10 F. 338 (E.D. Missouri, 1882).

3. Police Power vs. Zoning Authority

Question: Would the Michigan courts likely recognize a general police power regulation prohibiting armoring structures as valid, or would they construe that regulation as a zoning ordinance—or require that it be enacted as such? (Would the courts accept the proposition that the installation and maintenance of armoring is more akin to an 'activity' than a 'use' of the property by location or district?)

Summary: A local government's zoning authority is a special subset of its police power, one specifically delegated to localities by the Michigan Zoning Enabling Act (MZEA). The MZEA requires that local governments follow specific procedures to enact zoning ordinances, including notification, public hearing, and other requirement that do not apply for the enactment of general police power ordinances. To determine if a regulation is properly constituted as a police power ordinance or a zoning ordinance, courts apply the use v. activity test. This test asks a simple question: does the ordinance regulate an activity or a use of land? Courts' application of the test to real-world scenarios is less simple and often conflicting. Ultimately, the application of the test is a fact-intensive question. There are cases that may support the argument that shoreline armoring, particularly where it is intended to make contact with a lake, is an activity. Yet, there are also cases that support the argument that shoreline armoring is a land use. It is, therefore, difficult to predict which way a court would come out on this issue. Additionally, courts examine if an ordinance regulates according to zones and districts—even if not explicitly. If so, a court will likely hold that the ordinance should be constituted under the zoning authority.

Key Cases: Square Lake Hills Condominium Ass'n v. Bloomfield Twp., 471 N.W.2d 321 (Mich. 1991); People v. Sell, 17 N.W.2d 193 (1945); People v. Brazee, 149 N.W. 1053 (1914), aff'd 241 U.S. 340; 36 S.Ct. 561; 60 L.Ed. 1034 (1915); Forest Hill Energy-Fowler Farms, L.L.C. v. Twp. of Bengal, No. 319134, 2014 WL 6861254 (Mich. Ct. App. Dec. 4, 2014); Natural Aggregates Corp. v. Brighton Twp., 539 N.W.2d 761, 766 (Mich. Ct. App. 1995); Lakeside Resort, LLC, v. Crystal Township, No. 324799., 2016 WL 1358584 (Apr. 5, 2016); Tuscola Wind III, LLC. V. Ellington Township, No. 17-cv-11025, 2018 WL 1291161 (Mar. 13, 2018); City of Bloomfield Hills v. Froling, No. 288766, 1 (Mich. Ct. App. 2010); Independence Twp. v. Roy, 162 N.W.2d 339 (Mich. Ct. App. 1968); Warholak v. Northfield Twp. Supervisor, 225 N.W.2d 767 (Mich. Ct. App. 1975); Norton Shores v. Carr, 265 N.W.2d 802 (Mich. Ct. App. 1978) (ordinances regulating junkyards); Fass v. City of Highland Park, 39 N.W.2d 336 (Mich. 1949); Michigan Oil Co. v. Natural Resources Comm'n, 249 N.W.2d 135 (Mich. Ct. App. 1976).; Little Mack Entm't II, Inc. v. Twp. of Marengo, 625 F. Supp.2d 570 (W.D. Mich. 2008).

4. Extent of Police Power and Zoning Authority for Different Local Governments

Question: Under general police power authorities and/or the MZEA, can a local unit of government prohibit the installation and/or maintenance of hard shoreline armoring structures? Do those authorities differ by jurisdiction type (i.e., county, township, city, village)? If so, what would the legal and appropriate sanctions be for violations?

Summary: In Michigan, courts afford local governments broad discretion to enact both police power and zoning ordinances that relate to issues of municipal concern. This authority is essentially limited only by the state and federal constitution and preemption. Furthermore, courts also start with the presumption that ordinances are constitutional and treat them in the same way that they treat state legislative enactments. Consequently, the breadth of police power and zoning authority are likely sufficient to permit a local government to ban shoreline armoring structures—subject to preemption and procedural limitations.

For police power ordinances, however, the foundation of local government authority differs by the type of local government. Broadly, there are two general types of municipal governments: general law and home rule. General law municipalities are conferred specific powers by the State and only exercise those authorities that are conferred. Even so, the State legislature has granted each type of general law local government a generalized police power to enact ordinances that advance the general welfare, and as mentioned above, courts treat this generalized police power as expansive. Alternatively, home rule municipalities can exercise the same authority as the State Legislature to address issues of local concern. Though this authority is still conferred on the home rule local government by the State Legislature, the delegation is total and not subject to specific enumeration. Practically, however—given the broad interpretation of the generalized police power given to general law governments—this distinction is not material.

For zoning ordinances, there is no distinction between different types of local governments. The State confers all local governments zoning authority through the MZEA and does not meaningfully differentiate between forms of municipality.

Key Cases: City of Taylor v. Detroit Edison Co., 475 Mich. 109, 115 (2006); People v. Llewellyn, 401 Mich. 314 (1977); Rogowski v. City of Detroit, 374 Mich. 408 (1965); City of Detroit v. Oakland Circuit Judge, 237 Mich. 446 (1927); Rental Property Owners Ass'n of Kent County v. City of Grand Rapids, 455 Mich. 246 (1997); People v. Sell, 310 Mich. 305 (1945); People v. Brazee, 183 Mich. 259 (1914), aff'd 241 U.S. 340 (1915); Clements v. McCabe, 210 Mich. 207 (1920); Blue Cross & Blue Shield of Michigan v. Governor, 422 Mich. 1 (1985); Cady v. Detroit, 289 Mich. 499 (1939).; Detroit v. Recorder's Court Traffic and Ordinance Judge, 104 Mich. App. 214 (1981); Austin v. Older, 283 Mich. 667 (1938); Huron Portland Cement Co. v. Detroit, 362 U.S. 440 (1960); Huron Twp. v. City Disposal Systems, 448 Mich. 362 (1995); People v. Smith, 146 Mich. 193 (1906); Lobaido v. Dep't of Corrections, 37 Mich. App. 171 (1971); Euclid v. Amber Realty Co., 272 US 365 (1926); Pleasant Ridge v. Cooper, 267 Mich. 603 (1934); Krajenke Buick Sales v. Kopkowski, 322 Mich. 250 (1948); Sun Cmtys v. Leroy Twp, 241 Mich. App. 665 (2000); Korash v. City of Livonia, 388 Mich. 737 (1972); Olsen v. Chikaming Twp., 325 Mich. App. 170 (2018); Kirk v. Tyrone Twp., 398 Mich. 429 (1976).; Zaagman, Inc. v. Kentwood, 406 Mich. 137 (1979).; Kyser v. Kasson Twp., 486 Mich. 514 (2010); Kropf v. Sterling Heights, 391 Mich. 139 (1974).; Hect v. Township of Niles, 173 Mich. App. 453 (1988); Schwartz v. Flint, 426 Mich. 295 (1986); Alderton v. Saginaw, 367 Mich. 28 (1962); Hess v. West Bloomfield, 439 Mich. 550 (1992); Frericks v. Highland Township, 228 Mich. App. 575 (1998); Independence Twp v. Skiaowski, 136 Mich. App. 178 (1984); Towne v. Harr, 185 Mich. App. 230 (1990); Saginaw Housing Commission v. Bannum, No. 08-12148-BC, WL 2008 11355485 (E.D. Mich., 2008).

5. Lakeward Extension of Local Government Authority

Questions: How far lakeward does a locality's regulatory jurisdiction extend under the MZEA (or a police power regulation) both in general and, specifically, given state authorities that apply lakeward of the elevation-based ordinary high-water mark.

Summary: There is a dearth of legal authority on the question of lakeward extension of local jurisdiction, both in Michigan and other jurisdictions. Based on examples from municipal charters, it appears that shoreline jurisdictions generally extend no further than the "shoreline" or the "ordinary high-water mark." This might indicate that their regulatory jurisdiction does not extend into the public trust, but it is not clear. Also, this question necessarily implicates whether the State can delegate its authority under the public trust. The Supreme Court has definitively answered "no" to this question as to delegation to private parties, but there is little authority on delegation to local governments. One case has acknowledged the validity of an explicit delegation a local government entity for administrative authority over land subject to the public trust but rejected delegation of complete authority over the public trust, even where explicitly delegated.

Key Cases:
Deneen v. Houghton Cty. St. Ry. Co., 150 Mich. 235 (1907); Huron Portland Cement Co. v. City of Detroit, Mich., 362 U.S. 440 (1960); Miller v. Fabius, 366 Mich. 250 (1962); Protect Our Parks, Inc. v. Chicago Park Dist., 385 F. Supp. 3d 662 (N.D. Ill. 2019); In re Income Tax Cases, 403 N.W.2d 182 (1987); Peterman v. State Dept. of Natural Resources, 521 N.W.2d 499 (1994); Bott v. Comm'n of Nat. Res. of State of Mich. Dep't of Nat. Res., 327 N.W.2d 838 (1982); Illinois Cent. R. Co. v. State of Illinois, 146 U.S. 387 (1892); Friends of the Parks v. Chicago Park District, No. 14–cv–09096, 2015 WL 1188615 (2015).

6. Due Process

Question: Would the courts be likely to uphold an anti-armoring police power or zoning regulation as against an alleged violation of U.S. and Michigan constitutional due process protections?

Summary: Due process has both a substantive and a procedural component. Procedural due process requires (generally) notice and an opportunity to be heard. This is relevant as it relates both to the passage of the ordinance, and at the time when the ordinance is enforced. Substantive due process protects individuals from arbitrary and capricious or unreasonable government action. In the zoning ordinance context, courts are deferential to municipalities provided the ordinance is in some way related to a legitimate governmental interest (essentially rational basis review). It is unlikely that either form of due process claim would be successful at challenging a zoning ordinance if the governing body undertook basic procedures prescribed by law. This type of ordinance is also not an unreasonable method of achieving what is a legitimate governmental interest — protecting the shoreline for environmental and/or economic reasons.

Key Cases: Schad v. Mt Ephraim, 452 US 61 (1981); Mathews v. Eldridge, 424 U.S. 319 (1976); Board of Regents v. Roth, 408 U.S. 564 (1972); Mullane v. Central Hanover Bank and Trust Co.,

339 U.S. 306 (1950); Village of Euclid v. Ambler Realty Co., 272 U.S. 365 (1926); Shoemaker v. City of Howell, 795 F.3d 553 (6th Cir. 2015); EJS Properties, LLC. V. City of Toledo, 698 F.3d 845 (6th Cir. 2012); Brown v. City of Ecorse, 322 Fed.Appx. 443 (6th Cir. 2009); Sickles v. Campbell Cnty., 501 F.3d 726 (6th Cir.2007); Warren v City of Athens, 411 F.3d 697 (6th Cir 2005); Buckeye Cmty. Hope Found. v. City of Cuyahoga Falls, 263 F.3d 627 (6th Cir.2001);Wojcik v. City of Romulus, 257 F.3d 600 (6th Cir. 2001); Richardson v Township of Brady, 218 F.3d 508 (6th Cir 2000); Berger v. City of Mayfield Heights, 154 F.3d 621 (6th Cir. 1998); Shamie v. City of Pontiac, 620 F.2d 118 (6th Cir. 1980); Changler v. Vollage of Chagrin Falls, 296 Fed.Appx. 463 (6th Cir. 2008); Kochis v. City of Westland, 409 F.Supp.3d 598 (E.D. Mich. 2019);Bonner v. City of Brighton, 848 N.W.2d 380 (Mich. 2014); Kyser v. Township, 786 N.W.2d 543 (Mich. 2010); Carleton Sportsman's Club v. Exeter Twp., 550 N.W.2d 867 (Mich. 1996); Charter Twp of Delta v Dinolfo, 351 N.W.2d 831 (Mich. 1984);People v Llewellyn (City of East Detroit v. Llewellyn), 257 N.W.2d 902 (Mich. 1977); Robinson v. City of Bloomfield Hills, 86 N.W.2d 166 (Mich. 1957); Chicago Area Council, Inc. v. Blue Lake Twp., No. 285691, 2010 WL 986500 (Mich. Ct. App. Mar. 18, 2010); Cummins v. Robinson Twp, 770 N.W.2d 421 (Mich. Ct. App. 2009); Mettler Walloon, LLC v Melrose Twp, 761 N.W.2d 293 (Mich. App. 2008); Houdek v. Centerville Twp., 741 N.W.2d 587 (Mich. Ct. App. 2007); Township of Yankee Springs v Fox, 692 N.W.2d 728 (Mich. Ct. App. 2004); Fredricks v. Highland Twp., 579 N.W.2d 441 (Mich. Ct. App. 1998); People v. McKendrick, 468 N.W.2d 903 (Mich. Ct. App. 1991); Lyon Develoment Co. v. DNR, 403 N.W.2d 78 (Mich. Ct. App. 1986); Schubiner v. West Bloomfield Twp., 351 N.W.2d 214 (Mich. Ct. App. 1984); Orco Investments, Inc. v. City of Romulus, No. 303744, 2012 WL 2402599 (Mich. Ct. App. June 26, 2012); Divergilio v. Charter Twp. Of West Bloomfield, No. 261766, 2006 WL 3103012 (Mich. Ct. App. Nov. 2, 2006)

7. Equal Protection

Question: Would the courts be likely to uphold an anti-armoring police power or zoning regulation as against an alleged violation of U.S. and Michigan constitutional equal protection protections?

Summary: The federal and state Equal Protection Clauses require that similarly situated persons be treated similarly. An equal protection claim is analyzed either under strict scrutiny, intermediate scrutiny, or rational basis review. When there is no suspect classification made, as would very likely be the case with a shoreline armoring ordinance, rational basis review is used. Rational basis review is essentially the same as a substantive due process review, which only requires a government regulation be reasonably related to a legitimate government purpose. When a use is entirely prohibited, the burden of proving a rational relationship is shifted to the government. This should not be overly burdensome. Thus, in the shoreline armoring context, an ordinance that prevents their installation would very likely not vulnerable to an equal protection challenge.

Key Cases: Village of Willowbrook v Olech, 528 US 562 (2000); City of Cleburne v. Cleburne Living Ctr., Inc., 473 U.S. 432 (1985); Sinclair v. City of Ecorse, 1 F.Supp.2d 804 (E.D. Mich. 2008); Rifkin Scrap Iron and Metal Co. v. Ogemaw County, No. 06-12351-BC, 2008 WL 2157067 (E.D. Mich. May 21, 2008); Risko v. Grand Haven Charter Twp. Zoning Bd. of Appeals, 773 N.W.2d 730 (Mich. Ct. App. 2009);Houdek v. Centerville Twp., 741 N.W.2d 587 (Mich. Ct. App. 2007); Landon Holdings, Inc. v. Grattan Twp., 667 N.W.2d 93 (Mich. Ct. App. 2003); Neal v. Oakwood Hosp. Corp., 575 N.W.2d 68 (Mich. Ct. App. 1997); Countrywalk Condominiums, Inc. v. City of Orchard Lake Village, 561 N.W.2d 405 (Mich. Ct. App. 1997); Long Island Court Homeowners Ass'n v. Methner, 254 N.W.2d 57 (Mich. Ct. App. 1977).